Smallholder seed practices

Maize seed management in the Central Valleys of Oaxaca, Mexico

Lone Bech Badstue

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Dit onderzoek is uitgevoerd binnen CERES Graduate Research School for Resource Studies for Development.

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Proefschrift
ter verkrijging van de graad van doctor
op gezag van de rector magnificus
van Wageningen Universiteit,
Prof. Dr. M.J. Kropff
in het openbaar te verdedigen
op dinsdag 24 oktober 2006
des namiddags om 13.30 uur in de Aula

CIP-DATA KONINKLIJKE BIBLIOTHEEK, The Hague, The Netherlands

Badstue, L.B.

Smallholder seed practices: Maize seed management in the Central Valleys of Oaxaca, Mexico

Thesis Wageningen University. –With ref. – With Summary in Dutch

ISBN: 90-8504-502-9

Subject headings: Seed management, informal seed supply, seed transactions, local knowledge, collective action, transaction costs, embedded transactions, maize

For Jens

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Acknowledgements

This research was carried out while I was a member of the Social Sciences Group at the International Maize and Wheat Improvement Centre, CIMMYT, in Mexico. I am grateful for the opportunities this has brought me and for the support and encouragement I have received from CIMMYT.

My colleagues in the CIMMYT social sciences group have been an inspiring daily working environment. In particular Mauricio Bellon provided excellent guidance, constructive criticism and support as my direct supervisor, colleague and friend at CIMMYT. Mauricio's interest in my work and his key inputs and willingness to discuss has been a constant source of inspiration and learning for me throughout the time we have worked together. Special mentioning should also be made of Jonathan Hellin who has been a valuable colleague and friend with whom I have thoroughly enjoyed working and discussing. Prabhu Pingali, Michael Morris, and John Dixon have all as programme directors been exceedingly supportive of my research, and never wavered in their support for converting it into a Phd. I owe special thanks to John Dixon for his interest and keen support and for allowing me to concentrate entirely on the writing during the last months. In addition, I wish to thank Xochitl Juarez, Angel Pita-Duque, Irma Manuel Rosas, Ana Maria Solano, Amanda King, David Mowbray, Javier Becerril, Eduardo Martinez, Miguel Mellado, Betty Rojon, Janin Trinidad, Liliana Santamaria and Maria Louisa Rodriguez and a number of other CIMMYT colleagues for their valuable inputs and support. I also wish to thank Solveig Danielsen for her support and encouragement; Sophie Higman for patiently proof-reading the final manuscript, and Joost and Ton van Heerwaarden for kindly translating the summary into Dutch.

CIMMYT maize scientists Julien Berthaud, Kevin Pixley, Mark Sawkins, David Beck, David Bergvinson, Hugo Cordoba and many more have patiently eluded the mysteries of maize and we have had many interesting discussions regarding maize, seed practices, participatory methods, and technology diffusion, to mention a few. Special thanks goes to Julien Berthaud for his thoughtful inputs and his keen interest in my research and for helping me understand its implications for maize population genetics.

The academic home for the PhD project is Wageningen University, where Prof. Norman Long has been a brilliant supervisor and a great inspiration. Working with Norman Long has been challenging, stimulating and highly entertaining. I am grateful to Norman and Ann Long for their hospitality, hard work and delightful company and good humour. I also wish to thank

Alberto Arce for his interesting comments and observations, and Jos Michel for her timely and efficient support.

Ample recognition must be given to the institutions that have funded this research: The Systemwide Program on Collective Action and Property Rights (CAPRi) of the Consultative Group on International Agricultural Research (CGIAR), the government of Denmark, the government of France, and the Food and Agriculture Organization of the United Nations (FAO).

In particular I wish to thank all the farmers who participated in this research for the information they gave me and for their kindness and patience and for the pleasant time and laughs we shared together. I am particularly indebted to my colleagues on much of the fieldwork: Alejandro Ramirez and Dagoberto Flores, who deserve special thanks for their friendship, hard work, honest sparring and enjoyable company.

A special thanks goes to the 'lunch-table crowd' and to the marathoners, for their engagement and never-ending supply of exceedingly creative advice on how to finish the PhD yesterday. You made lunchtime a daily highlight and marathoning a pleasure.

Finally, my deepest thanks are to Jens, who has been my closest and most important support throughout it all. Without you I would not have completed this marathon.

1. Introduction

Without seed, there is no agriculture

Seed is a fundamental input for agriculture. Indeed, seed is the single most important input in all crop-based farming systems and a prerequisite for most of the world's food production. More than being the basis of production for the majority of the world's crops, seed determines the upper limit on yield and therefore on the ultimate productivity of all other inputs (Cromwell, 1990: 1).

Crop genetic diversity is the basis for research and improvement of crop varieties. Access to a wide range of genetic diversity allows farmers and plant breeders to adapt a crop to heterogeneous and changing environments, developing cultivars with high levels of adaptation to biotic and abiotic stresses and to human preferences. This makes the conservation of genetic resources important in addressing future challenges of research and crop improvement, seeking to intensify agricultural production and increase food supply, and trying to respond to farmers' different requirements and preferences.

In the 1960s the introduction of science based agricultural technologies often combined with governmental subsidies, increased the productivity of agriculture and this became known as the green revolution. What is less known is that for the last forty years this rapid increase of productivity has largely been sustained in the developing countries. Most of these gains have been in Asia and Latin America. However, according to Evenson and Gollin (2003a, b) there is recent evidence that impacts of varietal improvement in rice, maize, cassava and other crops have now started to show in Sub-Saharan Africa.

In the early green revolution period around 20% of the increase in agricultural production was simply due to an expansion of the area cultivated, and other parts can be attributed to improved agricultural practices and increased use of inputs such as fertilizer and insecticides (Evenson and Gollin, 2003a). However, for all developing countries some 21 % of the growth in yield and about 17% of production growth could be attributed alone to the use of improved seed (Evenson and Gollin, 2003a). Securing the conservation of crop genetic resources and farmers' access to seed of the desired varieties and of good quality is therefore a very important management issue for farmers and a concern for society in order to achieve food security.

The need for a better understanding of the dynamics of local seed practices

Informal seed systems are central to conserving crop genetic diversity, sustaining farmers' livelihoods and food security, and making small-scale agri-

culture a productive and viable option. Several authors have pointed out that informal seed systems are mostly based on traditional social alliances and family relations, cast in the context of mutual interdependence and trust, often forming dynamic networks with a high degree of complexity (Almekinders et al., 1994; Seboka and Deressa, 2000; Tripp, 2000). Still, although many authors have emphasized the role of informal seed exchange for the conservation of crop genetic diversity as well as for the improvement of farmers' seed security, little attention has been given to the detailed study of the mechanisms of informal seed systems, and relatively little is known about the factors and processes that influence and shape small-scale farmers' practices with regards to informal seed exchange. As stated by Seboka and Deressa (2000: 250): "The flow of seeds or farmer-to-farmer exchange of seed is a neglected area of research. There is an urgent need to understand more in detail the process of farmer-to-farmer exchange of seed" (see also Bellon, 2004; Longley et al., 2001; Rice et al., 1998; Sperling and Cooper, 2003).

A better understanding of the dynamics of local seed management can contribute to several important areas related to the improvement of supply of quality seed for agricultural production in poor countries, as well as to the conservation of crop genetic diversity in farmers' fields. These include:

- Better targeting of agricultural research and crop improvement towards the needs and priorities of poor farmers in the developing world;
- Faster and more widespread introduction of improved material by linking the formal and informal sector more effectively;
- Fostering new joint approaches to crop improvement where the contributions of farmer management is integrated deliberately into the improvement process;
- Assessment of the potentials and problems of *in situ* germplasm conservation.

Farmers' maize seed practices in the Central Valleys of Oaxaca, Mexico

The overall objective of the research presented here is to contribute to an increased understanding of what is commonly referred to as 'local seed systems', 'farmer seed systems' or 'informal seed systems', both in relation to seed supply for agricultural production and the conservation of crop genetic diversity in developing countries. Within a general understanding of seed as an essential input for agricultural production, as well as a representation of

important crop genetic resource diversity, this research focuses specifically on achieving an understanding of smallholder seed supply practices[1].

The purpose of this research is two-fold: Empirically, the objective is to contribute to an increased understanding of the workings of local seed practices, in order to provide a relevant input to the debate on crop genetic resources and how to strengthen farmers' access to seed with interesting and desirable characteristics and of good quality. At the same time, this study contributes to the debate concerning the relevance of the social sciences to agricultural research and development, by examining the value and limitations of a series of conceptual frameworks in relation to different aspects of farmers' seed practices.

Using a farmer perspective as the point of departure, a series of aspects of central importance to local maize seed management and transactions are examined and discussed. The main thematic and conceptual inways include:

- Farmers' seed practices as a form of local knowledge;
- The role of collective action in relation to crop genetic diversity conservation and seed supply at the local level;
- The social organization of seed supply, or, the embeddedness of local seed supply;
- An assessment of farmers' transaction costs in relation to seed acquisition.

Overall, an actor-oriented approach is applied putting the farmer at centre stage. Small-scale agriculture is contemplated as a product of social processes, and therefore as subject to change, as changes occur in the socio-economic and cultural context. This opens up to a conceptualisation of farmers' crop genetic resources management as subject to a continuous negotiation in the search for a compromise between the constantly changing conditions in the material world on one hand (e.g. increasing pressure on natural resources, economic factors, increased market integration, urbanization, migration) and individual farmers' needs, preferences and values on the other.

While each section analyses a different problematic, shedding light on a particular aspect of local seed dynamics in the study area, together they complement each other and provide a basis for a deeper understanding of farmers' seed supply practices from a local point of view. This in turn contributes to an improved understanding of local seed practices in a broader perspective.

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[1] The term 'seed system' implies that the set of sources of seed and related information, practices and transactional arrangements on which farmers rely to obtain seed for agricultural production, is bounded and organized in a systematic way. Though I will occasionally use the term 'seed system', I prefer to talk about farmers' seed supply practices. This will be discussed further in Chapter 6.

Maize continues to be the most important crop in Mexican small-scale agriculture. As the main staple its role in terms of food security is central and despite the low market price, maize continues also to be an important source of income for many rural households in Mexico. Furthermore, Mexico is a centre of domestication and diversity for maize (Matsuoka et al., 2002; Piperno and Flannery, 2001; Sánchez et al., 2000a,b), and small-scale farmers continue to play a key role in the maintenance of this diversity (Bellon, in press; Hernandez, 1985; Perales et al., 2003). The structure and evolution of maize genetic diversity depend on farmers' access to a diverse array of farmer varieties[2]. This in turn derives from the informal flow of varieties and seeds among households and communities (Bellon et al., 1997; Louette et al., 1997). An estimated 80% of the area planted to maize in Mexico is under seed selected from the previous harvest by farmers (Morris and López Pereira, 1999), and hence part of informal seed systems. Therefore, these seed systems are of great importance for the well-being of small-scale maize farmers in Mexico, as well as for the viability of their agriculture. To address the growing concern for the loss of crop genetic diversity and the importance of conserving genetic resources *in situ*, we need to know more about these practices (Bellon, 2004; Rice et al., 1998).

Crop genetic resource management in developing countries

In most developing countries two different systems of plant genetic resources management have developed. One is an informal plant genetic resource management system based on farmers' local knowledge. The other is a formal, science-based plant genetic resource management system consisting of institutions for plant conservation, breeding and seed multiplication and distribution. In many cases the formal sector evolved as a result of the emphasis in the 1970s and 1980s on formal crop genetic resource management, the science-based approach of the green revolution and the ideas on modernization of agricultural production (Friis-Hansen, 1999).

The informal and formal genetic resource management systems are, however, interlinked and the informal sector may for example supply seed derived directly from germplasm from the formal sector (i.e. improved material). A distinction can be made between seed supplied directly from the formal or the informal sector, and furthermore a distinction can be made between improved material, and land races or creolized material. The latter is a mixture of one or more landraces with improved material or simply improved

[2] *Farmer varieties* (referred to as "varieties" in this manuscript) are the crop populations that a group of farmers recognize as distinct units. They may not have specific names beyond the color of the kernel, i.e. a farmer may plant two varieties of white maize. A farmer variety is not a variety in the sense of commercial agriculture, where a variety should be distinct, uniform and stable. Even if considered similar, one farmer's variety can be somewhat distinct or distinguishable from the variety of another farmer (see Pressoir and Berthaud, 2003)

material that has been cultivated on farm for a number of cropping cycles. In practice it is difficult to distinguish land races from creolized material, and the term land race will be used to cover farmer produced material without trying to determine if it contains elements of improved material. Seed provided from the formal sector is generally improved seed, but seed from the informal sector can be anywhere on the sliding scale from improved material to creolized and to land races. The use of the term 'improved' when referring to seed from the formal sector is a question of using conventional terminology and does not imply that land races have not been improved by farmers' management.

In developed countries the formal sector is the dominant system for seed supply, crop development and conservation of crop genetic resources. Most crop production in these countries depends on seed of modern varieties provided by the formal seed sector. In many cases the informal seed sector has almost disappeared or serves only hobby-farmers, though in some cases, according to some authors the informal seed sector continues to play a significant role. For example it is reported by Almekinders and Louwaars (2000), that only 50 % of the total seed demand of overall agricultural crops in Germany is supplied by the formal seed sector, and that in Spain it is as low as 10 %, while the same data for Denmark, and the Netherlands and are reported to be 95 and 75 % respectively. It should, however, be kept in mind that the apparently low use of the formal sector as seed supplier does not mean that the material is not improved material.

Teshome (in Seboka and Deressa, 2000) estimates that around three quarters of the world's farmers use farm-saved seed, and unlike farmers in developed countries or commercial farmers in developing countries, small-scale farmers in the developing world, who produce primarily for their own consumption, often depend almost entirely on themselves or other farmers for seed. In many developing countries, therefore, informal seed sources supply the vast majority of the seed. Within this broad field a number of authors have set out to describe local seed systems and their importance in relation to agricultural production, among others Almekinders and Louwaars (2000), Almekinders et al. (1994), Cromwell (1990), Friis-Hansen (1999), Rohrbach (1997), Sperling et al. (1995), Thiele (1999), Tripp (2001), Wierema et al. (1994). These and other studies have stressed the importance of informal seed supply in terms of seed security for small-scale farmers in developing countries, for example in years of deficit harvest or in emergency situations.

Although the adoption of improved varieties for a number of food crops in developing countries is significant, the share of the formal sector in the total seed supply remains low. Furthermore, a considerable part of the spread of improved materials has taken place through the informal seed sector, for example as farmer-to-farmer distribution of seed of improved and creolized varieties (e.g. Bellon et al., 2003, 2005).

The mechanisms of local seed exchange have important implications in several respects. It is essential for individual farmers to be able to obtain seed of a certain variety and quality in order to secure agricultural production and food supply. However it also has implications of utmost importance in relation to the evolution and conservation of crop genetic diversity.

Changing views on agricultural research over the last decades

The literature on seed systems research is diverse and reflects very different approaches to the subject matter. Rather than presenting a disciplinary overview of the literature, it is described from a thematic angle, following three main approaches, namely, the development approach, the biodiversity conservationist approach, and the emergency seed relief approach. The presentation does not focus narrowly on seed, but sees it in the larger context of agricultural development and agricultural research.

The 'development approach'

Modernisation of agriculture and the Green Revolution

The re-discovery in the beginning of the 20th century of Gregor Mendel's findings regarding the genetics of plant reproduction triggered the development of modern plant breeding (Almekinders and Louwaars, 2000; Hardon et al., 2000). The advances in plant breeding and other technologies, and their impacts in terms of crop yields, paved the way for formal crop improvement and seed production. Large investments were made in agricultural research. Increasingly specialized organizations developed in the form of a formal seed sector, composed of specialized public and private enterprises involved in plant breeding, seed production and distribution, and served by a system of legislative standards for seed quality and variety protection. This also brought substantial changes in the role of farmers in crop improvement and conservation of crop genetic resources.

In parallel to plant breeding, the mechanization of agriculture was also fast increasing, and chemical fertilizers and eventually chemical pesticides were developed. The success of science and technology in agricultural modernization in The United States and Europe after the Second World War became a model for development in the third world (Amanor et al., 1998; Ravnborg, 1996). Several years of severe food crisis and famine in various parts of the world, in particular in South Asia, led to the initiation of the development of modern crop varieties for developing countries in the 1950s. The success of the efforts, also known as '*the green revolution*', to increase yields were indisputable and over the following decades world grain production more than doubled due to the spread of new agricultural technologies, in particular modern high-yielding crop varieties and new agricultural practices (Muir, 1998).

In view of the initial successes of the green revolution, agricultural development agencies and governments in developing countries sought to stimulate the flow of seed of modern varieties to farmers. In many developing countries, formal sectors for plant breeding, seed production and distribution programs were established, often with support from international donor agencies, and with public agencies carrying out most of the activities (Wiggins and Cromwell, 1995). For the most part, these systems for plant genetic resource management were modelled on the formal seed sectors in industrialized countries, and activities were professionalized and segregated.

In development circles, technology came to be seen as the generator of development and growth. Technology became the point of departure, and the transfer of technology became the dominant approach towards development (de Amanor et al.,1998). The 'ideology of the neutrality of technology' (Koppel and Oasa, 1987; Ravnborg, 1996) gained currency. According to the latter, any adverse impacts on poor farmers should not be blamed on the inherent nature of the technology but rather on the agrarian structure, the economic policy environment or the agro-ecological conditions under which the technologies are implemented. As Hardon et al. (2000) comment, instead of striving for crops and cropping systems to be finely in tune with their environment through natural balance, environments were increasingly adapted to the requirements of the crops.

Research station technologies were viewed as superior to farmer practices since crops performed better on-station with standardized inputs. The failure of modern varieties to spread into marginal areas was thought to be rooted in the conservatism and backwardness of traditional farmers. New and superior technologies were envisioned to be adopted first by a few, more progressive farmers, in order to subsequently filter down to the smaller, more traditional farmers, as they realized the benefits gained by the early adopters (Amanor et al., 1998).

Technological and economical determinist approaches to technology diffusion assume that a technology will spread almost by itself if it is technologically superior to, or more profitable than, existing technologies (Campbell, 1996). However, experience has shown that though these factors are important, they are by no means a guarantee for success. Most technologies that fulfil these criteria have no or very little practical impact, and often it can be observed that the technology that achieves widespread adoption is not the best from a technological stand point, nor necessarily the most profitable. Modern approaches to technology diffusion stress the importance of conceptualising technology diffusion as a social process, where people's perceptions and networks play a crucial role. In addition, when the technologies are aimed at resource poor people, experience also highlights the importance of involving the people early in the process in order to adapt the development to their particular situation.

The challenge of reaching farmers in marginal areas

Some have argued that international agricultural research is organized in a way which creates structures that are frequently indifferent and insensitive to the needs of small farmers (Biggs and Farrington, 1991 in Amanor et al., 1998). Another way of putting this could be that the focus of international agricultural research organizations on the production of global public goods, such as generally applicable technologies, has not been able to sufficiently address more local needs or preferences.

The Green Revolution technologies were particularly successful in favourable environments which were adequate for the improved germplasm that was available at that time. In particular this was the case in the irrigated areas in Asia and in Latin America. The improved germplasm available at the beginning of the green revolution was not well adapted to the production conditions, for example, in large parts of Africa. This limitation was further aggravated by the fact that when artificial fertilizer is applied, cereal landraces often grow too tall and lodge. In many cases this meant that unless improved germplasm was used, farmers could not use chemical fertilizer to increase productivity in their landraces.

In less favourable and marginal areas, where production conditions are usually more complex and more risk prone, the green revolution and the formal seed sector have generally had considerably less success (Evenson and Gollin, 2003a, b). Low soil fertility, frequently occurring droughts, inundations or other climatic hazards reduce the productivity of the crop. Likewise, access to agricultural inputs like capital, land, labour, water, and fertilizer, is generally limited, more expensive, and more variable due to bad roads and remote markets. In these conditions farmers may lack cash to buy seed. In addition, higher seed quality may not be expressed in higher yields because of other limiting factors, and the purchase of expensive seed may not be considered economical. Farmers in these areas may grow a wider range of locally adapted varieties with different characteristics. Varieties that are suitable for favourable high-input conditions may not prove the best option for low-input conditions in these marginal areas. Moreover, modern varieties that are bred for high yield may not serve the many different purposes for which a subsistence farmer produces a crop, such as special preferences for home consumption as well as the need for secondary products. Farmers in marginal areas often have different needs and require varieties with multiple characteristics in particular combinations. This can be difficult to address through formal seed programmes (Almekinders and Louwaars, 2000).

Many developing country governments and international development agencies have until recently only supported formal sector institutions for plant genetic resources, and have linked credit, subsidies, research and extension to the adoption of modern varieties. The introduction of Structural Adjustment Programs in the 1990s reduced, or in many cases completely re-

moved, the subsidies for this kind of agriculture and has probably increased the number of farmers unable to take advantage of modern crop improvement (Friis-Hansen et al., 2000).

Furthermore, in several countries public sector programs have faced a series of problems, including severe lack of resources, and as a result they have often produced less than expected. At the same time private sector seed enterprises have encountered high transaction costs and inappropriate legislatory frameworks (Wiggins and Cromwell, 1995; Friis-Hansen, 1999; Ravnborg, 1996). In many regards, NGOs have therefore been seen as an important complement and go-between for the strengthening of linkages between the formal seed sector and farmers. However, not all NGOs have been equally successful in this role. Wiggins and Cromwell (1995) report on a review of 19 NGOs involved in local seed production and distribution. Though also acknowledging several strengths of NGOs, the authors note that operations are generally small-scale and depend heavily on external funding. Furthermore, in several cases they lack technical expertise, and rather than being innovative, activities appear often to be moulded after those of the formal seed sector (Wiggins and Cromwell, 1995).

The diminishing support from governments for farmers is further aggravated by the increased use of intellectual property rights related to crop improvement. Previously a lot of agricultural research was done in public research institutions and there was a relatively free flow of new technologies, but with the advent of biotechnology, new discoveries are more frequently protected by intellectual property rights and the improvements in productivity are likely to take even longer to reach small scale farmers in developing countries.

The importance of seed regulations and legislatory frameworks in relation to efforts to support and strengthen farmers' access to seed of diverse varieties is increasingly being acknowledged, and attention to these aspects has grown significantly (e.g. ASARECA, 2002; GTZ, 2000; Louwaars, 2000; Musa and Rusike, 1997; Tripp, 2000). Meanwhile, other approaches have emerged which focus more on the facilitation of farmers' access to seed within local contexts, for example, 'seed vouchers and fairs' (CRS et al., 2002; Longley et al., 2001).

Advances in agricultural productivity have not only benefited farmers. The prices of agricultural products have fallen over the last decades, and consumers are the largest beneficiaries of the production increase. Some small-scale farmers, particularly in less favourable agro-ecological regions, who were not able to increase their productivity sufficiently to compensate for falling prices may in fact be worse off today (Evenson and Gollin, 2003a). In summary, therefore, the science-driven increase in agricultural productivity has hugely benefited consumers, and also benefited the farmers who have the capacity to increase their productivity. However, effectively reaching farmers in more marginal and more remote areas remains a challenge.

The 'conservationist approach'

Since the beginning of agriculture farmers have domesticated and developed crops, adapting them to diverse environments and specific human preferences through thousands of years of selection and experimentation (Almekinders and Louwaars, 2000; Amanor et al., 1998; Friis-Hansen, 2000; Hardon et al., 2000; Pimbert, 1999). Farmers' crop improvement experimentation, as well as the management, production and exchange of crop genetic resources by and amongst farmers are often referred to as informal seed systems, local seed systems or farmers' seed systems. In these, crop improvement, seed supply and conservation perspectives are combined at the local level in farmers' strategies for local crop development. The adaptation and improvement of varieties, seed production, utilization and exchange, as well as the conservation of crop genetic resources, are all integrated activities in these systems. They are part of the local agricultural system and are usually carried out on the same farm through processes that are based on local knowledge accumulated and used in the community through generations (Friis-Hansen, 2000).

The point of departure for this approach is the focus on seed as an important source of germplasm and its role in small-scale agriculture as well as in the evolution of crop genetic diversity and in crop improvement initiatives (Almekinders, 2001; Almekinders and Boef, 2000; Bellon, 2004; Boef et al., 1993; Brush, 1986; Jarvis et al., 2000; Meng and Brush, 1998; Orlove and Brush, 1996).

During the last decades concerns about the loss of biodiversity have increased substantially and *genetic erosion* has become a much debated issue, particularly since a diverse set of genetically variable crop landraces has been replaced by a few, genetically uniform, high-yielding varieties (Brush, 1991; Harlan, 1992; Hawkes, 1983; National Research Council, 1993; Plucknett et al., 1987 in Bellon, 2001). The increasing pressure on land and labour increases the importance of yield as a selection criterion for farmers, leading to intensified crop production, the adoption of improved varieties with higher yield potentials, the use of more inputs, and the planting of fewer varieties on the farm (Lipton and Longhurst in Almekinders et al., 1994: 209). Fading cultural diversity and traditions have also been associated with the increasing disappearance of local cultivars (Almekinders, 1994: 209).

Concerns about the loss of plant genetic resources are especially valid in areas of crop domestication, where diversity is concentrated and where farmers maintain not only seed of local varieties of ancestral crop populations but also the human knowledge and behavioural practices that have shaped this diversity for generations (Bellon et al., 1997; Brush, 1991 in Bellon, 2001).

In many regions local cultivars tend to be left to the more marginal, risk-prone habitats and ethnological niches for which the improved varieties are less suitable (Almekinders et al., 1994: 209). Though traditional varieties tend

to be sturdier, the tendency to focus their use on marginal lands increases the risk of losing some of these varieties in a bad year.

Some argue that low input farming systems may be particularly subject to genetic vulnerability because of pests and tropical conditions, weak infrastructure and economic marginality. Anthropologists and others have argued that crop genetic diversity is one of the principal means that farmers in low input farming systems use in order to protect production, for example planting several varieties of the same crop as a way of confronting risks and heterogeneous production conditions, (Bellon, 2001; Friis-Hansen, 2000; Hardon et al., 2000: 5f; Wiggins and Cromwell, 1995). From this perspective the loss of crop genetic diversity may therefore leave local cultivators even more vulnerable (Orlove and Brush, 1996: 11).

From a social interactionist perspective, local technical knowledge, skills and capacities to manage plant genetic resources are embedded in the cultural, ecological and sociological context of the community. Farmers' local experimentations are not based on scientific theoretical models, but emerge from strong interests in and knowledge of practical local application that provide options for improving their livelihoods (Friis-Hansen, 1999).

Modern theories on knowledge argue that science and technology are socially constructed and embody social relations. The development and uptake of scientific and technological knowledge rely upon and modify existing modes of communication and organisational relations. It is by no means a passive process. Rather, it must be considered an active process, an interaction between various agents within particular cultural and organisational contexts, during which the technology may be adapted and transformed, influenced by a series of social and cultural factors (Friis-Hansen, 1999).

Local institutions for managing plant genetic resources only seldom take the shape of organizations. They commonly consist of shared norms and practices within a community or ethnic group of people. While the natural resource management by local institutions is often associated with conflict over access and use, plant genetic resources are renewable and are therefore seldom the cause of conflict over access at the local level. Plant genetic resource management is largely the product of social processes and institutions in the community (Friis-Hansen, 1999). When these change it is likely also to have an effect on local plant genetic resource management.

In general, studies investigating these aspects at the local level have often portrayed small-scale farmers as the caretakers of important crop genetic resources who continue to maintain and cultivate diverse varieties. However, most small-scale farmers do not maintain crop genetic resources merely for the sake of conservation. Rather, it appears that many farmers give social value to local resources and make special use of diverse crop varieties, either for consumption purposes or as a means of confronting heterogeneous agricultural conditions. Similarly, the ability of local seed management practices

to adapt varieties to specific cultural, economic and social requirements through the application of farmers' knowledge and skills has been documented (Fussell, 1992; McCann, 2005; Museo Nacional de Cultural Populares, 2002; Orlove and Brush, 1996). In many cases decisions regarding varietal choice depend on multiple considerations, not just on yield. As Orlove and Brush (1996) point out, such issues can be illuminated by in-depth, qualitative studies.

Seed relief approach

The seed relief approach grew out of efforts to address seed security in connection to disaster or emergency contexts. Obviously inspiration was found in food relief programs in such situations, with the idea that seed relief would contribute to the restoration of local food production.

Originally seed relief interventions were based on the assumption that no seed were available in the affected region. The response was therefore to bring in large quantities of seed of the most important crops and simply distribute it. Later it was found that in fact, the assumption that the problem was one of seed availability was not always correct (Longley et al., 2001; Sperling and Cooper, 2003). Studies showed that often local seed systems were quite resilient, even under very extreme circumstances (Sperling and Cooper, 2003). In some emergency situations (e.g. the civil war in Rwanda) bean seed was in fact available in the local seed system, and some farmers managed to plant and harvest in spite of the war and its devastating effects on society (Sperling et al., 1996). These revelations showed that farmers' problems acquiring seed during crisis were not necessarily due to lack of seed availability. Instead, it seems that farmers' problems in many cases stem from difficulties of access, because the crisis has destroyed social networks (as in the case of Rwanda), thereby disrupting the customary channels for informal seed acquisitions, or because farmers simply lack the means with which to acquire the seed, for example through purchase or barter (Sperling and Cooper, 2003).

A new 'paradigm' for seed aid interventions has therefore emerged, shifting the focus from merely concentrating on direct seed aid distribution, to a broader approach more oriented towards agricultural rehabilitation and development (Jones et al., 2002; Longley et al., 2001; Longley et al., 2002; Sperling and Cooper, 2003). Within the seed relief literature, steps have been taken towards the formulation of a framework for analyzing seed security in disaster / crisis situations. One important perspective is the use of the concepts of *Availability – Accessibility – Utilization* as well as the distinction between *acute* and *chronic* seed insecurity/stress in order to determine the most appropriate type of intervention, for example, a one-time direct seed distribution intervention or a longer term process of agricultural rehabilitation and development (Longley et al., 2002; Sperling and Cooper, 2003).

Acute stress normally refers to a sudden and very violent form of crisis which affects large numbers of people in large areas, such as natural disasters or war. Chronic stress, on the other hand, refers to a constant situation of vulnerability and crisis, for example, very difficult agro-ecological and/or socio-economic conditions (Sperling, 2002). Chronic stress is closely linked to severe poverty and may not affect all groups equally.

Seed relief in the form of direct distribution of seed brought in from elsewhere has been criticized in a number of other respects. Repeated relief interventions in the same area have turned out often to be due to a misinterpretation of the situation, that is, where a case of chronic stress has been interpreted as an acute stress. In some cases, such repeated emergency seed interventions have led to seed aid dependency and the destruction of local seed systems.

Seed relief interventions have also been criticized for not always presenting appropriate crops or varieties and for not leaving farmers sufficient choice. In some cases it has even been criticized as an unfair or 'back-door' method for promoting modern varieties (Remington et al., 2002). Similarly the introduction of large quantities of seed from elsewhere, for example of modern crop varieties, has been associated with risks for local crop genetic diversity, and finally, seed relief interventions have been seen as inappropriately benefiting certain actors from the formal sector, for instance by providing opportunities for corruption.

The direct seed distribution approach is also sometimes called the *Seeds and Tools approach*. It has been criticized in a number of regards: for not always being based on, for example, a proper assessment of the problem (e.g. availability vs. accessibility), which in turn can result in aid dependency (Longley et al., 2001, Sperling and Cooper, 2003); for being based on a negative perception of farmer seed systems (Jones et al., 2002); and for benefiting other sectors more than the intended farmers, such as the formal, commercial sector (Remington et al., 2002), or the use of inappropriate distribution channels (Archibald and Richards, 2002).

As an alternative to the Seeds and Tools approach, agricultural rehabilitation and development tends towards interventions that strengthen existing seed systems and with that the linkages between the formal and informal seed sectors. New strategies emphasize working to understand and strengthen local seed systems, and on integrating relief and development approaches in seed interventions (Jones et al., 2002; Longley et al., 2001; Sperling and Cooper, 2003). Rather than focusing solely on direct seed distribution, interventions now try to place grater emphasis on strengthening seed systems from the inside.

The dynamics of smallholder maize seed practices in the Central Valleys of Oaxaca, Mexico

The research which constitutes the basis of this book formed part of a much larger research effort by The International Maize and Wheat Improvement Centre (CIMMYT) on maize genetic resources in Southern Mexico. This included a multidisciplinary approach spanning different social sciences, plant breeders, agronomists, and population geneticists. Being part of this larger effort facilitated the research both in terms of availability of data, contacts and logistics, as well as opportunities for stimulating discussions with members of other disciplines, which served to broaden the understanding of many issues.

The research was partially funded by two specific research projects:

- "Collective action for the conservation of on-farm genetic diversity in a centre of crop diversity: an assessment of the role of traditional farmers' networks". This study was undertaken with a grant from the Consultative Group on International Agricultural Research (CGIAR) Systemwide Initiative on Collective Action and Property Rights (CAPRi), and with additional funding from the governments of France and Denmark. It was carried out by CIMMYT in collaboration with The Universidad Autonoma de Chapingo (UACH), Mexico; Institut de Recherche pour le Developpement (IRD), France; and the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Mexico, from October 2000 to September 2003. This project explored the possible role of collective action among small-scale farmers in managing and maintaining genetic resources in a centre of crop diversity. It focused on the local institutions that ensure the supply of seed of diverse maize landraces to small-scale farmers in the Central Valleys of Oaxaca, Mexico. The key hypothesis was that the medium-to-long-term supply of a diverse set of varieties to any individual small-scale maize farmer depends on an agreement among a group of farmers to manage and supply the seed of these landraces to each other, if the need arises, and that this constitutes a form of collective action.

- "Identifying the factors that influence small-scale farmers' transaction costs in relation to seed acquisition". This study, carried out by CIMMYT from October 2003 to December 2003, was funded by the Food and Agriculture Organization of the United Nations (FAO). In this study, small-scale farmers' perceived transaction costs in relation to maize seed acquisition were examined from a farmer perspective through the use of qualitative data, and with special emphasis on issues regarding information about maize seed, seed transaction negotiation and enforcement. The purpose of this study was to generate experience and findings which would serve as the basis for the design and planning of a subsequent phase, in

which to attempt to quantify the transaction costs experienced by various actors in relation to maize seed transactions.

The point of departure was the study of the role of collective action in relation to local maize genetic diversity conservation. However, relatively early in the process it became clear that the importance of collective action was limited in relation to farmers' seed supply strategies. Similarly, early in the process of the study of farmers' transaction costs in relation to seed acquisitions it became apparent that the explanatory value of the proposed analytical framework based on standard transaction cost theory might be limited. In view of the initial findings in relation to both studies, the research was redirected. Though the issues regarding the role of collective action in relation to local maize seed supply and farmers' transaction costs in relation to seed acquisition still needed to be addressed and properly documented, the overall scope of the research was broadened to investigate more generally the functioning of the local seed practices from a farmer perspective, albeit with particular emphasis on farmers' seed supply strategies. This account of the research process is important in understanding why this document reports on both the limited role of collective action and the limited importance of transaction costs, as well as presenting a broader study of on-farm seed practices and seed transactions.

Before proceeding to the main body of the text, let me briefly explain how it is organized, and provide a few guiding remarks for the reader.

Guidance to the reader

This book is written with two main audiences in mind. The primary one is social scientists who are interested either in local seed practices or in the theoretical issues being discussed. However, the hope is also that other scientists or development professionals working with agriculture will find the topic of interest, and an effort has been made to convey the findings in a way that should make them accessible also to this group.

This chapter has stressed the importance of seed in agriculture and also the importance of local seed practices in securing seed in developing countries. An overview of agricultural development and research in relation to seed issues is presented, and the expected contributions of this study are outlined in relation to this broader context.

Chapter two presents the conceptual framework and the methodological strategy used in the study of seed practices. It should be noted that the theoretical elements are outlined in more detail in subsequent chapters, and only an overview is presented here.

Chapter three is an introduction to maize for readers who are new to maize. The global importance of maize and its many uses is documented, as is the origin of maize and its spread. The chapter also includes an introduction to

maize breeding and the biology of maize. In particular it is important that the reader is familiar with the concept of genotype by environment interaction which is fundamental to understanding many maize practices, and the concept is referred to repeatedly in the other chapters.

Chapters four and five present background information on the study area. Chapter four provides a general overview of the Central Valleys of Oaxaca and the six study communities. In Chapter five the physical and social context of the two most contrasting of the six study communities is described in more detail, including an overview of their agricultural production systems. Finally, in order to give the reader a sense of the diversity and complexity of local livelihoods, you will also meet some of the farmers from these two communities.

Chapters six to nine analyse various aspects of local maize seed dynamics in the study communities. Chapter six examines different aspects of on-farm seed management practices and concepts from a local knowledge perspective. Initially key elements of the relevant literature on local knowledge are reviewed. This is followed by five sections on: Seed concepts, farmers' varietal choice, and sources of seed, on-farm seed management practices, and moral dimensions of local seed practices. It is argued that the notion of seed *system* is misleading and a focus on seed practices is preferable. Furthermore, it is argued that local seed practices to a large extent constitute performative knowledge and the transformation of this into verbalized knowledge is problematic. Finally, it is argued that local knowledge on seed and seed practices also include social values, which influence the shaping of farmers' practices.

Chapter seven examines the role of collective action in informal seed practices in Oaxaca. A brief literature review on collective action is undertaken and an operational definition of collective action is given to explore its role. The empirical findings are focused on the types of seed transactions, the types of social relations between the parties in the transactions, and also their frequency. It is argued that collective action does not have an important role in seed transaction. However, social relations and trust are very important, and this is explored further in Chapter eight.

Chapter eight analyses the social organization of seed exchange or the embeddedness of seed transactions. Drawing on literature on embeddedness, social capital, trust, and social network analysis it is agued that due to the lack of transparency of seed and the infrequency of transactions, it is very important to consider social relations when analysing seed practices, as the mobilization of social capital, including trust, reduces the risk involved in acquiring seed. It is also argued that purchase, or payment in money rather than exchange of seed, is a very important factor in augmenting the number of potential seed suppliers. A final caveat is a caution on reducing seed exchange to a simple question of demand and supply.

In Chapter nine the relevance of standard transaction cost analysis in relation to farmers' maize seed acquisition is examined. Three types of transaction costs are investigated: Search costs, negotiation costs, and enforcements costs. It is argued that the risk of crop failure is a major concern for farmers in relation to seed acquisition. However, in order to reduce this risk and to facilitate acquisition of reliable information on seed quality and availability, farmers draw on local mechanisms of trust and social capital. As a result the transaction costs related to local seed acquisitions are negligible from the farmers' point of view.

In Chapter ten the key findings from the analysis of the dynamics of smallholder maize seed practices in the Central Valleys of Oaxaca are briefly reviewed and pulled together in a general discussion. This is followed by a series of concluding remarks, and finally, by a number of considerations concerning the implications of the analysis presented here.

2. Conceptual framework and methodological strategy

The research underlying this book was initially directed towards investigating the role of collective action in seed systems in Oaxaca. Based on a hypothesis regarding the presence of collective action in relation to local seed exchange, an analytical and methodological approach was identified in order to examine this, including a study of the role of local networks that might be related to collective action for seed supply. Other funding was later added with the purpose of studying transaction costs in relation to seed acquisition. In consequence the analytical framework was expanded and the methodological approach adjusted to investigate this angle. Meanwhile, I had previously worked with an actor oriented approach, and was keen to use this to look more openly at different aspects of local seed practices in order to try to understand them from a farmers' perspective.

The combination of a clear initial hypothesis and an open framework with which to investigate these created a useful tension between theory and empirical findings. During the research it became apparent that collective action does not play an important role in seed practices, and that other sociological concepts such as embeddedness, social capital and trust had more to contribute to the understanding of seed exchange. Likewise, it became apparent that the transaction costs related to informal seed exchange are perceived by the farmers to be negligible, and that other concepts relating to information and knowledge could contribute to understanding this better. As such the theoretical framework evolved over the course of the study, while the limitations of the initial theories were investigated.

The first part of the chapter outlines the research approach and the elements of the conceptual framework used to analyze seed practices. The latter is only meant to provide an overview and more detail is provided in the relevant chapters. The second part describes the methodologies applied for data collection and analysis. Finally the chapter offers some reflections on the methodological challenges of this study.

Research approach: Actor-oriented analysis

Actor-oriented research is concerned with how different individuals and social groups interact and develop strategies for dealing with social change; and how different social actors become involved in negotiations over resources, meanings, and control, while attempting to create room for manoeuvre to pursue their own projects. At the same time actor-oriented research focuses on how, in turn, individual choices and practices are influenced and shaped by other dimensions of social life and interaction (Long, 1992b, 2001).

In philosophical terms, the actor-oriented approach falls under social constructionism and addresses key issues such as the constant reworking of existing cultural repertoires (Long, 1997), learned behaviour and modes of interaction, and the ways in which people improvise and experiment with different elements and experiences; and their conscious or unconscious responses to the circumstances they encounter.

Thus, actor-oriented analysis does not imply that people are necessarily conscious of the ways their perceptions of reality are formed, or how this may shape their actions and the outcomes thereof. As Long points out, citing Ellen, 1996, all we know is that "social life is always provisional, 'work-in-progress', never completed and therefore not constructed in any ultimate way" (Long, 2001: 3).

Aiming for an understanding of social action and practices from the point of view of the actors involved, actor-oriented research adopts an open-ended approach, taking as its point of departure real life situations and everyday social practice; in other words, actors' lived experience[3].

Background to actor-oriented analysis

With the publication of *An Introduction to the Sociology of Rural Development* in 1977, Long made a call for an actor-oriented development sociology, which at the same time would recognize and elucidate, on one hand, the agency of individual actors and their capacity to influence, directly or indirectly, the outcomes and directions of regional or national processes, and, on the other hand, the ways in which individual choices and strategies are also shaped by broader contexts.

This call for actor-oriented analysis was in several ways a reaction to various perspectives which had characterised development debates over the previous decades and certain key developments in the fields of anthropology and sociology in the 1960s and early 1970s. The modernization theories popular in the 1950s and into the 1960s saw development as a linear and progressive move from the 'traditional' towards technologically, as well as institutionally and economically, more complex (i.e. modern) forms of society, a process in

[3] Drawing upon Schutz, Long uses the concept of *lifeworlds* to refer to the "lived-in worlds and largely taken-for-granted social worlds of particular individuals". He points out that this should not be interpreted as a kind of "cultural backcloth" that frames individuals' actions, but rather as the outcome of "individuals' own constant self-assembling and re-evaluating and negotiation of relationships and experiences" (Long, 2001: 241). All forms of external intervention necessarily enter the existing *lifeworlds* of the individuals and social groups affected, if only to be mediated and transformed by these same actors and structures. In as far as large-scale and 'remote' social forces alter the life-chances and behaviour of individuals, they can only do so via the shaping of the everyday life experiences and perceptions of the individuals and groups concerned (Long, 2001: 241).

which the transfer of technologies, resources and organizational forms from industrialised countries to developing countries were considered central elements. Meanwhile, various neo-marxist approaches emerged, including theories of structural dependency and approaches that focused on the articulation of modes of production (Long, 1984). Although they contrasted in theoretical and ideological terms (one associated with liberalism, the other with Marxism) both orientations represented deterministic and centralist perspectives (i.e. viewing development as resulting from external influences, see Long, 1977, 1984, 1992b). At the same time, both gave little, if any, attention to "the ways in which local groups and processes can contribute and indeed modify the patterns of regional and national development" (Long, 1977: 187).

Meanwhile, in anthropology and sociology, the 1960s and early 1970s brought increased interest in symbolic and social interaction and phenomenological perspectives (Douglass, 1966; Garfinkel, 1967; Ortner, 1974; Rosaldo, 1974; Turner, 1967). Theories of social entrepreneurs and brokers emerged, in addition to models of strategic decision- making, transactions and exchange (e.g. Barth, 1966; Kapferer, 1976; see also Long, 1977: Chapter 5). However, while modernization and dependency approaches tended to take the form of abstract, deterministic, macro-level theories, these social interactionist initiatives, or early versions of actor-oriented approaches, often fell short due to a tendency to focus entirely on the social interactions and decision making processes of individuals, while paying little or no attention to the shaping of individual choices and strategies by larger frames of meaning and action (e.g. cultural dispositions, social organisation and power relations, see Long, 1992b: 21).

The actor-oriented approach originated to a certain extent in the discussions of development, but soon discussions touched on more general sociological issues. In the early 1980s development sociology was characterised by a schism between macro-level structural theories and voluntaristic models of micro-level interaction and decision-making. The need to acknowledge that external conditions are interpreted, and thus, mediated and transformed by 'internal actors', became increasingly clear, as well as the need for "a more dynamic approach to the understanding of social change which recognizes the interplay and mutual determination of external and internal factors and relationships" (Long, 1984: 171).

Thus, actor-oriented analysis developed out of this theoretical impasse (see Booth's 1985 and 1994 characterization of this), attempting to pull together agency and historical-structural perspectives in a combined manner, and addressing the challenge of relating local processes to larger scale social structures (Long, 1984). Today the relationship between structure and agency remains of fundamental importance, since it emphasises central dilemmas in the social sciences, such as voluntarism versus determinism and subjectivism versus objectivism.

Elements of the actor-oriented perspective

For many years the understanding of culture was influenced by a view of culture as something common and equally shared among all. Some commentators think that the premise of cultural sharing has been so deeply ingrained in anthropological thinking, that for a long time it has been more of a hindrance than a help to theoretical development (e.g. Archer, 1988; Hannerz, 1989). In more recent times, however, attention has increasingly centred on the importance of also considering individual freedom and capacity for action. As Archer puts it: "…It is part and parcel of daily experience to feel both free and enchained, capable of shaping our own future, and yet confronted by towering, seemingly impersonal, constraints" (Archer, 1988:x).

A central element in the actor-oriented approach is the *concept of agency*. According to Hannerz (1989: 29), agency concerns different types and degrees of consciousness tied to the actions of social actors; the related variations in the degree of freedom to choose one's own direction of action as well as to experience such freedom. Long considers agency as a social concept that refers to the ways in which "actors acquire and sustain appropriate forms of knowledgeability and capability in carrying out their social actions", as well as "how they enrol others in the projects they develop" (Long, 2001a: 112). In other words, agency represents the view that actors have capacities to process social experience and to devise ways of coping with life, even under the most extreme forms of coercion (Long, 1992b; Marx Ferree et al., 1999; Villareal, 2001).

In Long's conceptual framework, the concept of social actor refers to all those social entities that can be said to have agency because they are 'knowlegdeable and capable' (Long, 1992b: 23). That is, they are able to assess problematic situations, process experience and organise 'appropriate' responses. This includes both individual and collective actors (Lon, 1997). However, as Long points out, the term 'social actor' should not be used to refer to collectivities, agglomerates or other social categories, such as "'society' in general or classes, that have no discernable way of formulating or carrying out decisions" (Long, 2001: 16; Long, 1992b). Instead, these forms of collective and organisational endeavours are better depicted in terms of 'coalitions of actors', 'interlocking actor projects' and 'the interplay of discourses' (Long, 2001: 241; see also Long, 1997: 9f for a brief overview of three distinct understandings of the idea of 'collective actor').

Another key aspect of actor-oriented analysis is the emphasis on social action and interpretation as context specific and contextually generated. While meanings, values and interpretations are socio-culturally constructed, their application may vary considerably according to circumstances and available cultural repertoires (Long, 2003). The approach also includes the notion of social heterogeneity, which refers to social actors' different social

responses to similar social conditions (Long, 1984). This points to the fact that social life comprises a wide diversity of social arrangements and cultural repertoires, even under seemingly homogeneous circumstances (Long, 2001). Within any social context variations exist, and therefore different patterns of response and change are to be expected. These different forms are in part created by the social actors themselves, indicating that change cannot simply be imposed from outside. Rather, farmers and other local actors actively try to shape the outcomes of change, and thus different social patterns develop within the same structural circumstances.

Similarly, people who live within the same set of social relations may have seemingly incompatible interpretations of social value. Yet, at any moment, events may make it necessary to clear up ambiguities and negotiate an agreed point of view or simply to agree to differ. Thus, attention to the negotiation of social value makes it possible to analyse how diverging values and interests are knitted together to construct workable social arrangements.

The actor-oriented approach is not a grand theory based on universal principles governing social processes. This is not its aim. Instead, its purpose is to provide an open-ended conceptual and methodological approach to social phenomena that avoids an extreme eclecticism resulting from the combination of elements drawn from contrasting and often incompatible theoretical frameworks. The approach is particularly useful when examining the ways different social actors continuously negotiate, redefine and challenge existing social forms. Independent of predefined models of analysis, this open-ended approach makes it possible to ground the analysis in actors' lived experiences. This makes the actor-oriented analysis particularly well-suited for the exploration of the perspectives and values of different actors, as well as the various processes and structural dimensions that influence individual action and shape social practice.

These characteristics make the actor-oriented approach particularly apt for interface analysis. That is, for the analysis of encounters between diverging perspectives and values, and the ways in which social actors attempt to negotiate, manage or otherwise get to grips with the circumstances in which they find themselves (Long, 1984, 1992, 2001). While this includes issues such as 'critical events' (Long, 1997: 7p) or discrepancies in socio-cultural interpretations, knowledge or power relations, this dimension of the actor-oriented approach makes it highly useful in relation to the analysis of social change in general. What is more, this also makes the actor-oriented approach able to bring different levels of analysis together: policy-maker – extensionist – farmer, or, local –regional – global (see Long, 1997: 13pp for a brief description of how the approach can contribute to research on 'global commodity networks' and 'rural livelihoods and transnational migration'). These various qualities of actor-oriented analysis have been used by researchers and practitioners within a range of fields, for example, development sociology (Arce,

1993; Long, 1977, 1984, 2001, 2004; Long and Long, 1992), anthropology (Sardan, 2001), history (Stern, 1995), law (Benda-Beckman, 2006), gender studies (Melhuus and Stølen, 1996; Villareal, 1996), policy analysis (Roberts, 2001), and medicine (Fajardo, 2001).

Actor-network theory and the issue of methodological individualism

Actor-oriented research has been charged with giving too much emphasis to the agency and instrumental rationality of individuals (Long, 2001: 15). Such research devotes considerable attention to the ability of actors to process experience and devise ways of coping with life. But this should not be interpreted as assuming that individual actors live out their lives in a social vacuum. In fact, the role of social relations and networks, and the processes in which these are used to shape, and are shaped by, notions of meaning and value in actors' efforts to create space for manoeuvre, are central to actor-oriented analysis.

Among those criticizing social actor analysis are researchers who favour 'actor-network theory'. Their main line of criticism seems to rest on the assumption that the approach is built upon a form of 'methodological individualism', whereby social phenomena are reduced to the dispositions and actions of individuals. As an alternative they propose the notion of a sociology of 'hybrid collectives', thus overcoming the division between individualistic and holistic approaches (Callon and Law, 1995; Callon and Law, 1997; Goodman, 1999: 25; Latour, 1993: 107; see also Long, 1997 on the notion of collective actors). Later I will return to discuss the question of methodological individualism as such.

A fundamental difference between actor-network theory and the more conventional sociological definition of actors as social entities is actor-network theory's insistence that actors are entities that act – whether they are strictly social or not (Stadler, 1997). Callon and Law (1997), for example, argue that the social is inherently heterogeneous and that entities are in fact networks of heterogeneous materials.

As such, an actor-network is considered not to be limited to its 'social actors'. It embraces not only people and social groups, but also machines, animals, texts, money, architectures, and artefacts, to mention a few (Law, 1992). The actor-network cannot be reduced to either the actor or the network. It is, at the same time, an actor whose activities span diverse elements, and a network capable of redefining and changing that which constitutes it. According to Latour, the idea behind the actor-network concept is to designate "two faces of the same phenomenon, like wave and particles" (Latour 1998).

In the case of seed systems the actor-network perspective would consider a bag of seed a separate actor, and obviously the particular characteristics of the seed are important for understanding the transactions that take place. How-

ever, the seed does not possess its own agency, and for this reason I do not find it useful or even meaningful to consider it an actor in itself.

Though actor-oriented analysis uses a social actor perspective and takes actors' lived experience as a point of departure, it distinguishes itself from individualism as well as from extreme versions of ethnomethodology, by recognizing and arguing for the need to take analysis to another, broader level. While it distances itself from the use of predetermined models of analysis and 'institutionalised' analytical concepts, it seeks a certain level of generalization through the construction of more open, dynamic and flexible analytical concepts such as social field, arena and lifeworld (Long, 2001)

Methodological individualism can be explained as the view that human social behaviour can be explained only as a function of individualistic, non-social motivations of individual actors. According to this, the explanation of social phenomena should be grounded in individual action, and interpreted as the results of individual actors' behaviours and decisions (Boettke and Coyne, 2005; Jose, 2003; Mises, 1962).

One type of methodological individualism, which has been very influential in the social sciences, is the view of man as a rational, self-interested, utility maximizing individual; sometimes also known as '*homo economicus'*. Theories based on the idea of rational, self-interested actors, propose a general model for explaining the basic properties of human behaviour (Long, 1992b: 22, citing Gudeman, 1986). This model has been criticized for adopting a Western ideological or philosophical standpoint. In contrast, actor-oriented approaches are not based on any predefined notion of what motivates people's behaviour. Rather, it adopts an open-ended approach, which recognizes the complexity of social life and the importance of social relations, conflict and power.

Elements of a conceptual framework

As indicated earlier, the research behind this book was part of a project on the significance of collective action in informal seed systems. Later, as the research evolved I was led to question the role of collective action. Empirical evidence emerged to suggest that other concepts drawn mostly from anthropology and economic sociology, such as local knowledge processes, social embeddedness and networking, social capital and trust were more useful for exploring the empirical dynamics and for developing a conceptual and theoretical understanding. At a later stage an additional research issue arose concerning the relevance of the theory of transaction costs for analysing seed exchange.

In the following a summary is provided of the main conceptual/theoretical components. Theories relating to knowledge and information are highlighted in particular in Chapter six, which discusses seed practices as an example of 'performative knowledge'. Issues of collective action and the assumptions underlying it are discussed in Chapter seven and the elements from economic

sociology in Chapter eight. Finally, theories on transaction costs are discussed in Chapter nine. These concepts are discussed below and follow the sequence of chapters six to nine.

Local knowledge

The various ideas and practices that form part of farmers' seed management can be considered a form of local knowledge – a central concern of many anthropological studies (Barth, 2002; Marchand, 2003; Sillitoe, 2006). However, knowledge is also an important field of theory and study in itself, where elements from many disciplines including philosophy, psychology, and anthropology can play a role. Approaches within theory on knowledge can tentatively be divided into two; those that focus mainly on social aspects as distinct from those that relate to cognitive aspects.

The former have focused on issues related to power, how power influences what is considered knowledge, and how discourses on knowledge reproduce power relations (Foucault, 1979). Another important contribution has been the recognition that knowledge is not unitary and systematized, either for the individual, or for the social group; on the contrary, knowledge is fragmentary, diffuse, and multi-layered (Long, 1992c; Pottier et al., 2003). Considerations of power and interface are central to many studies involving local people's negotiations with government officials or representatives of private companies.

Certain schools of anthropology have, in particular, stressed the usefulness of cognitive theories of knowledge. This has been convincingly argued by Bloch (1991), and Marchand (1999, 2003), who underline the limitations of relying on overly linguistic models of knowledge. This and other analytical aspects of local knowledge, in particular the communication and negotiation of local understandings, and some of the analytical and methodological implications these imply, are discussed further in Chapter six. This is followed by a presentation and discussion of several aspects of local seed concepts and practices in the study area.

Collective action

As an analytical concept, collective action has been particularly useful in the study of social movements and the management by multiple actors of public goods or common resources such as forests, fisheries, rangelands, irrigation. However, though crop genetic resources are broadly regarded as a public good, they are very different from other natural resource public goods for which the main problem is over-use. The case of crop genetic resources is quite the opposite - in fact, for many landraces and wild relatives, their conservation is often entirely dependent on their continued use and from a conservation point of view, one might say, the more they are used the better.

Most definitions of collective action share the notion that it necessarily involves multiple actors and is directed towards the achievement of certain

common interests or goals. While the definition of what constitutes the collective, and to what degree the actions it takes can be said to represent a common purpose, remain highly debated, a large body of research has documented the processes by which collective organisation emerges and constitutes itself. This literature gives attention to the rise and functioning of both formal and informal organisations. Moreover, close attention has been paid to how collectivities have developed that concern themselves with sets of rights and responsibilities related to the use of common resources (Meinzen-Dick and Di Gregorio, 2004).

On a more theoretical level, the study of collective action is marked by a divide between those who are interested in social movements as distinct sociocultural entities with a common identity, and those who take their point of departure as the lived experiences and agency of multiple social actors who negotiate to form coalitions that are continuously being reshaped (Long, 2001; Melucci, 1988 in Hilhorst, 2000; Nuijten, 2001; Rucht, 2002).

Social embeddedness

Farmer seed transactions can be regarded as an economic practice, involving the exchange of a good between two parties. Rational choice theory has played an important role in the development of economic theory and in several respects has contributed greatly to the understanding of economic phenomena. However, with regard to the study of the practices of economic actors at a more specific level, various critics have pointed to the limitations of theories based on utility maximization. In particular the critique has been directed at the view of actors as independent, 'atomized' and 'rational' decision-makers with little or no concern for the role of human emotions, social interaction and networks (Fafchamps, 2002; Granovetter, 1985; Portes and Sensenbrenner, 1993).

Seed transactions can be looked at from a market perspective. In much economic theory a competitive market is viewed as being constituted by a large number of consumers and suppliers who do not influence market dynamics individually. Furthermore, it is often assumed that the actors have perfect information, and that social relations do not significantly influence actors in their transactions. Yet, many detailed studies of social behaviour in real market situations seriously question these assumptions (Beckert, 2003; DiMaggio and Louch, 1998; Geertz, 1978; Granovetter, 1974). Granovetter (1985), for example, distances himself from the utilitarian theories of classical and neo-classical economics, and discards the idea of economic behaviour as something heavily embedded in pre-market societies which unfolds and becomes more autonomous as modernization occurs. As an alternative, he proposes a more integrated view of human actors capable of processing information and experience and acting upon it, but who do not exist independently of the social context of which they form a part. Following this line of thought I argue that

farmers' seed exchange cannot be fully understood unless analysed as part of their specific social context.

Social capital

From an analytical point of view, farmers' seed exchanges can be regarded as interactions in which social capital is mobilized. The concept of social capital has been much debated and used in many different ways to deal with the social aspects of economic practice. Putnam defines social capital as different forms or institutions of social organization that allow individuals to coordinate and pursue interests for their mutual benefit (Putnam, 1995). Putnam furthermore posits a clear relation between the amount of social capital and the level of economic development and democracy in any given society. While Putnam's work has played an important role in popularising the concept of social capital and has been widely used, among others by the World Bank, it has also been criticized by many for being misleading and for obscuring the role of power (Fine, 2003; Foley and Edwards, 1999; Harriss, 2001; Portes and Landolt, 1996; Tarrow, 1996).

Social capital has also been described as the result of institutional and individual or collective investments in the reproduction of social relationships that are directly usable in the short or long term (Bourdieu, 1977). According to Bourdieu, social capital is constantly reproduced through a process in which goods, favours, information, etc. are continuously exchanged as a means of recognizing and affirming social relations and group membership.

Others, such as the economists Marcel Fafchamps and Bart Minten, distinguish between different meanings of social capital according to their origin and types of trust. According to Fafchamps and Minten (2002), social capital can be seen, on one hand, as "a 'stock' of trust and an emotional attachment to a group or society at large that facilitate the provision of public goods"; they call this generalized trust. On the other hand, social capital can also take the form of "an individual asset that benefits a single individual or firm", which they refer to as personalized trust.

Other uses of the term merely signal awareness of the significance of social aspects in relation to economic or political processes, without actually contributing to an improved understanding of the issues in question. A related view is that social capital is no more than resources that are obtained through social relations and networks. Another interpretation is that social capital must be understood as the *ability* of actors to use social networks in order to mobilize resources, and not as the actual resources themselves (Portes, 1995 in Long, 2001). Furthermore social capital is often viewed as an asset and in some regards also a constraint (Long, 2001; Portes, 1997; Portes and Landolt, 1996; Portes and Sensenbrenner, 1993).

In relation to the dynamics of farmer-to-farmer seed flows in the Central Valleys of Oaxaca, I will use the concept of social capital to illustrate how

farmers mobilize social networks in order to negotiate favourable terms for seed transactions and to acquire maize seed with favoured characteristics.

Trust

As a good, seed lacks transparency. That is, the person acquiring the seed cannot know the characteristics of the plant the seed may produce merely by looking at it, and therefore must rely on the information provided by the seed supplier. This makes trust an important issue in seed transactions.

Trust is relationally and culturally constructed. The notion of trust is often used to describe the expectation or confidence one has that someone will act in a particular way, for example with honesty or sincerity. Different categories of trust have been discussed (Cook, 2005; Hardin, 2002; Rose-Ackerman, 2001), and it has also been pointed out that, while trust is generally regarded as something positive and desirable, it can, under certain circumstances, also be regarded as something negative, depending on one's interpretation of the context (e.g. Adler Lomnitz and Sheinbaum, 2004; Cook et al., 2002).

With regard to transaction and social exchange it has been noted that the cultivation and use of trust and trust relations tends to grow in importance under different conditions of risk and uncertainty. Thus, the notion of trust appears to be able to contribute to a feeling of security, when social actors are faced with circumstances they perceive to be risk-prone. According to DiMaggio and Louch (1998) this is because the use of relations of trust in connection to commercial exchange, envelopes the exchange in a web of obligations and holds the seller's network hostage to appropriate role performance in relation to the transaction.

Trust and reciprocity appear to be quite closely linked. While trust can lead to relations of reciprocity, reciprocity can also lead to trust (Cook, 2005; Mauss, 1954; Sahlins, 1968; Simmel, 1907; Rose-Ackerman, 2001).

Transaction costs

The concept of transaction costs is used to refer to costs incurred in the course of carrying out an economic exchange. Transaction cost theory is part of what has come to be known as new institutional economics. This line of economic theory expands neo-classical economic theories by incorporating property rights and transaction costs into neo-classical economics to explain economic behaviour.

Within the framework of standard transaction cost theory, transaction costs are often divided into different categories. Search or information costs refer to costs that are incurred while exploring whether the required good is to be found on the market, its costs, providers, and so forth. Bargaining or negotiation costs are the costs of negotiating and arriving at an agreement with the other party, as well as carrying out the transaction. Finally, the term enforce-

ment costs is used to refer to the costs of ensuring that the other party keeps his/her part of the agreement, and, if necessary, of taking action to this effect.

While new institutional economics places a stronger emphasis on empirical testing than, for example, standard neo-classical economics, it also has strong roots in rational choice theory. Some authors argue that this does not change the fact that transaction costs are difficult to measure in any objective way, and that the issue of what constitutes a transaction cost or not is specific to the circumstances and the parties involved (Buckley and Chapman, 1997; Sadoulet and De Janvry in Gabre-Madhin, 2001).

In this book, the concept of transaction costs is used, in a broad sense, as an entry point for examining what, from a farmer's perspective, is regarded as a cost or a sacrifice incurred in relation to maize seed exchanges. It is argued that in farmer-to-farmer seed transactions the transaction costs are perceived by the farmers to be negligible.

The fieldwork

Data were collected through the use of both qualitative and quantitative methods, including in-depth, semi-structured ethnographic interviews on a variety of issues related to maize and maize seed supply; participant observation; focus group discussions; household case-studies and a quantitative tracer study of seed flows between farm households. The different methods complemented each other and allowed key issues to be addressed from several angles. The selection of study sites and informants is explained below, followed by a description of the different data collection activities, which together formed the empirical basis for the present study on smallholder maize seed practices in the Central Valleys of Oaxaca, Mexico. A chronology of fieldwork activities is presented in schematic form in Appendix 1.

The present research builds on previous investigations by CIMMYT and INIFAP (Bellon, 2004; Bellon et al., 2000, 2003; Smale et al., 1999, 2003) in the same study area. The communities had been selected for the contrasts they represented in terms of maize yield potential and dependency on non-farm income (Smale et al., 1999). Because the CIMMYT/INFAP project was conducted in the same area, considerable background information on all six communities was already available, including a baseline study based on a random sample of 240 households[4], which I will draw on repeatedly. The CIMMYT-INIFAP project was still ongoing when the study of the role of collective action in the conservation of local maize genetic diversity was initi-

[4] Smale, M.; Aguirre, A.; Bellon, M.; Mendoza, J.; Rosas, I M. (1999). *Farmer management of maize diversity in the Central Valleys of Oaxaca, Mexico: CIMMYT-INIFAP. 1998 Baseline socioeconomic survey.* CIMMYT Economics Working Paper 99-09. International Maize and Wheat Improvement Center (CIMMYT), Mexico D.F.

ated. This provided excellent opportunities for information exchange and sharing. For example, at the beginning of this study, information from the previous investigation was used as a basis for the selection of informants for the study in such a way that the diversity of different social groups was captured in terms of age groups, gender, ethnicity, economic status, and level of formal education. Later, as the research progressed and our knowledge about the communities accumulated, the basis of information for selection of additional informants broadened.

In a similar way the information from the CIMMYT-INIFAP project provided useful background information for the planning of the various research activities and a good basis for deciding which activities should be carried out in all six communities and which could be limited to just some of them.

The initial qualitative survey was carried out in the three most contrasting of the six study communities: Santa Ana Zegache, San Lorenzo Albarradas and San Pablo Huitzo. This activity was carried out in only three of the original communities because of the labour-intensive and time-consuming character of the methodology. By focusing our efforts on the communities with the most contrasting conditions of the six, we were able to obtain high quality information that sampled the range of situations present in the study area. The data gathered during these interviews were later confirmed in the focus group discussions and in the tracer study.

The focus group discussions were carried out in all six communities. They explored the relative importance of seed loss among the vulnerability factors that farm households faced and the mechanisms that guided farmers' seed transactions. This provided a valuable source of rich information.

The survey-based seed flow tracer study (which involved male and female representatives from 153 farm households) focused again on the same three communities where the initial interviews were conducted. This was justified because the results of the focus group discussions suggested that the conditions of these three communities were representative for all six, and because the tracer study was very labour intensive and the resources limited.

Both the case studies and the transaction cost study were limited to the communities of San Pablo Huitzo and Santa Ana Zegache. Rather than spreading these activities to a few informants in each of the six communities, the decision was made to concentrate on just two. This made it possible to follow and interview members of several households in each community and to document the differences in seed practices between households.

Review of previous studies

At the beginning of the research, a review of previous work by CIMMYT in the study area was carried out. This included scrutinizing published works and reports as well as internal memos, survey questionnaires, and data sets, and interacting with researchers assigned to the CIMMYT-INIFAP research

project. Due to the overlap between the different research projects, much of the data from the CIMMYT-INIFAP project were at the time in different stages of being cleaned or processed and therefore not readily accessible. In addition, data were still being produced since the CIMMYT-INIFAP project was ongoing, when the study of the role of collective action in relation to farmers' seed exchange started up. The review of findings from previous studies carried on throughout the latter study. In 2005 additional curation of data from the CIMMYT-INIFAP project was undertaken which greatly facilitated the access to and use of data from this research.

Initial qualitative survey

At an early stage in the research process an initial assessment of local practices for accessing seed of diverse maize materials was conducted through semi-structured ethnographic interviews with key informants from three of the six studied communities in order to identify relevant issues and questions. This was fundamental because many issues are embedded in people's minds, practices, and institutions, and are not easily articulated by farmers, without some prior knowledge on the part of researchers that allows the identification and proper framing of effective questions.

The ethnographic interviews were conducted with 22 key informants from the three most contrasting of the six study communities: Santa Ana Zegache, San Lorenzo Albarradas and San Pablo Huitzo. The selection of key informants was based on our prior knowledge using the above mentioned criteria so as to reflect contrasting socioeconomic and ethnic conditions.

This exercise constituted the first step in understanding social arrangements and local farmer-to-farmer maize seed supply. No evidence of existing institutions of collective action with respect to seed was identified in this early survey. This led to a focusing of the research and an adjustment of the methodology towards a more general description of how farmers access seed of diverse maize varieties and to understanding the reasons behind the apparent lack of collective action.

Community characterizations

In order to provide a description of the research location, background information was collected for a systematic characterization of each of the six communities in which research was being undertaken. The objective was to elaborate a general description of the agro-ecological and socio-economic context in which farmer-to-farmer maize seed flows were being studied, in order to provide a backdrop for the analysis and understanding of local farmers' seed transaction practices. Based mainly on secondary sources (i.e. formal survey data), and information provided by community authorities and individual community members, an internal working document was elaborated in the

form of a systematic background description of each of the six study communities.

Focus groups

A series of focus group discussions with men and women from all six study communities was carried out in September 2001. The objective was to discuss and establish the relative importance of seed loss among different vulnerability factors faced by farmers, and to explore the mechanisms that guide different seed transactions between the parties. The results from the initial qualitative survey constituted the basis for the planning of the focus group discussions, in which the following themes were emphasized: Situations in which seed acquisition becomes necessary; Ways to acquire seed and address seed problems- how and with whom?; Who has seed problems?; Important information relative to seed acquisition; Transaction strategies – how to strike a deal?

A total of 12 focus groups were carried out, in each community one with women and one with men. It was decided to separate the groups by gender in order to ensure female participation in the discussions and to avoid female farmers' inhibition or intimidation vis-à-vis male participants. In other aspects, however, focus group composition was heterogeneous and the selection of participants was based on the same criteria as mentioned above so as to ensure that the diversity of different social groups was reflected, (e.g. in relation to age, ethnicity, economic status, and level of formal education). Participants were invited in the form of a personal, written invitation.

In total 46 women and 58 men participated in the focus groups and contributed with information on the issues mentioned above. Detailed reports of each of the focus group interviews were subsequently elaborated as well as individual summaries of the results.

Each focus group event was initiated with a brief presentation of the objectives and the dynamic of the event, as well as an explanation of the characteristics and mandate of the institution responsible for organizing the event (CIMMYT). Participation in the group was not associated with the provision of technical or material support in any form.

A previously elaborated discussion guide was used in combination with posters, coloured cards and so forth. Discussion focused on reasons for seed acquisition and the most important farmer criteria for seed acquisition and information flow, and special attention was paid to the norms and social arrangements associated with seed flow.

Furthermore, participants were asked to enact a seed transaction simulation in which one person would represent the person in need of seed while another would represent the seed donor. In addition to generating a considerable amount of merriment and applause, the combination of discussion and socio-drama further enriched the discussions, causing more questions to be

posed, and comments, recommendations or even objections to be made. It provided examples of dialogues and an understanding of some of the ways in which farmers approached the issue of seed transactions. The presence of the other participants served to ensure a certain degree of reality to the simulation.

Besides generating an incredible richness of detailed data, the focus group discussions provided an opportunity to compare and test the information gathered up until then. Though the understanding of farmer-to-farmer seed flow in the study communities was broadened and many details were added, the focus group discussions largely confirmed the results obtained from the initial qualitative survey.

Tracer-study

As a means of achieving quantitative information about the flow of maize seed between farm households, a tracer study of individual households' seed transactions and the social relationships entailed was carried out. The survey questions were based on the information obtained in the previous activities.

The seed-flow tracer study involved male and female farmers from 153 farm households in three communities: Santa Ana Zegache, San Lorenzo Albarradas y San Pablo Huitzo[5]. We focused again on these three communities because the tracer study was very labour intensive and expensive. Special attention was given to events of seed acquisition and seed distribution, and incoming and outgoing maize seed flows of each household were carefully noted and mapped out with special attention to the specific details of the transactions and the social relationships behind the flows.

The focus of the tracer study was on the flows of maize seed among farm households and the farmers' explanations of the transactions, for example: How was the seed transaction carried out? Why did they acquire/provide seed? With whom? For a total of 516 maize seed transactions incoming and outgoing flows were registered, and the details recorded concerning the type of transaction and the social relations involved.

In each community approximately 50 structured interviews regarding seed acquisition and distribution were carried out using a structured survey form. In total some 153 interviews were carried out with male and female maize farmers, each representing their respective household production unit. The data were subsequently entered into a small database for the purpose of quantitative analysis.

As starting points, 10 households in each community were selected using criteria similar to those described for the selection of informants (i.e. economic

[5] The results of the focus group discussions provided further support for the impression that conditions in these communities fairly represented the diversity of conditions existing in all six.

level, production system, and the number of maize varieties they cultivated); hence this was not a random sample. A representative, man or woman, from each of these households was interviewed. After this first round of interviews, the information gathered about other households who gave or received seed was used to include these households in a second tier of interviews, until each household originally interviewed led to an average of four additional households.

When using interviews the fact of focusing on events in the past may cause certain problems or complications. Obviously, these complications depend on the type of events in question. In a tracer study like the present one, much depended on the memory of the informant and his/her degree of precision. If the informant did not remember to whom he/she had provided seed, no distribution was registered, and in general it was more difficult to remember things in the distant past than in the recent past. Likewise it was common to remember things which were particularly important to the person in question.

The factors mentioned above affect the present study in several ways:

- Many informants had difficulty remembering the details of the seed transactions, the precise year, the price or the quantity of seed that was negotiated; the type of transaction and, in relation to distributions, the reasons why the seed receiver asked for seed.
- In general, the informants had less difficulty remembering the acquisitions than the distributions, probably for the above mentioned reason (that it is easier to remember the events in which the person had to look for seed themselves, than the occasions where others came to solicit seed).
- On several occasions the respondent had not been the person in charge of all the seed transactions of the household, and therefore could not give precise information about the transactions and their details.

Most statistical tests require random sampling. But, in this case, where the seed flows between specific households were the focus, it was decided not to use a random sample, in order to analyse the seed flow chain and identify possible networks of collaboration between farmers. The methodology allowed the team to observe the complexity of farmer-to-farmer seed flow. However, a limiting factor was that it was not possible to determine the statistical significance of differences between communities. Hence, because the samples were not random or independent, the data are presented and used in a descriptive form, with no statistical analyses.

Revision of seed acquisition data

By August 2001 a number of baseline survey follow-up questionnaires had been applied as part of another CIMMYT research project in the same study area (the CIMMYT / INIFAP project mentioned above). A special section

dealing with issues relating to the acquisition and loss of maize seed among maize growing small-scale farmers had been included in these questionnaires. As part of the preparations for the next phase of the research regarding the role of farmers' social networks in relation to seed flow and the conservation of on-farm genetic diversity, a review of the particular data set pertaining to this section of the questionnaire was carried out. The purpose of this review was to assess, on the basis of the data at hand, the frequency of seed acquisitions and how these were distributed according to maize type, transaction type and the social relations involved in the transactions, as well as to obtain an idea of the different motivations for acquiring maize seed from outside the farm.

Seed acquisition data from 129 questionnaires were reviewed. A total of 512 events of maize seed acquisitions were categorized according to maize type (white, yellow, black, red or *pinto* (mixed colour)), type of transaction and category of social relation of the seed provider.

Analysis of formal maize sector through the use of ethnographic methods

In order to understand in a broader context, the local dynamics related to maize production and seed supply that farmers engage in, a series of semi-structured interviews with other actors in the Oaxacan maize sector, including government institutions, NGO's and private sector representatives, was carried out in the autumn of 2002. The questions explored in this activity included the following: What other actors influence the Oaxacan maize sector? What are their interests and priorities? What are the different resources they draw on and what constraints do they experience?

Through the use of ethnographic methods, this exercise provided important insights into the broader socio-political context of maize and small-scale maize production in Oaxaca, its actors and their projects. In particular, it contributed to a broader understanding of some of the problems small-scale farmers experienced in their interactions with the formal agricultural sector, especially government institutions.

In-depth ethnographic case-studies

In order to acquire deeper and more nuanced understanding of individual farmers' or farming households' strategies in relation to maize and maize seed management and exchange, a closer study of ordinary social life and everyday practices of a number of farmers and their households was carried out.

As Mango mentions (2002), case studies can be considered a slice of everyday life that reveal the social dynamics and complexity of ongoing social processes. The case studies in the present research provided a social and practical context for a number of maize- and maize seed related practices about which considerable data had been gathered by then. Studying the practices of several farmers and their households close-up, and learning from

them about their lifeworlds by direct interaction and participation in their various activities provided a different insight into how various aspects directly or indirectly relating to maize farming are negotiated and fitted into ordinary everyday life. One could say that the case study approach put the various issues concerning maize and maize seed into a practical everyday context and shed light on farmers' different ways of responding to similar situations or problems. At the same time, the case studies put the focus on maize agriculture and maize seed management practices into proportion by highlighting the relative importance, as well as the practical interweaving of maize agriculture with other livelihood strategies in different small-scale farm households.

The case-studies involved a mixture of participant observation, ethnographic interviews and informal conversations. While I sought to take part in different activities, I would often simply participate in whatever people were doing. This proved to be a good strategy as people generally appreciated the help (or at least the intention – depending on how successful my efforts were). Furthermore the obvious interest in learning about the different aspects of everyday life and the willingness to participate actively in peoples' different tasks helped establish good rapport and make farmers realize that their knowledge and experience was genuinely valued.

A total number of 18 farming households from two of the six study communities were treated as case-studies. The households were selected in such a way as to ensure the representation of diverse groups in terms of economic level, educational level of household principals (male and/or female), ethnicity, land tenure, household composition, off-farm income, remittances, animal ownership, and the number of maize types cultivated. Because of the labour intensity and time requirements of this methodology, the case studies were limited to the communities of Santa Ana Zegache and San Pablo Huitzo, which were considered the two most contrasting of the six study communities.

Transaction cost study

In the later stages of the initial research project on the role of collective action in farmers' seed exchange, the opportunity arose to expand the study with an additional perspective. As part of a larger research initiative under the title 'Making markets work for the poor', the Food and Agriculture Organisation of the United Nations, FAO, commissioned CIMMYT to carry out a study in Mexico on small-scale farmers' transaction costs in relation to seed acquisition. A first phase consisting of a qualitative assessment of the factors influencing farmers' transaction costs in relation to seed acquisition was aimed at

providing the basis for the design of a larger scale quantitative study of farmers' transaction costs in relation to seed acquisition[6].

The proposed research idea built upon the standard model of transaction costs within neo-institutional economic theory, taking as the point of departure the model's conceptual distinction between information costs, negotiation costs and enforcement costs. The goal was that of providing an assessment of farmers' experience in relation to each of these.

Due to the contacts and rapport already established during previous research, and the large body of background information gathered, it was decided to carry out the initial, qualitative assessment of the factors influencing maize growing small-scale farmers' transaction costs in relation to seed acquisition in Santa Ana Zegache and San Pablo Huitzo.

Information gathered during CIMMYT's previous research activities in the two communities was used to select the informants for this study, particularly information from the seed flow tracer study of a sample of 50 households per community (Badstue et al., 2003b) and the baseline study of a random sample of 40 households per community (Smale et al., 1999). Based on this information, in each of the two communities the informants were selected in order to represent different social groups in terms of gender, ethnicity, economic status, and level of formal education.

Data gathering took place primarily in the form of a series of informal, semi-structured ethnographic interviews with key informants from 16 households, 9 in San Pablo Huitzo and 7 in Santa Ana Zegache. An informal interview guide was used and the interviews were tape recorded. The themes covered included: what kind of information farmers considered important about the seed and/or the seed provider? How to get this information? What determines the type of transaction used and the costs involved? Do possibilities exist for compensation if the seed does not live up to expectations?

[6] Based on the findings of the first phase, the objectives of the second phase were redirected to focus on the examination of different seed markets in the state of Chiapas and the various actors involved in them, as well as their effects on farmers' access to seed of diverse maize varieties.

3. Maize

Maize is one of the three cereals, together with rice and wheat, that make up the backbone of the world's food supply. The versatile use of maize furthermore, means that over the next decades the importance of maize will increase even further. Considering the less than impressive cob of the ancestor of maize, teosinte, this was far from a foregone conclusion and exactly how it happened is still being debated. Part of the explanation is found in the biology of maize, and in particular in how it reproduces, and how it interacts with the environment. All of these issues directly or indirectly play a part in the maize seed systems of small-scale farmers in Oaxaca, and the following chapter provides a short overview primarily targeted at readers new to maize.

The global importance of maize

Maize is one of the world's most important crops. Measured in terms of area harvested or in terms of its global average contribution to human daily calorie intake, maize ranks third after wheat and rice; however, measured in terms of total production, it is the most important cereal crop (Table 3.1). Maize is grown around the world from 50 degrees north to 50 degrees south; from sea level to altitudes above 3,000 masl, on flat lands and steep slopes, and in climates ranging from tropical to temperate and from semi-arid to extremely wet (Centro de Investigaciones Agrarias, 1980; Morris, 2002; Shaw, 1988). In this sense, maize is today the world's most widely grown cereal, a fact that reflects its ability to adapt to a wide range of agricultural environments.

Table 3.1 Important food crops: - production, area, and average contributions in calories per capita per day.

Crop	Production 2004 (000 Mt)	Area harvested 2004 (000 ha)	Calories/cap/day 2002
Maize	704,246	144,759	148.5
Wheat	617,286	213,551	514.8
Rice, Paddy	607,902	153,019	575.0
Potatoes	324,898	19,011	60.5
Soybeans	206,409	91,611	15.6
Cassava	195,501	17,863	51.0
Sweet potatoes	127,524	9,010	36.2
Sorghum	60,102	44,038	49.3
Millet	27,650	33,847	34.4
Beans, Dry	18,698	26,860	22.8
Peas, Dry	12,134	6,761	7.1

Source: FAO, 2004 and 2002.

Approximately 69% or 99 of the 144 million hectares of maize in the world are grown in the developing world according to FAO (2004). Nevertheless, only about 44% of the global maize harvest is produced in this part of the world. A wide gap (>5t/ha) in average maize yields/ha continues to exist between the developed world and the developing world (Table 3.2).

Table 3.2 Maize area, production and yield/ha in developed and developing countries.

Region	Production (Mt)	Ha	Yield/ha
Developed Countries	396,340,068	46,033,548	8.61
Developing countries	307,906,406	98,725,725	3.12

Source: FAO, 2004.

Economic importance of maize

Global maize demand is projected to increase by 50% from 1995 to 2020. By 2020 maize demand in the developing world is expected to exceed the demand for both wheat and rice (Pingali, 2001). In the developing world alone the demand is expected to increase almost 80%. Rising incomes in certain parts of the developing world, and with that, increased consumption of meat and poultry, particularly in East and South-east Asia, is resulting in growing demand for maize as animal feed.

Table 3.3 Developing countries where maize accounts for 15% or more of the total daily calorie intake per capita.

Country	Maize contribution in percent of total daily calorie intake/capita	Country	Maize contribution in percent of total daily calorie intake/capita
Zambia	56.5	Jordan	22.0
Lesotho	56.0	Nicaragua	22.0
Malawi	52.2	Ethiopia	21.3
Guatemala	38.5	Cape Verde	20.1
Zimbabwe	36.3	Cameroon	18.4
Kenya	34.2	Benin	17.8
Mexico	33.6	Egypt	17.8
Tanzania	33.2	Angola	17.0
South Africa	31.6	Burkina Faso	16.5
El Salvador	31.4	Nepal	16.4
Honduras	31.1	Bolivia	16.3
East Timor	28.5	Venezuela	15.8
Mozambique	25.7	Botswana	15.3
Swaziland	25.6	Namibia	15.0
Togo	23.5		

Source: FAO, 2002.

In other parts of the developing world maize continues to be the most important food crop and the source for more than a quarter of the average daily calorie intake per capita, for example, in Eastern and southern Africa as

well as in Central America and the Caribbean. In Sub-Saharan Africa, Central America and parts of South Asia, the persistence of poverty in combination with continued population growth is expected to continue upward pressure on maize demand for human consumption. In Sub-Saharan Africa, for example, the annual maize demand is expected to double between 1995 and 2020, and in many Latin American countries the demand for food maize continues to be high (Pingali, 2001).

No other crop produces so much food per unit of land or labour as maize (McCann, 2005) and no other cereal crop has so many uses as maize (Fussell, 1992; Morris, 2002). Maize also plays an important role in relation to global food security. This is particularly the case in Africa and Latin America, where maize makes up a significant part of the overall daily per capita calorie intake. In Zambia, Lesotho and Malawi, maize contributes more than 50% of the average daily calorie intake, while in the Americas, in countries like Guatemala, Mexico, El Salvador and Honduras, maize remains the source of more than 30% of the average calorie intake per capita per day (Table 3.3).

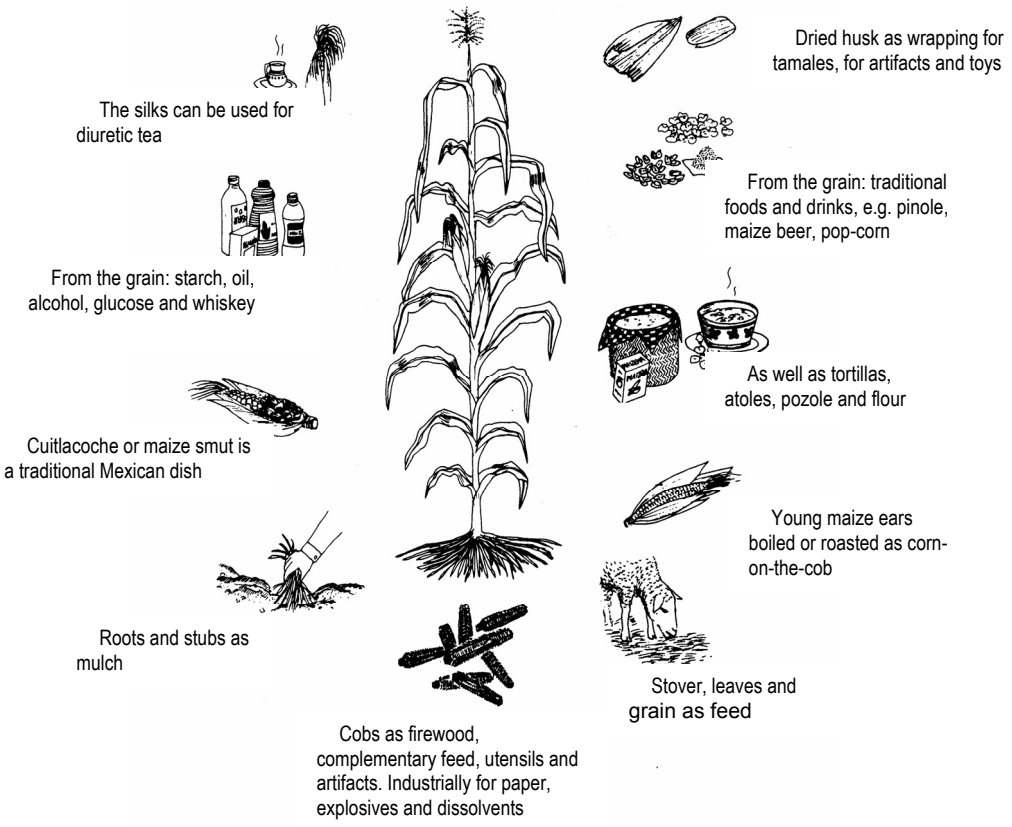

Figure 3.1 Schematic illustration of uses of the maize plant in Mexico, here from Museo Culturas Populares, 2002.

Meanwhile, the demand for maize as livestock feed, mainly for poultry and pigs, is growing significantly, as the living standards in several developing

countries, especially in Asia, is rising and the demand for meat and eggs increase (Pingali, 2001).

In addition to its importance as a food crop and its value as animal feed, maize has several other diverse uses both in a rural household and in industry, as illustrated in Figure 3.1.

Whether fresh or processed, maize can be used as food for humans, as feed for animals, as a raw material in the industrial production of starch, oil, sugar, protein, cellulose, ethylic alcohol, as construction material, for fuel, mulching, for the artisanal fabrication of handicrafts and tools.

In the industrialized world, the role of maize as human food is minimal. The major role of maize in this part of the world is as feed, mainly for cattle, pigs and poultry, and as raw material in a number of extractive industries. As Fussell points out (1992), maize is therefore a significant if indirect input in the production of meat, eggs, milk, cheese and butter, as well as in an endless list of other products. Among others Fussell (1992: 8) lists products as diverse as whiskey, chewing gum and soft drinks, toothpaste, shaving cream, shoe polish, detergents, rayon, rubber tires, explosives and embalming fluid.

The origin and spread of maize

The origin of maize

Maize is unknown in the wild (Galinat, 1988), and maize as we know it today is unable to survive without human interference (Wallace and Brown, 1988). The maize cob is so tightly wrapped in the husks and the seeds so tightly compacted and attached to the cob that maize is unable to reproduce itself without the farmer's help. Even if a whole ear is buried and left to sprout, the young shoots will overcrowd each other and perish (Fussell, 1999). As Wallace and Brown comment (1988: 26), for maize to survive on its own more than two years without human intervention would be astounding.

The origin of maize has been much debated in the past, and several theories regarding its ancestry and place of origin and domestication have been proposed These often feature other members of the *Maydeae* tribe such as teosinte, the common name for a group of annual and perennial species of the genus *Zea*, and tripsacum, *Zea*'s sister genus (Doebley, 2003). Among the early theories, one argued that maize was developed from teosinte with the help of early humans. Other hypotheses held that cultivated maize was domesticated from an earlier, hypothetical 'wild maize', which had later become extinct, and that teosinte on the other hand was the result of hybridization of maize and tripsacum or, as was later suggested, from the hybridization of maize and perennial teosinte (Fussell, 1992; Galinat, 1988; Mangelsdorf and Reeves, 1939; Museo Nacional de Culturas Populares, 2002; Pandey, 1998; Wallace and Brown, 1988).

In addition, the extraordinary morphological and genetic diversity of maize, as well as its widespread cultivation in the Americas at the time of the conquest, lead some scientists to suggest that maize domestication had taken place independently in multiple locations (Galinat, 1988; Matsuoka et al., 2002).

Today, however, teosinte is widely recognized by scientists as the ancestor of maize (Doebley, 2003, 1990; Galinat, 1988; Jaenicke-Deprés et al., 2003; Matsuoka et al., 2002; Piperno and Flannery, 2001). Furthermore, studies using multilocus microsatelite genotyping, a technique that was unavailable until a few years ago, have produced strong indications that maize evolved from a single domestication, and that this took place approximately 9,000 years ago in Southern Mexico (Matsuoka et al., 2002). Moreover, the research by Matsuoka et al. clearly indicated the progenitor of maize to be *Zea parviglumis*, which is a subspecies of teosinte (see also Doebley, 1990).

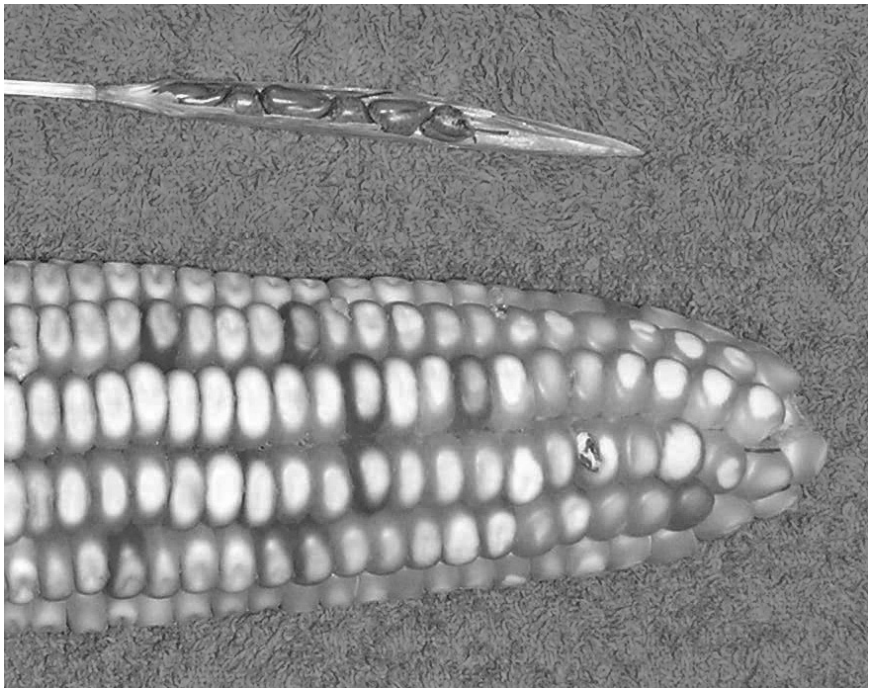

Figure 3.2 Teosinte and a present day maize ear.

Domestication of maize

The evolution of maize from teosinte is highly unlikely to have taken place without human interference (Galinat, 1988), and it is widely believed today, that humans were a crucial selective agent in the evolution and domestication of maize (Fussell, 1992; Galinat, 1988; Wallace and Brown, 1988). As a result of, on the one hand favourable natural mutations and hybridization between different types of maize, and on the other hand farmers' selection for ear and grain size, as well as colour, and other kernel and plant characteristics, maize evolved from a wild plant with a small, self-sowing type of 'ear', into a highly

productive plant with multi-rowed ears enclosed in a protective husk and with multiple uses (Dowswell, 1996; Fussell, 1992; Galinat, 1988).

The oldest known remains of domesticated maize were found in the Guila Naquitz cave in the Central Valleys of Oaxaca and date back approximately 6,250 years, according to Piperno and Flannery (2001). Before Piperno and Flannery's reanalysis of the finds from Guila Naquitz, the earliest maize cobs known were thought to be from Tehuacan on the border between Puebla and Oaxaca (Fussell, 1999; McNeish and Eubanks, 2000; Piperno and Flannery, 2001). No crops are thought to have been domesticated in Mexico earlier than 10,000 years ago (Smith, 1997). Hence, it is estimated that maize was domesticated between 6,000 and 10,000 years ago. This is consistent with indications from molecular dating analysis, which suggests that maize was domesticated in Southern Mexico about 9,000 years ago (Matsuoka et al. 2002).

The fact that the oldest archaeological maize finds are from Oaxaca, points in the direction of Oaxaca as the area of domestication of maize. However, it is not unlikely that even older maize remains may be found elsewhere in the future.

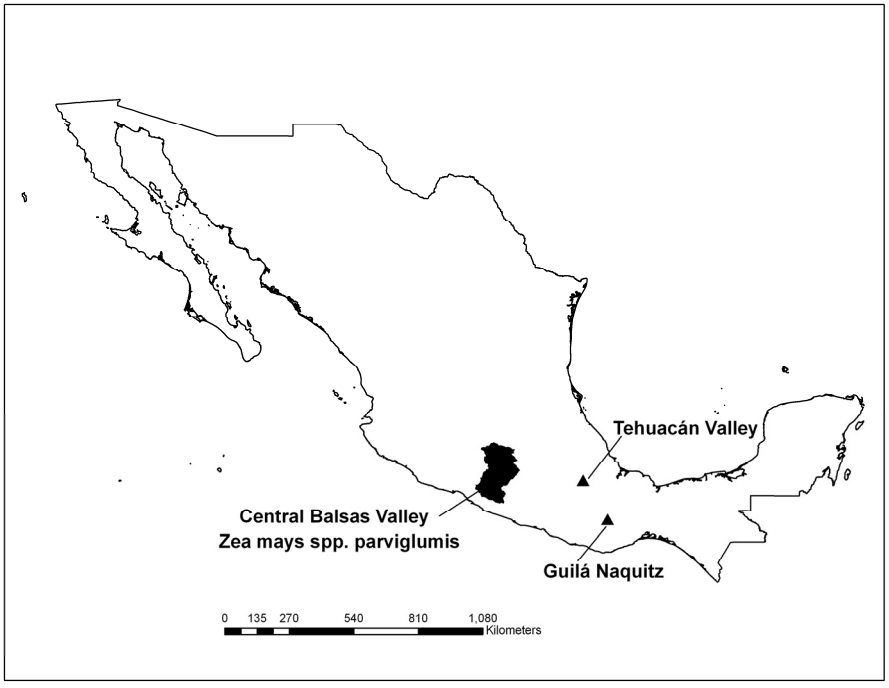

Figure 3.3 Map showing Guila Naquitz and the Rio Balsas basin.

Zea parviglumis is a contemporary teosinte subspecies. It is still found in the wild between 400 and 1800 masl in the Rio Balsas region, along the western escarpment of Mexico from Nayarit to Oaxaca (Doebley, 2003).Within the highlands of Southern Mexico, Oaxaca and the area of the Rio Balsas watershed on the border between the states of Michoacan and Guererro are both regarded as possible locations for maize domestication (Matsuoka et al., 2002).

However, of the teosintes found today, the type most closely related to maize is found in the Rio Balsas region. This may be seen as pointing in the direction of this area as the location of maize domestication, although it should be noted that the modern distribution of teosinte populations may not be the same as during the domestication period (Doebley, 2003, 1990; Fussell, 1999; Matsuoka et al., 2002; Piperno and Flannery, 2001).

Mexico is widely recognized as a centre of diversity for maize. Though ancient maize remains have been found elsewhere in the Americas, none of these are thought to pre-date the earliest Mexican finds. The presence of *Zea Parviglumis* in modern day Mexico, and the results of various studies using modern population genetic analysis and other advanced technologies, furthermore point convincingly to Southern Mexico as the original cradle of maize.

The spread of maize

Numerous artefacts and other archaeological evidence testify to the importance of maize in the ancient cultures of the Americas (Eubanks, 1999; Fussell, 1992; Museo Nacional de Culturas Populares, 2002).

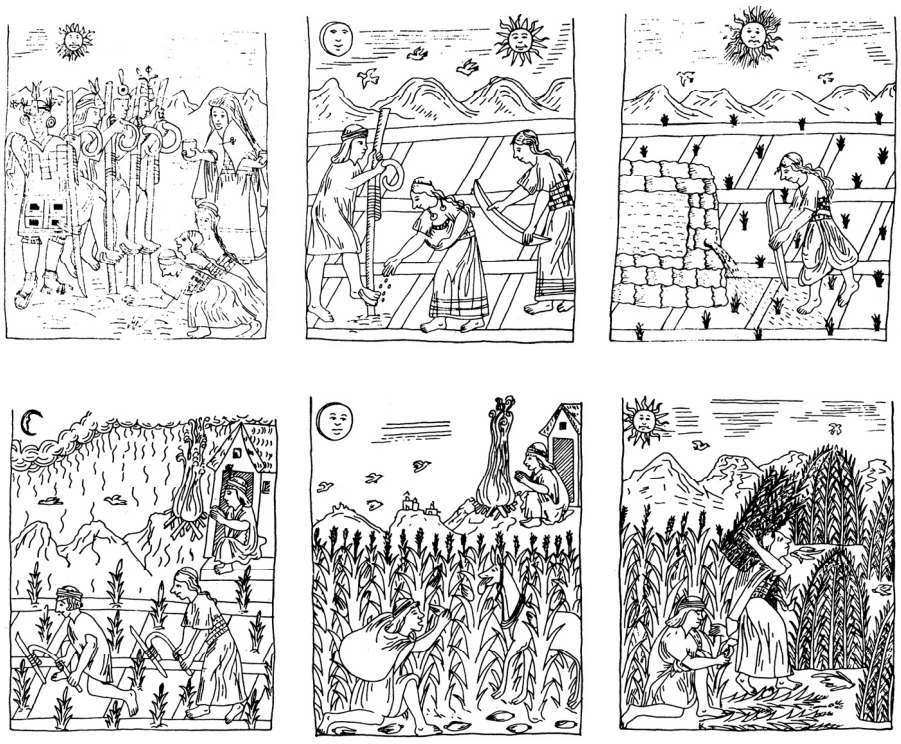

Figure 3.4 Drawings from Guaman Poma de Ayala's almanac "Nueva coronica y buen gobierno" (1528-1620) show a planting ceremony, as well as planting, irrigation, weeding, and harvest of maize in the Andean zone. Reproduced here from Museo Nacional de Culturas Populares (2002).

Urn depicting the God Cocijo with a collar of maize ears; period Monte Alban IV (A.D. 750-1000), Museo Nacional de Antropologia 6-6758, here from Eubanks, 1999.

God of Lightening and Rain, Cocijo was the most important deity in the Zapotec pantheon. "Since maize was the mainstay of pre-Columbian life and the development and survival of urban society depended on its successful production, this divinity, who controlled the elements on which the success of maize and other crops depended, was of paramount importance" (Eubanks, 1999: 100).

Statue with maize ear headdress and a maize ear in each hand (Musee de l'Homme, Palais de Chaillot, Paris. Here from Mangelsdorf, 1974). The figure's protruding lips, elliptical eye shape and ear rings are characteristic of Oaxacan funerary urns. Based on the characteristics of the maize, the piece is suspected of being post-Columbian (Mangelsdorf, 1974).

Figure 3.5 Artifacts indicating maize as an important crop in ancient Oaxacan culture.

At the time of the Europeans' arrival, maize was grown in large parts of the American continent. The analyses of Matsuoka et al. (2002) indicate two main routes of maize's dispersal throughout the Americas. One took maize through western and northern Mexico into the south-west of the US, from where it continued to spread eastwards and north into Canada and the eastern US. Meanwhile a south-bound route went through the western and southern

lowlands of Mexico into Central America and the Caribbean Islands and from there into the lowlands of South America and finally the Andean region. In addition, archaeological evidence suggests continued contact and exchanges through time between populations of Meso- and South America, which may well have included maize (Eubanks, 1999). Maize continued to develop alongside pre-columbian civilizations and became one of the most important food staples, if not *the* most important, in much of pre-hispanic America. Indeed, as Eubanks comments (1999), it has been suggested that hybridization of maize from Meso- and South America, resulting in more productive and higher yielding races better equipped for adaptation to different agro-ecological conditions may have played an important role in terms of increased food supply, which in turn may have accelerated population growth and the development of these civilizations.

On the 5th of November, 1492, two members of Columbus' crew returned from an expedition into the interior of Cuba. Among other things they reported that the natives had a kind of grain, they called 'mahiz', which tasted good and which they baked, dried and made into flour (Fussell, 1999; Lavine, 1974; Mangelsdorf and Reeves, 1939). The two crew members were probably the first Europeans to have seen the plant which has since become one of the world's most important food crops, not to mention its importance in numerous other respects - as Mangelsdorf and Reeves (1939: 7) comment, "a cereal treasure of immensely greater value than the spices, which Columbus travelled so far to seek".

When he returned from his first journey in 1493, Columbus brought kernels of yellow flint maize from Cuba to Spain where it was received with much interest. According to Dowswell (1996), what arrived with Columbus as a botanical curiosity, became an important commercial field crop within just a hundred years, and was widely grown in Spain, Italy and southern France by the end of the 1500s.

Its high multiplication ratio and high yield potential spurred maize's spread from Europe to Asia and Africa with the explorers and traders of the 16th century. By the mid 1700s maize had established a strong foothold in west and central Africa where it had even started to displace other food crops; it had also spread to south and south-east Asia and was a well-established crop in several of the southern Chinese provinces.

Meanwhile in North America, need led European settlers to adopt this 'Indian corn' which they regarded with a certain disdain, as a substitute for wheat. As Wallace and Brown put it (1988: 10), maize became "the bridge by which the pioneers crossed America to the Missouri", and "decade after decade, beginning in 1780, the progress of American civilization was measured by the western expansion of the corn acreage".

Maize breeding basics

Variety concept

Throughout this thesis, I refer to different types of maize populations, including landraces, creolized varieties and modern or 'improved' varieties. The term maize population can be used as a generic term for any group of maize plants under management by breeders or farmers. 'Landrace' is used to refer to "a locally grown maize population that has been the result of farmer selection and management over many generations" (Bellon and Berthaud, 2006: 12). An 'improved or modern variety' is a maize population that has been scientifically bred and conforms to the International Union for the Protection of New Varieties of Plants, UPOV, criteria of being distinct, uniform and stable (UPOV, 1991). A creolized variety is an originally improved variety that has been under farmer management for several generations (Bellon and Risopoulos, 2001).

The term 'farmer variety' is sometimes used to refer to a crop population that a group of farmers recognize as a distinct unit, regardless of whether it is a landrace, an 'improved' or creolized variety. They may, or may not, have specific names beyond the colour of the kernel. 'Farmer variety' contrasts with the variety concept used in the context of developed country agriculture, where a 'variety' is defined as a plant grouping within a single botanical taxon of the lowest rank; this grouping can be defined by the expression of characteristics resulting from a given genotype or combination of genotypes (Bellon and Berthaud, 2001). Additionally for a commercial variety it should be new, distinct, uniform, and stable, as according to UPOV mentioned above.

Open pollinated

In self-pollinating crops, for example wheat and rice, pollination of the ovules of each individual plant happens with pollen from the same plant. The genetic make-up of the crop population remains largely unchanged from one generation to the next. However, maize is an open-pollinated crop. This means that the ovules of each plant are largely pollinated by pollen from other maize plants (Pandey, 1998), or, put in a different way, that the male and female heritage is contributed by two different plants. Under natural circumstances maize reproduction therefore entails a high degree of exchange of genetic material between plants.

When the silks of a maize plant are fertilized by pollen from the same plant, scientists refer to the resulting kernels as *inbred* (Wallace and Brown, 1988). Inbreeding decreases genetic variability, thereby increasing the uniformity of the maize in this case. However, inbreeding also increases the frequency of deleterious mutations, which can lead to a decline in plant vigour in species, like maize, that are normally open-pollinated (Tootill, 1984). This phenome-

non is also called inbreeding depression. According to Wallace and Brown (1988: 13), after three generations of systematic, targeted inbreeding, maize will yield only half as much as usual, though it will be very uniform.

A similar effect sometimes occurs in farmers' fields, though normally over a much longer time span. If the farmer, who selects and saves seed from his/her own maize harvest year after year, selects all the seed from a very limited number of cobs, the genetic variation of the seed lot may eventually become so limited that the frequency of deleterious mutations will increase and inbreeding depression will be the result. Mexican small-scale farmers will sometimes refer to this phenomenon by saying that the maize has become tired (*cansado*).

While maize self-pollination or inbreeding tends to produce offspring that underperform their parents, the crossing of genetically different maize plants tends to produce offspring that perform better than their parents (Pandey, 1998). This phenomenon is known as *hybrid vigour* or heterosis. In their own way farmers sometimes make use of this phenomenon. When Mexican small-scale farmers consider that their maize has become 'tired', they will sometimes deliberately mix their maize with another kind of maize in order to make their own maize 'stronger' (*para reforzar el maíz*).

In principle the term hybrid simply refers to an animal or a plant produced from genetically distinct parents. However, maize scientists have combined the mechanisms of both inbreeding and hybrid vigour in the creation of what has come to be known as *hybrid maize*. The use of inbreeding serves to limit the genetic variability and enhance the homogeneity of lines used as parents; and the crossing of genetically distinct parents are used to achieve hybrid vigour. Many different types of hybrid maize exists; as an example, a single-cross hybrid is produced by crossing two distinct inbred parents: Inbred A x inbred B = single-cross hybrid AB.

The first generation of a hybrid will exhibit more vigorous growth, yield or disease resistance than either of its parents. However, the hybrid vigour effect tends to decline in subsequent generations. Though the degree of this decline varies between the different types of hybrids, single-cross hybrids are often highly unstable and may exhibit yield declines of 25-40 % or more already in the second generation (Pandey, 1998). This may not prove a problem in areas where a well-developed formal seed sector exists, and farmers are able to buy fresh commercial seed every year. However, yield stability is an important issue in relation to hybrid maize seed in areas where farmers do not have reliable access to seed supply or are accustomed to selecting and recycling seed from their previous harvest.

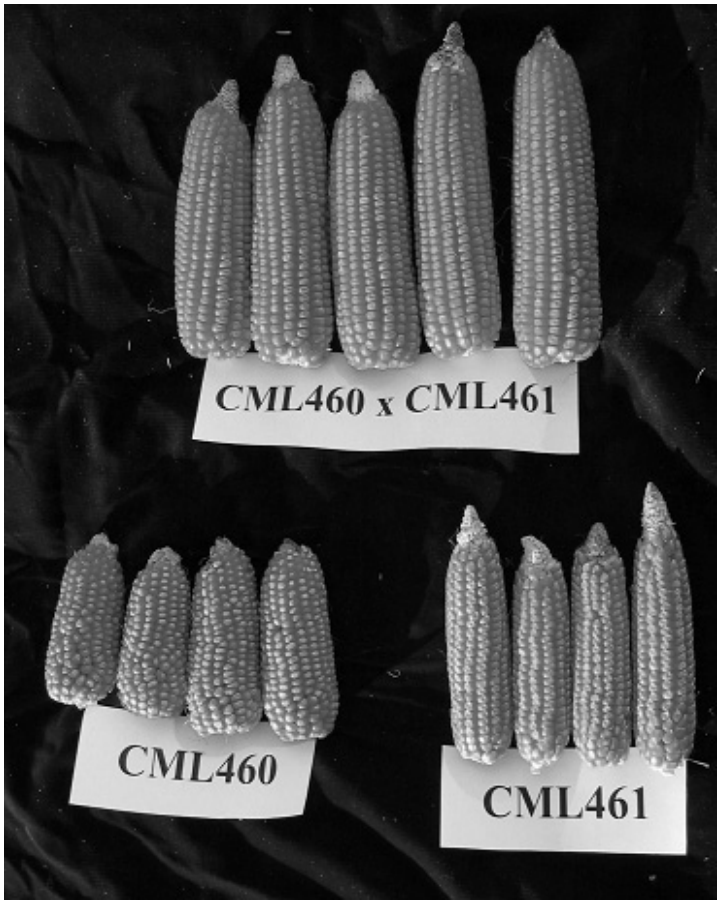

Figure 3.6 Hybrid vigour of the single cross CML 460 X CML 461 compared to the parent inbred lines. Courtesy of David Beck, CIMMYT.

Another popular strategy for the development of improved maize varieties consists of routinely crossing genetically diverse maize types in order to develop maize populations, which are then improved through recurrent selection. This category of improved maize is normally referred to as OPVs or *open-pollinated varieties*. According to the CIMMYT Maize Program (1999) an OPV can be defined as an assemblage of phenotypes that is different, relatively uniform and stable. As mentioned above, all maize is naturally open pollinated. However, the use of the term OPV refers to the fact that seed is produced by open (uncontrolled) pollination, as opposed to hybrid varieties which require controlled pollination.

Modern hybrid maize demonstrates a yield advantage in comparison to improved OPVs (Pandey, 1998). However, while studies have shown best hybrids to be superior over best OPVs by an average of 15 -20 % (Pixley, 2006), improved OPVs do not show the dramatic declines in yield characteristic of hybrids, in subsequent generations. For example, Pixley and Banzinger, (2004) found the effect of planting recycled seed to be negligible for OPVs, severe for hybrids (>30%) and intermediate for topcross hybrids (approximately 16%).

OPVs have an important role in maize agriculture in developing countries. Compared to hybrid maize, improved OPVs are easier to develop and their seed production is simpler and relatively inexpensive (CIMMYT Maize Program, 1999; Pandey, 1998). Furthermore, farmers can recycle the seed of OPVs for 3-4 years with only negligible to minimal yield declines. Thus, instead of buying new seed every year, it is only necessary to buy new seed every 3-4 years, a fact that significantly reduces farmers' dependence on external seed sources (Pandey, 1998, CIMMYT Maize Program, 1999). Furthermore, as management and input requirements for OPVs are similar to those of many local landraces used by poor maize farmers, farmer-to-farmer seed flow is relatively uncomplicated (CIMMYT Maize Program, 1999).

Genotype-by-environment interaction

Environmental factors play an important role in crop performance; however, some crops respond more strongly than others across different environments. Maize exhibits what plant breeders call a high *genotype-by-environment interaction* or GxE, meaning that its' performance across different agro-ecological environments depends on its specific genetic make-up. In other words, a genotype, that is, the specific genetic constitution of a certain maize 'variety', which performs well in one environment, may not do so in another[7].

The ability to perform under extremely diverse growing conditions reflects the impressive morphological and genetic diversity in maize, which enables this crop to adapt to a wide range of environments. At the same time, though, maize's genotype-environment sensitivity also means that, often, a maize 'variety' that is well adapted to a specific growing environment will not perform satisfactorily if introduced into a markedly different agro-ecological context. A process of adaptation is sometimes possible which can mitigate this, for example, through farmers' selection or what breeders call adaptive breeding.

However, the essence of maize's high genotype-by-environment interaction is that different maize 'varieties' are appropriate and will perform well in different agro-ecological environments. For formal maize breeding purposes this also means that maize breeding efforts must be targeted carefully to relatively specific agro-ecological conditions. For example, the hybrid maize varieties that are popular in the American Midwest are not appropriate in the tropics – in fact, they may not even be able to produce viable seed. This has important implications for farmers, who must make sure that the varieties they plant are appropriate for the particular agro-ecological conditions present on the farm.

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[7] For more on genotype-by-environment interaction see, for example, Banziger and Cooper (2001) or Sawkins et al. (2005).

The maize plant

Maize's scientific name is *Zea mays* L. Like all the major cereals, it is a grass. In botanical terms, maize forms part of the *Gramineae* family, within which it belongs to the *Maydeae* tribe (Centro de Investigaciones Agrarias, 1980; Galinat, 1988; Mangelsdorf and Reeves, 1939).

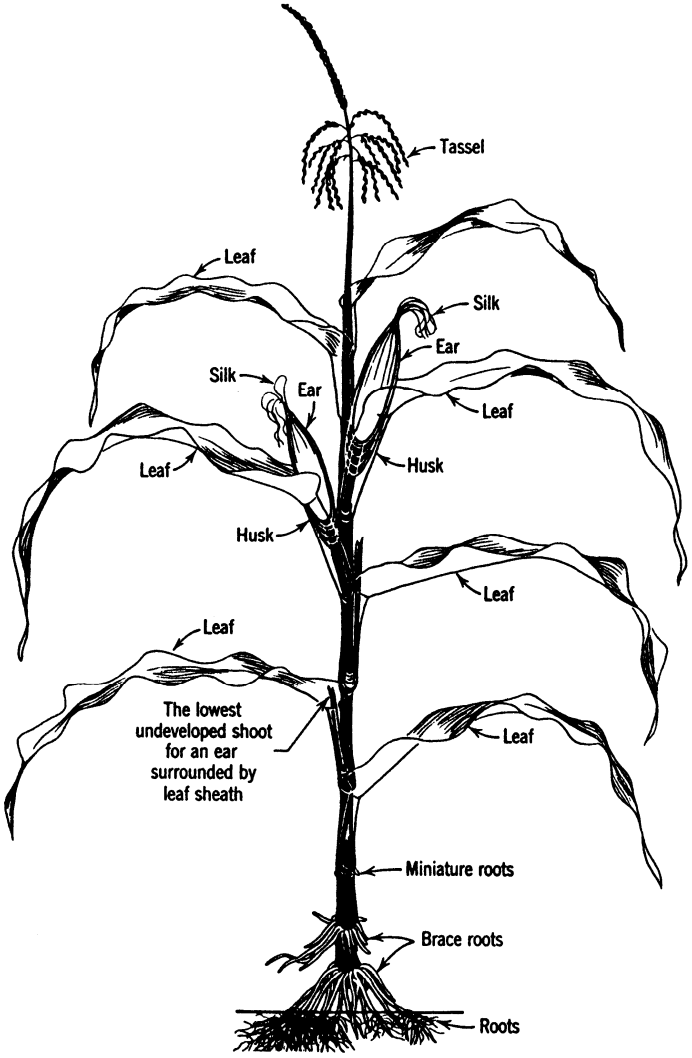

Figure 3.7 Mature maize plant with parts labelled. Here reproduced from Wallace and Brown, 1988: 4.

A mature maize plant normally has a single dominant stalk. The stalk has between 8 and 20 nodes from each of which a leaf emerges on alternate sides of the stalk. The part between the nodes is called the internode and is where growth takes place (Fussell, 1992; Morris, 1998). The roots of maize are the strongest of all annual crop plants. The main roots may penetrate as much as

1.5 – 1.8 meter into the ground and 0.9 – 1.2 meter sideways. In addition maize often features brace roots beginning 2-3 nodes above the ground (Wallace and Brown, 1988), see Figure 3.7.

While some types of maize barely reach a maximum height of 1 meter, others grow to more than 5 times this height. At the top the stalk ends in a tassel with 5-20 branches, each with hundreds of little spikelets, which are the male flowers of the maize plant. From nodes along the stem several ear shoots may develop, each covered by a protective layer of husk leaves. While most of the ear shoots degenerate, one or two will continue to develop into the female inflorescence of the maize plant.

The maize plants' ability to convert sunlight, water, air and soil into biomass is extraordinary. In about 3 months a single maize seed can develop into a plant more than 5 meters tall, carrying more than 1000 seeds (Morris, 1998, citing Aldrich et al., 1975; and Hallauer, 1994).

When flowering time approaches, a tuft of silks will protrude from the tip of the ear. Each silk is connected to an ovule on the maize cob, and each ovule is a potential maize kernel. Ovules and silks make up the female element of the maize plant.

Each spikelet on the tassel contains a number of pollen sacs, also called anthers. When these ripen they begin to shed pollen - the male element of the maize plant. The moment a pollen grain lands on a silk, it starts to travel down through the silk for 20-25 cm to the ovule, where the pollinization is completed.

Figure 3.8 Maize cobs with 26, 18 and 12 rows of kernels.

Maize ears, kernels and cobs exist in a variety of shapes, sizes and colours. An average maize ear contains approximately 800 kernels. However, the number

can vary considerably, and depends, in part, on the number of rows of kernels on the cob. Some cobs have only 8 rows, while others can have up to 30 rows. Similarly, maize ears come in different sizes ranging from 7.5 – 40 cm long (Wallace and Brown, 1988). The shape of maize kernels depends on the type of maize in question. Dented maize has wrinkled or indented kernels; flint maize has smooth kernels; and floury maize has smooth – slightly dented kernels (Dowswell et al., 1996; Wallace and Brown, 1988).

Figure 3.9 Black, white, *pinto*, yellow and red maize ears.

Maize kernels can be different colours; including white, yellow, black and red, and for each of these different nuances may apply. Finally, some maize is of mixed colour, that is, produce ears with kernels of 2-4 different colours, for example, white-and-black, or white-black-and-yellow. Only in yellow maize does the pigment that gives the kernel its particular colour reside in the endosperm; in black/blue, red and white maize the pigmentation is limited to a thin layer just below the pericarp and covering the endosperm.

The oblong centre of the maize kernel is the germ, that is, the dormant seedling from which a new maize plant will grow. It is surrounded by the endosperm, a body of starch which serves as nutrition for the germinating seedling. The kernel is covered by a thin membrane called the pericarp, and is attached to the cob by the pedicel (Pandey, 1998; Ritchie and Hanway, 1982). On average a maize kernel contains 72% starch, 10% protein, 3% sugar, 4.8% oil, 8.5% fibre and 1.7% ash, of which the oil is contained in the germ, while the rest are in the surrounding endosperm (Neukom and Büchi, 1979).

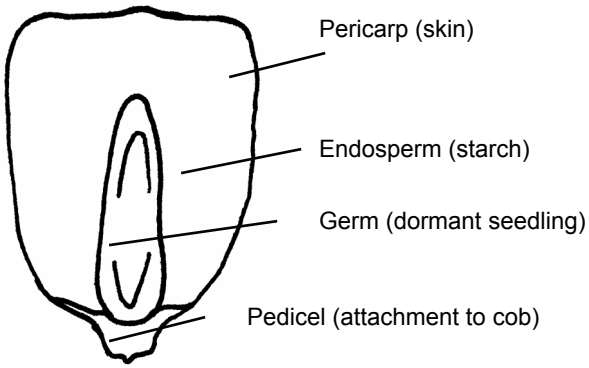

Figure 3.10 Cut through drawing of a maize kernel.

4. General information on the Central Valleys and the study communities

The following presents general background information on the villages in the Central Valleys of Oaxaca, Mexico, where the fieldwork was carried out. Seed practices are not undertaken in a vacuum, but are an integrated part of the agricultural system and of the broader social setting. The purpose of this and the following chapter is to provide the reader with background information that contextualises local seed dynamics in the study communities. The information covers all six villages; it is kept at a general level and, as such, presents mainly averages and common elements. In Chapter 5 more detailed examples are provided from San Pablo Huitzo and Santa Ana Zegache as these two communities were where the most intensive fieldwork was carried out, and in many respects they are the most contrasting of the six. In Chapter 5 some of the local farmers are introduced, and the differences between households will become clearer.

Maize has been cultivated for thousands of years in the Central Valleys of Oaxaca. The region is considered to be the probable cradle of maize cultivation and is broadly recognized as a centre of genetic diversity for maize (Matsuoka et al., 2002; Piperno and Flannery, 2001). A remarkably large diversity of maize landraces has been found in the area (Bellon et al., 2000) and studies have shown that farmers in this region value and demand diversity (Bellon, 2001, Smale et al., 1999). This makes the Central Valleys of Oaxaca a particularly interesting and well-suited area for the study of small-scale, maize-growing farmers' seed management and acquisition strategies.

The region known as the Central Valleys of Oaxaca covers the central part of the state of Oaxaca in Southern Mexico. Surrounding the city of Oaxaca at 1800 masl, this highland region has been the heartland of the Zapotec people for more than 3,000 years. As the name indicates, the Central Valleys consist of a set of highland valleys stretching out from the state capital like three fingers pointing towards the east, south, and north-west. Though conditions vary across the region, particularly in relation to altitude differences, in general the climate is mild with a yearly medium temperature of 18-22° C and an average annual precipitation of 500 – 1000 mm (Garcia, 1998). December, January, and February are the coolest months and April and May the warmest. The rainy season usually starts in May stretching into September-October (SEP, 1991).

In the UNDP's global human development report, Mexico is placed at the lower end of the 'high human development' category and occupies the 53rd rank out of 177 countries. As such Mexico is not regarded as a poor country. A

closer look across the Mexican country side and statistics, however, reveals many areas with extreme poverty. In fact, Mexico has been ranked among the countries in the world with the largest inequalities in terms of the distribution of wealth and human welfare (Bellon et al., 2005; UNDP, Mexico, 2004).

Oaxaca is one of Mexico's poorest states regardless of the methodology used to measure poverty (Wodon et al., 2003). According to a marginalization index used by the National Population Council, CONAPO (Consejo Nacional de Población) Oaxaca is the third poorest state in Mexico (CONAPO, 2001), while the United Nations Human Development Index ranks Oaxaca as the second poorest (UNDP, 2004).

The State of Oaxaca has a large indigenous population, of which the Zapotec make up the largest group. Overall, Oaxaca is home to 16 different indigenous groups, and according to the National Institute of Statistics, Geography and Informatics, INEGI (2001), almost 1/3 or 1,120,000 of the total population (3,438,765) speak an indigenous language. In the Central Valleys also, the most prominent indigenous group are the Zapotec. Despite social change and ever-increasing globalization, elements of indigenous culture remain reflected in many parts of Oaxacan life; in the languages, in food, in handicrafts and other goods that are part of everyday routines, as well as in dress, in community life, and agriculture. The noticeable presence of indigenous culture in modern day Oaxaca and the numerous, significant archaeological sites and beautiful colonial buildings, without doubt contribute to the image of Oaxaca as associated with traditional culture and folklore, and to the region's popularity with both national and international tourism.

According to the latest census data (INEGI, 2001), more than 40% of Oaxaca's workers are occupied in agriculture and this continues to be a basic element in many families' livelihoods. The vast majority of farms are small-scale family enterprises producing for household consumption and small-scale marketing of eventual surplus production. The most common crops are maize and beans, often intercropped with squash, and small-scale animal husbandry is common. Land is mostly tilled with bullocks, and those who do not own the means will normally pay others to do the tilling for them, either with bullocks or alternatively with a tractor. Harvesting is done almost entirely by hand with family labour and sometimes a few hired hands.

The state capital, Oaxaca de Juarez or Oaxaca city with roughly 350,000 (Whipperman, 2000) inhabitants is situated in the centre of the Central Valleys. Like the rest of Mexico, the State of Oaxaca is divided into districts and municipalities. The Central Valley region has a population of 878,132 (CEAMO, 2002)) and comprises the Oaxaca, Etla, Tlacolula, Ejutla, Ocotlán, Zaachila and Zimatlán districts. Municipal elections are held every three years and the inhabitants must decide whether they want to follow a model of local government based on political parties, or a more customary model referred to as *Usos y Costumbres*. The municipal government is headed by the municipal

president and the town council. The municipal authorities are sometimes also referred to as the *ayuntamiento*, the entity responsible for providing public services and infrastructure such as drinking water and electricity, as well as overseeing that law and order is respected. However, the degree of services provided varies across localities.

A municipality may consist of several communities and/or hamlets. In addition to belonging to a municipal council each community also has a set of agrarian authorities depending on the category/ies of land tenure scheme it falls under[8]. If more than one tenure category is represented in a community, it is not unusual for individual farmers to have various parcels under different tenure systems, though this makes little difference to seed practices. According to an official of the Oaxaca branch of the government program for Support and Services for Agricultural Comercialisation, ASERCA (Apoyos y Servicios a la Comercialización Agropecuaria), land tenure inOaxaca, and in particular in the Central Valleys, has the highest degree of 'land tenure fragmentation' [9] in the country, with plot sizes anywhere between 2 rows [of maize or other crop] and 2 hectares.

The study communities

The total study area encompasses six rural communities in the Central Valleys: San Pablo Huitzo (Huitzo) and Santo Tomás Mazaltepec in the valley of Etla; San Lorenzo Albarradas in the valley of Tlacolula; and finally San Agustín Amatengo, Valdeflores and Santa Ana Zegache (Zegache) in the valley of Zimatlán, see Figure 4.1.

Five of the six communities are also municipal centres, while one community, Valdeflores, has the status of *agencia*[10] and belongs to the municipality of Zimatlán. All six communities have electricity and drinking water, some medical services, and a primary school. San Pablo Huitzo, Valdeflores, San Agustín Amatengo and Santo Tomas Mazaltepec furthermore have secondary schools, and Santa Ana Zegache and San Lorenzo Albarradas each have a *telesecundaria* (a national secondary school program via television).

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[8] In Mexico there are three categories of land tenure: *pequeña propiedad*, the *ejido*, and the *tierra comunal*. The first category refers to privately owned land. Ejido land, which was established after the revolution, is officially owned by the state, which confers usufruct rights to land reform recipients. The *ejido* also refers to the community of *ejidatarios*, and as such entails a form of social organization. Legally recognized *comunal* lands, the *tierra comunal*, belong to particular communities and are distributed according to tradition. In 1992, a controversial constitutional reform put an end to land reform and made possible the privatization of *ejido* lands. http://www.everyculture.com/Ma-Ni/Mexico.html

[9] "Land tenure in [this] state is the most fragmented in the whole country, especially in the Central Valleys, where plot sizes vary between two rows and two hectares" (Ing. Avendaño, ASERCA, Oax., personal communication, 24 Sept. 2002. My translation).

[10] *Agencia* is a Mexican administrative term for branch or unit.

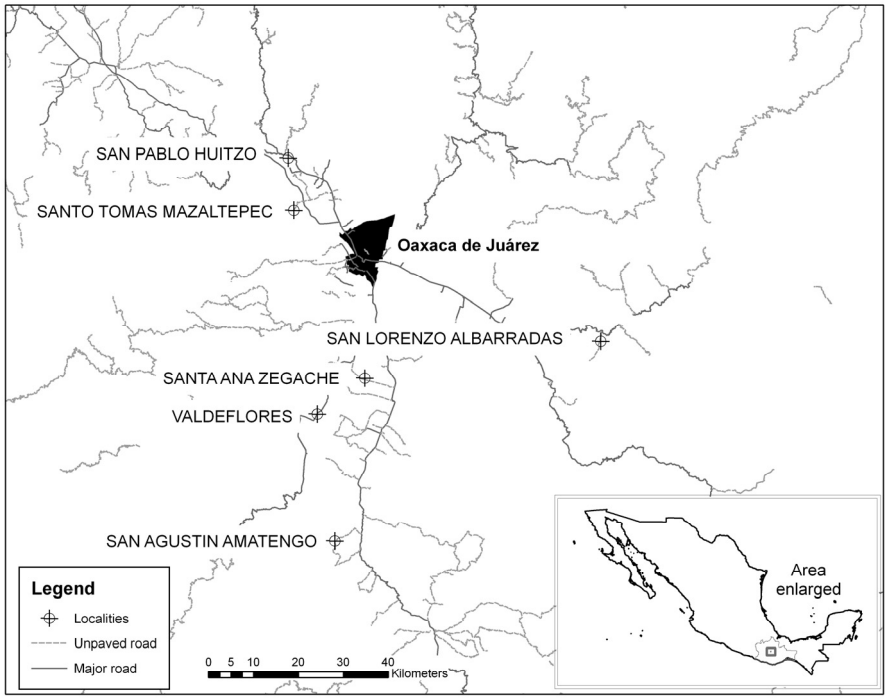

Figure 4.1 The location of the six study communities in the Central Valleys of Oaxaca.

The population in the study area is predominantly Spanish-speaking, but both in Santa Ana Zegache and in Santo Tomas Mazaltepec a large part of the population (>30%) speaks Zapotec as their first language. However, according to INEGI (2001) in both communities almost all Zapotec speakers also speak Spanish. Only 1.3% of the Zapotec speaking population in Sta. Ana Zegache, and 0.9% of the Zapotec speaking population in Santo Tomas Mazaltepec do not speak Spanish (INEGI 2001).

Table 4.1 shows a number of wealth indicators and development indices. It is clear that Huitzo is relatively better off than the other communities, and that Zegache is the most marginalized. The table also illustrates how the methodology might affect the conclusions, as for example in the case with Santo Tomás Mazaltepec, which has a high human development index, but also a high degree of marginalization.

Table 4.1 Population and wealth indicators.

Indicator	Avg.	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valdeflores	Santa Ana Zegache
Population[a]	2,337	4,685	1,939	1,857	1,752	1,246	2,543
Human Dev. Index[b]	0.69	0.773	0.759	0.666	0.598	0.746	0.592
Degree of marginalization[c]	3.7	2	4	4	4	3	5
Years of education[d]	3.33	5.51	4.98	2.29	2.60	2.74	1.84
				Percent of respondents			
Literacy[d]	75	88	96	55	83	76	53
Electricity[d]	97	98	100	100	93	95	98
Gas stove[d]	50	98	45	20	48	68	23
Television[d]	74	95	75	53	65	88	68
Refrigerator[d]	35	85	28	15	15	40	25
Tractor[d]	2	5	0	3	0	0	5
Car or pickup[d]	12	23	10	10	13	13	5

Sources: Baseline study; CONAPO, 2000; Website of Gobierno de Oaxaca; INEGI, 2001.

[a] Total population in the localities in which the research was carried out within the municipality (INEGI 2001)

[b] Human Development Index (HDI), calculated using the UNDP methodology for HDI estimation. Source: Website of Gobierno de Oaxaca

[c] The Consejo Nacional de Población (CONAPO) categorize communities according to their level of marginalization, using a scale of 1-5. The 5 categories of marginalization are the following: 1= very low; 2 = low; 3 = medium; 4 = high and 5 = very high marginalization. For more information on the methodology used to calculate the marginalization index, see CONAPO (2000), Índices de marginación, 1995.

[d] Baseline study

Sources of income

Based on data from the baseline study, Table 4.2 shows the percentage of households that indicated that a source of income was either more or less important or very important. It clearly demonstrates that maize is very much a fundamental part of the household economy, and that the households in general consider income from agriculture and livestock production key components of the household economy. However, for a considerable number of households, off-farm work and/or remittances are also important.

The table also shows some variation between household incomes in the communities. San Pablo Huitzo stands out as having a high level of off-farm *non*-agricultural work, and low levels of remittances and off-farm agricultural work. Santo Tomás Mazaltepec has a relatively high level of off-farm agricultural work, whereas in San Lorenzo Albarradas and San Agustín Amatengo remittances are important for over half the households. And finally, Zegache is the community with the highest reliance on agricultural income.

Table 4.2 Percent of households from the baseline study that considers a source of income important or very important.

Source of income	Avg	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valdeflores	Santa Ana Zegache
Maize	98	95	100	100	100	93	100
Other cultivars	80	83	90	53	78	78	100
Livestock	55	53	83	43	25	65	63
Off-farm non-agri-cultural work	36	55	45	33	40	25	20
Remittances	36	8	23	53	58	43	35
Off-farm agricultural work	25	10	50	18	25	20	30

Source: Baseline study

Migration

According to the Coordinación Estatal de Atención al Migrante Oxaqueño (CEAMO), high levels of marginalisation, low salaries and lack of industrial and productive infrastructure, low productivity, poor living conditions and lack of basic services such as health care, education, and so forth, all influence the flow of migrants from Oaxaca to other parts of the republic or further north to the United States.

Approximately 150,000 Oaxacans leave their native state every year to seek work, principally in North-western Mexico and the United States. An estimated 1,000,000 Oaxacans are thought presently to live in the US, particularly in the state of California where many work in the agricultural sector (CEAMO, 2002).

According to CEAMO, 45 % of the Oaxacan migrants are women and approximately 30% are minors. In general the level of formal education of the migrant population is extremely low (CEAMO, 2002).

The remittances that migrants send back are an important factor in household incomes in Santa Ana Zegache, and many people have one or several relatives who live and work elsewhere in the republic or abroad, in most cases in the US. Both temporary and long term emigration take place. Within the district of Ocotlán, Santa Ana Zegache has the highest level of migration, most of whom are men (CEAMO 2002). Their principal destinations are the centre of the republic, the North-western states of Sinaloa, Sonora and Baja California, as well as the United States, in particular California (CEAMO 2002).

Migration abroad or to other parts of Mexico also takes place from Huitzo, though, judging from the data in Table 4.2 the role of remittances in household income appears to be much less pronounced than in any of the other study communities. Nevertheless, many families have one or more relatives 'up North' or in other parts of the Mexican Republic, and in many cases these persons continue to contribute in different ways to the livelihood of their

family back home in the community. In all six study communities, migrants occasionally come home to visit, and once in a while someone returns to the community for good. Others never come back.

Politico-financial support programs

The Mexican government implements several programs that provide different kinds of support to the population in rural or marginalized communities. In all six study communities this includes the Programa de Educación, Salud y Alimentación (PROGRESA) [Program for Education, Health and Food] and Programa de Apoyo al Campo (PROCAMPO) [Program for Support to Rural Areas). PROGRESA is directed at families with children and old people. The support is financial and helps to cover basic needs. The mother of the family receives the money and is responsible for its use. The support is given on a monthly basis and according to the number of children and their grade level in school. For example, children in 3rd grade can claim a monthly contribution from PROGRESA of approximately 150 pesos[11].

The implementation of PROCAMPO (1995-2008) is the responsibility of the Distrito de Desarrollo Rural (DDR) [Rural Development District], which forms part of the Ministry of Agriculture. For each plot registered in the program the farmer receives a certain amount of money per hectare of land cultivated (in 2001 approximately MX$ 873/ha). Each community is assigned a *controlador de campo*, whose role is to check whether subsidized plots are, in fact, being cultivated according to the claims made by the farmer, and to distribute the benefits of the program.

Socio political institutions

A major theme in this study is the importance of social relations in local seed practices. However, before this is examined it is useful to have an overview of both the formal and informal social and political institutions in the communities.

In all the study communities the most important formal institutions are the municipal and agrarian authorities, both of which are publicly elected. The municipal council is elected for a term of three years and normally includes the president, the *síndico*, the *alcalde* and a number of councillors (Figure 4.2). The number of councillors can vary from one municipality to another. Each of these persons is responsible for a particular set of obligations and responsibilities. Their functions and corresponding responsibilities are described in more details in Appendix 2.

All of the above mentioned positions have a deputy, whose role it is to assist or substitute for the official in question whenever necessary. Furthermore, the

[11] Irma Manuel Rosas, CIMMYT researcher, personal communication, 3rd of April 2001.

municipal government normally includes a treasurer, who manages the municipal funds and is in charge of the payment of any expenses acquired during the term; and a secretary, who draws up the documents required by the municipality and who is in charge of daily business whenever the municipal president is absent.

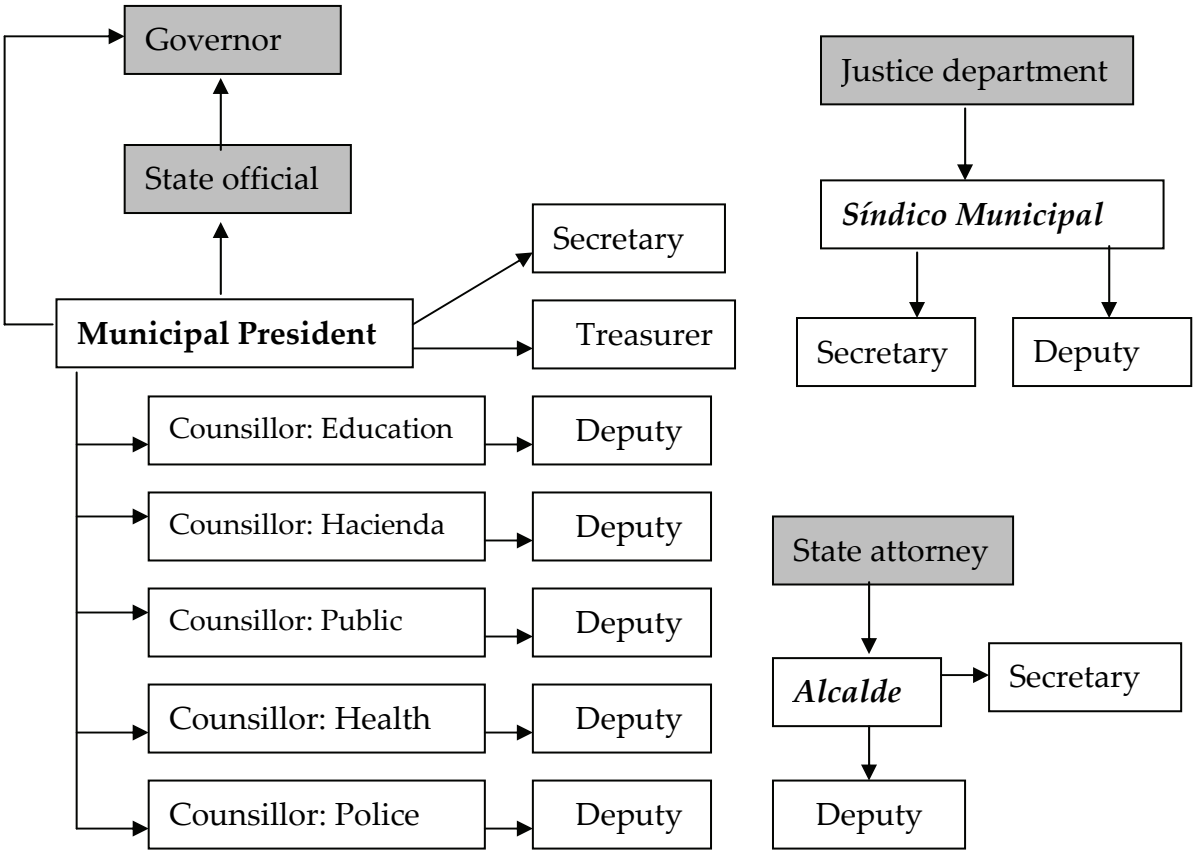

Figure 4.2 Sketch of the formal organization of municipal authorities with state level entities on grey background.

Land tenure and agrarian authorities

Three different systems of land tenure exist in Mexico: *Ejidal*, comunal and private. The land tenure system in a community can be one, or a combination of these. In practice there is little difference in the way the *ejidal* and the *comunal* land tenure systems work and are organized. In both cases the *ejidatarios* or *comuneros*, people who hold lands under either system, are considered members of the organization and of the general assembly. The general assembly elects the executive entity of the *ejido*, the *Comisariado ejidal*, or *Comité de bienes comunales* in the case of comunal tenure, as well as an oversight committee to supervise the former, known as the *Consejo de vigilancia*. In both cases the executive entity is headed by a president, assisted by the treasurer and the secretary, and depending on the specificities of each locality, other members or entities may be added. In San Pablo Huitzo, for example,

the president of the *Comité de Bienes Comunales* is the supervisor of a group of forest rangers, and the *Comisión de siembra*.

Under both systems there is usually a distinction between agricultural lands and comunal lands. The former refers to agricultural fields in use or in fallow under the management of individual farmers, while the latter is regarded as a resource, such as forest or grasslands, which belongs to the community as a whole, and is subject to comunal management.

In general terms, the roles of the members under either system (i.e. *ejidatarios* or *comuneros*) correspond to those stipulated in the agrarian law; however, from one community to another, differences may exist in the implementation of these stipulations according to the customs and the internal set of rules of the community in question.

Of the three, private land tenure is the only land tenure system under which the holder owns the piece of land, in the strict sense of the term. Under *ejidal* and *comunal* tenure, what the *ejidatario* or the *comunero* 'owns' is the usufruct right to the land. Also, under private land tenure the owner is not obliged to follow the instructions or rules defined by the general assembly, for instance, payment of membership fees or participation in *tequios* (communal work parties). Nor can the private land owner be subjected to sanctions by the assembly. For example, in San Pablo Huitzo the rules established by the general assembly stipulate that if a *comunero* does not cultivate a particular plot of land for three or more years in a row, his/her claim to that plot of land can be terminated and passed on to any other *comunero* who might have solicited it. Private land is not subject to such rules.

The main land tenure system in San Pablo Huitzo is comunal, although a number of the *comuneros* also hold land under private tenure. In Santo Tomas Mazaltepec land tenure is also *comunal*, while in San Lorenzo Albarradas it is a mixture of *ejidal* and *comunal* and in both San Agustín Amatengo and Valdeflores it is a mixture of *ejidal* and private land tenure. Land tenure in Santa Ana Zegache is mainly private, while a smaller area is comunal land controlled by the community authorities. The comunal land is mainly used for grazing, but under certain circumstances the use of small plots for agriculture, for example by landless farmers, can be authorized. Figure 4.3 shows a graphic representation of the organization of agrarian authorities using San Pablo Huitzo as an example. A description of the roles of the representatives of the local agrarian authorities is provided in Appendix 3.

Farmers who share access to irrigation from wells are often members of an irrigation unit. They organize among themselves and generally refer to themselves as irrigation associates or partners. Irrigation from wells is often done at night. The members of the unit maintain the wells, channels or hoses, and take turns to irrigate their own and the plots of the other unit members. It is common for units to collect a certain amount of money from members every month to cover maintenance expenses. At least three such irrigation units

exist in San Pablo Huitzo, and it is also an important element in irrigation in Santo Tomas Mazaltepec.

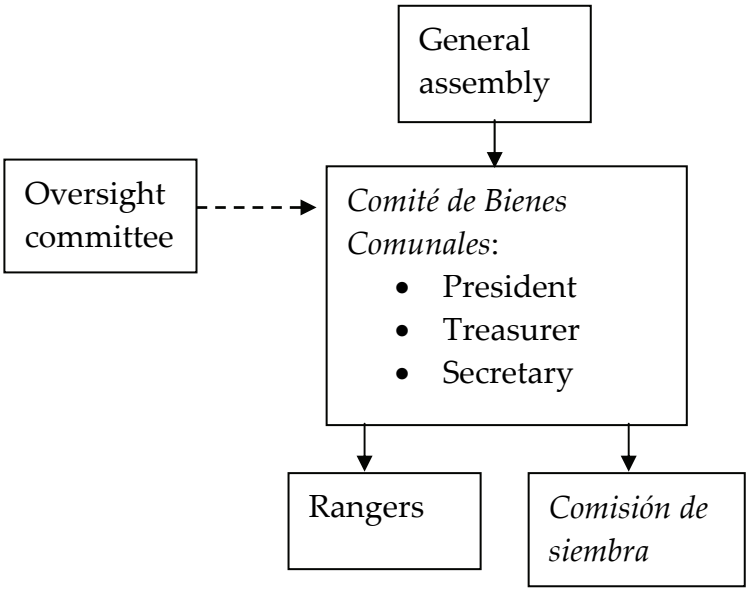

Figure 4.3 The formal organization of the agrarian authorities in San Pablo Huitzo.

Socio cultural institutions

As in other parts of Mexico social relations and networks between people play an important role in Oaxacan cultures and communities. The most important social institution is the family and the fundamental reference is kinship. This group of social relations includes biological and affiliate kinship, but also includes fictitious kinship, into which category fall friendships and *compadrazgo*.

C*ompadrazgo* refers to very close social relations considered almost as family. It is a very important institution in the campesino communities of the Central Valleys of Oaxaca, including all the study communities, as well as in Mexican culture in general (Cohen, 1999). It can be perceived of as a way of formalizing a close relation of mutual help, reciprocity and confidence. One can ask *compadres* for help, and they cannot easily refuse. Being asked to be a *compadre* includes a certain element of prestige, being as it is, a sign of recognition, and being *compadre* or *comadre* also creates ties of loyalty and assistance. In a certain way *compadrazgo* can signify social capital (Cordero Avendaño de Durand, 1997; Greenwood, 1966).

In the Central Valley communities where this research took place, it is common practice to establish or reconfirm *compadrazgo* relations at the baptizement of a child, at the presentation of a child in the church, at confirmation, graduation, at girls' 15th birthday and at weddings. However, in everyday life the most important role of *compadrazgo* is that of friendship, mutual help and as a safety network.

Other institutions of social organization also play a significant role in the study communities. *Tequio* refers to a form of comunal work provided as a service to the community (Cohen, 1999). It can be in the interest of a certain group (for example parents' interest in the conditions of the local school), or it can be in the interest of the community in general (for example the construction and maintenance of community roads, drinking water infrastructure, sewage, and so forth). Whenever a *tequio* takes place, records of attendance are normally kept and failure to show up and do one's share of the work or sending someone else in one's place, often results in a fine, that is, the demand for monetary compensation[12]. Fines can accumulate over time, and if debts are not paid eventually, the debtor may lose the right to certain benefits, for example, use of the school, drinking water access, and irrigation.

Guelaguetza, also known as *go'ozona* in the eastern Zapotec mountain range, is an ancient institution of mutual aid among the Zapotecs. It consists of formalized reciprocal exchange among individuals, households or communities, who support one another with 'gifts' of labour, animals, materials or food. It can take place in many different situations and between different people, but most importantly *guelaguetza* is practiced in agricultural tasks, the roofing of houses, weddings, funerals, and the village saint fiestas (Montes Vasquez, 1985). When the giver is in need, 'gifts' will be returned equal in value to those originally given. In a way, *guelaguetza* can be likened to using the community as a type of 'bank' from which one can withdraw or accumulate 'capital'. According to Beals (1970) and Montes Vasquez (1985) it is a significant point of the *guelaguetza* institution, that gifts must be repaid in kind, and in exactly the same amount. For that same reason gifts are normally carefully recorded; turkeys are weighed or appraised as to maturity; maize, sugar and other contributions are measured, and notes are taken recording 'gifts' received and 'gifts' made (Beals, 1970; see also Cohen, 1999: 90pp). Most farmers in the study communities know the meaning of *guelaguetza*, and though in most of the study communities it is no longer common in its traditional form, the principles of reciprocity and mutual help remain a strong aspect of social life.

At one and the same time, life in the farming communities of the Central Valleys is strongly influenced both by traditional values and customs and by modernization, urban life and globalization. Although the longstanding traditions of *tequio* and *guelaguetza* are known in all the study communities, in most of them they are no longer common. Only in San LorenzoAlbarradas, in the *agencia* of Roaguía is the concept *guelaguetza* still used to refer to certain work related matters. The examples typically mentioned by farmers here were harvesting and roofing of houses. Farmers explained the phenomenon as a

[12] See Cohen (1999: 114pp) for a discussion of the use of money payment or hired labour as a way of fulfilling one's *tequio* obligations.

pooling of labour, that is, a group of farmers help each other harvesting the maize and bringing it home to the owner's household. Each will bring tools and any available mules or donkeys for transporting the maize, and the owner will provide food and drink, including *mezcal* and cigarettes for all. Over a number of days they will rotate from one farm to another until everybody has received help. In the case of roofing a house, a task which typically requires a lot of helpers in a short time, the owner of the house to be roofed will 'call or invite for a *guelaguetza'*. On the set day people will appear to work on the roof and the owner will provide food and drink, and so forth, for all helpers. Often the men will carry out the specific work task, while a group of women prepare the food. In the other study communities it appears that the use of the concept *guelaguetza* has almost disappeared as the use of paid labour has become more common. However, this does not mean that mutual help and favours are no longer important. On the contrary, social networks continue to play a central role in local livelihoods.

Another important element of social organization in the communities is the *mayordomías* and the committees in charge of organizing the yearly fiestas in honour of the villages' patron saints. The celebrations go on for several days and involve both religious and secular events and festivities. Processions, dances, fireworks and plenty of food and drink are central elements in the celebrations. Preparations for the village fiesta are a complex organization of sponsorship and voluntary work. The *mayordomía* is responsible for all that has to do with the religious part of the fiesta and the religious celebration of the saint, such as the processions, music, food and drink, flower arrangements and decorations, presents and fireworks. In some cases a fiesta committee organizes the more secular aspects of the celebration - the dance, the rodeo, merry-go-rounds and other food and drink stands - or it may all fall under the responsibility of the *mayordomía*. For those who assume the principal responsibilities for this organization it is a very big effort, not only in the amount of work required, but also in terms of costs and other resources. Often there are several *mayordomos* sharing the burden of sponsoring these fiestas, and thus the responsibility, the work and the costs of the celebration can be shared among several households.

Mayordomos are expected to sponsor a considerable part of the celebration, which may go on for several days and involve attending to and feeding most of the community, hosting the dance or other parts of the celebrations. In order to be able to take on this burden, *mayordomos* ask for contributions from other people, and call in the debts others owe them, be it in cash, in *kind* or in terms of labour - perhaps even in the form of *guelaguetza*. Even though these are heavy responsibilities requiring much time, work and resources, they also give much prestige. One might say that the better organized the celebration and the more abundant it is, the more prestige it brings to the *mayordomos* and their helpers (Beals, 1970; Montes Vasquez, 1985; Starr, 1993; Stephen, 1991).

The actual structure and organization of the *mayordomía* as an institution may differ from place to place. Formerly an important civic-religious authority, the *mayordomía* institution has been weakened significantly with the introduction of civil municipal government (Thomas, 1962). In the past, *mayordomía* service by community members used to be a 'duty' following a cyclical and dyadic rotation between civic and religious service government (Thomas, 1962). In most communities the *mayordomía* institution nowadays is a voluntary service motivated by the seeking of status and by vows made to the saints (Thomas, 1962).

Nevertheless, respect for these social institutions is strong and many Oaxaqueños living and working outside their communities, in other parts of Mexico or abroad, send their contributions to the village fiestas by mail. Many furthermore return to take part in the annual fiesta or to comply with the responsibilities and duties that may correspond to their status, or that they have chosen to take on (SEP, 1999; Stephen, 1991).

In addition to the aspects of social organization described above, other types can also be observed in the study communities. In Santa Ana Zegache, for example, men and women have organized into various groups in order to obtain funds or other kinds of support from donors outside the community. These include three women's groups, Princesas Donají 1 and 2 and Fundación Rodolfo Morales; one men's group known as Piedra del Coyote; and one mixed group, Frente Amplio de Lucha Popular. Furthermore, there is a Sociedad de Solidaridad Social in Santa Ana Zegache, as well as various religious groups, and a cultural group of young people led by the painter Niceforo Urbieta.

In San Pablo Huitzo, other more formal aspects of social organization include the savings clubs (*cajas de ahorros*), which function as a kind of comunal bank and provide their members with the opportunity to save or acquire loans. In addition there are different religious groups, as well as a couple of fund raising groups similar to those in Santa Ana Zegache.

The role of maize in the study communities

In all the study communities, maize is the one crop which occupies the majority of farm land (see Table 4.3). Similarly, when in the 1998 baseline study, farmers were asked about the relative importance of their different sources of income, 98 % of all respondents considered maize to be an important or very important source of income (see Table 4.2).

Throughout the Central Valleys, the agricultural calendar revolves around the cultivation of maize. Two cropping seasons are recognized; the rain fed season also known as spring-summer (Table 4.4), and the irrigated season known as autumn-winter (Table 4.5). However, as the majority of farmers only have rain fed land, it often makes sense to speak of only one cropping

season, namely the one which coincides with the rainy season, usually starting in May and stretching into September-October (SEP, 1991).

Table 4.3 Farming system key characteristics of the study communities.

Community Characteristic	San Pablo Huitzo[a]	Santo Tomas Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas[a]	Valdeflores	Santa Ana Zegache[a]
Altitude (masl)[b]	1,700	1,660	1,360	1,810	1,460	1,480
Maize yield potential	Good	Poor	Poor	Poor	Good	Good
			- mean –			
No. farmer varieties[c] per household in 1997	1.26	1.21	1.10	2.13*	1.11	1.98*
Farm size 1996 (ha)	2.44**	3.91	2.84**	4.01	3.87	3.46
% land privately owned	49.60*	0.00	27.42*	1.00	0.00	100**
Maize area (ha)	1.99	3.65	2.76	3.02	3.55	3.22
% maize area irrigated	54.2*	15.7	11.9	8.1	3.8**	0.2**
% maize area in improved seed	0.14*	0.00	0.00	0.04	0.00	0.01

Sources: Smale et al. (1999), INEGI (2001).

[a] Communities where the seed flow tracer study took place

[b]Altitude of municipal centre (INEGI, 2001)

[c] Crop populations that a group of farmers recognize as distinct units. A farmer variety is not a variety in the sense of commercial agriculture, where a variety should be distinct, uniform and stable.

§ Land tenure in Santa Ana Zegache is mainly private, while a smaller area is comunal land controlled by the community authorities.

* Mean (frequency) significantly higher (different) using one-tailed t-test (chi-squared test), .05 significance level.

** Mean significantly lower using one-tailed t-test .05 significance level.

Table 4.4 Agricultural calendar starting in April for rain fed maize in the central valleys of Oaxaca.

Rain fed maize calendar	4	5	6	7	8	9	10	11	12	1	2	3
Preparation of land	xx											
Planting		xx	x									
Weeding			xx	x	x							
Fertilization			xx									
Second weeding (orejera)			x	xx	x	x						
Recollection of green stover					x	x						
Harvest of ears								xx	xx			
Recollection of dry stover							x	xx	x			
Separation of ears for grain and seed									xx	xx	xx	
Shelling										xx	xx	xx
Storage of seed	xx	x								xx	xx	xx
Storage of grain	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

Table 4.5 Agricultural calendar starting in January for irrigated maize in the central valleys of Oaxaca.

Irrigated maize calendar	1	2	3	4	5	6	7	8	9	10	11	12
Preparation of land	xx											
Irrigation before planting	x	x										
Planting		xx										
Weeding		x	x									
Fertilization		x	x									
Second weeding (orejera)			x	xx								
Recollection of green stover				x								
Harvest of ears				x	xx							
Seed selection and shelling						x	x	x				
Storage of seed						xx	xx	xx	xx	xx	xx	xx
Storage of grain					xx	xx	xx	xx	xx	xx		

Maize continues to be the most important crop for the majority of rural households in the Central Valleys of Oaxaca. For Mexico in general, maize contributes more than 1/3 of total daily calorie intake per capita (Table 3.3) and in Oaxaca, including the Central Valleys region, it is by far the most important food staple and of fundamental importance in terms of food security. In addition, maize is considered an important source of income, both directly and indirectly, for example, in terms of the sale of surplus production as grain or feed, or through the processing and sale of tortillas, *tlayudas* and other local specialities. Finally, maize is used for numerous other purposes and is imbued with meaning (Museo Nacional de Culturas Populares, 2002). It plays a central role in relation to Oaxacan culture, traditions and identity, and has done so for many centuries (See Chapter 3 on the origin of maize).

The most important food crop

Farmers in the study communities will talk about maize and other crops with much affection and respect. "They are things to eat and one shouldn't disregard them, they are alive!" as Miriam explained. However, of all the food crops maize is the most important. "It's the one that's eaten the most", says Josefina, "Everyday for the tortillas. It cannot be missing. Without maize – what will the tortillas be made from? Beans, on the other hand, well, there are days on which there will be something else. Sometimes there is no bread, because sometimes there is no money for bread, but there will be tortillas - tostadas - you put the coffee on and then - everything will be all right!" Catarina's comment is similar. Maize is more important than beans, she says, adding: "People say: 'If only the maize will succeed, then never mind the beans!' It's that beans are not for every day – they are eaten every 2-3 days. It is not as important as maize."

The relative importance of maize can also be observed in other ways. For example, most farm households plant much more maize than beans, even though some farmers claim that bean cultivation is actually economically

more interesting. Francisco and Liliana, for example, have always cultivated both maize and beans as well as other crops, but "we have always [planted] more maize" says Francisco.

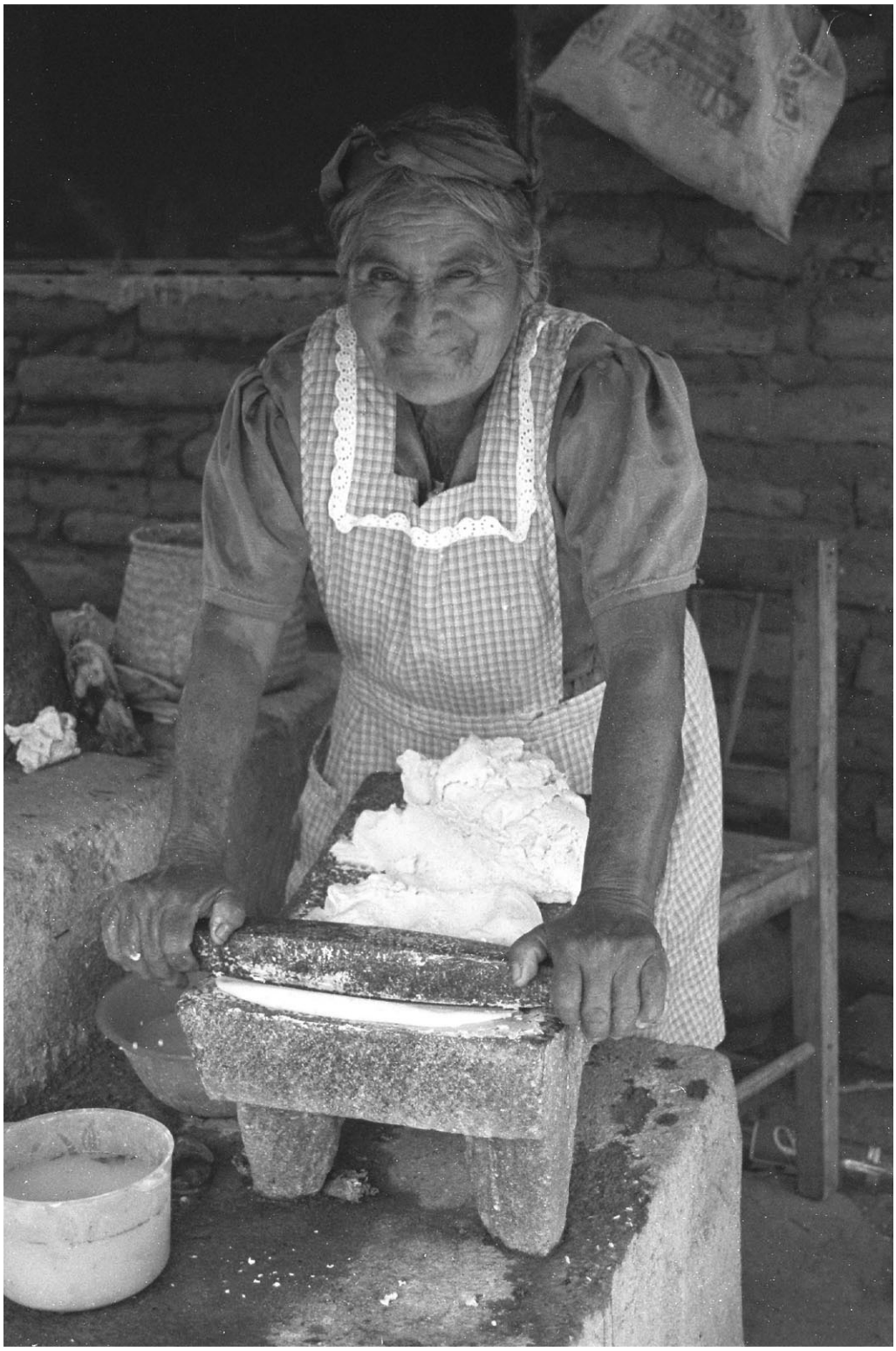

Figure 4.4 Grinding the maize dough on the *petate.*

Many farmers in the study communities express a special attachment to maize. Miriam, for example, kissed the ears of maize she showed during the interview, saying "Aye, dear god! If there is no maize, what do we eat! It is the same as if there was no water – without water, what would we drink?" In another interview, Eduardo used almost the same words: "Maize is like water. If there is no water, there is no life. …If there is no food, well… one is not well". This brings to mind the meaning of the Taino word, *mahiz* or *mahis*: 'life giver' or 'source of life' (see Chapter 3 on the spread of maize). The Spanish word *maíz* and the English *maize* are recognized as phonetical transmutations of the original Taino word (Fussell, 1999; Salvador, undated).

The special position of maize seed

Maize seed can be acquired through various types of seed transactions, although purchase is clearly the most frequently used (Badstue et al., 2003a, b). However, at least according to the informants interviewed for this study, transactions like exchange or lending seemed to be unheard of for chickpeas or beans. As Miriam exclaimed, when asked if beans are exchanged in the same way: "No! You buy it. No! Because nobody will ever exchange it. Maize, yes, but beans? No. That's for sure. And they are not going to give it to you as a loan either! You buy it. Sold. If you have money, you buy it, if not – no."

In general, farmers seem much more attached to their maize than to their beans or other crops, and these are therefore not treated specially. At the same time, while it is more difficult for poor farmers to access beans for planting, because one has to buy bean seed, this special status of maize makes it possible for people with very limited means to still access maize for planting (or consumption) without paying for it with money, and as several of the informants emphasized, for them, maize is the more important of the two.

In addition to these aspects, a series of traditional beliefs and recommendations are tied to maize seed, contributing to the reproduction of the special role of maize seed. A common saying encountered in all the study communities is, for example, that one must take care not to spill any seed on the ground while shelling the maize ears for seed, lest a hen, turkey, or other animal run and pick it up. This is sometimes interpreted as an omen that the maize plot will not succeed; likewise if flocks of birds are seen picking seeds in a newly planted field. Another precaution mentioned by several informants, is to keep the cobs from which seeds were selected in a tightly tied sack in a safe and dry place until the *milpa* (maize field) is knee high and well-established. Burning the cobs, feeding them to animals, or discarding them too early is supposed to bring bad luck and, consequently, the *milpa* will not develop properly.

Maize seed is sometimes also attributed certain human aspects, for example, feelings. Don Erasmo, from Valdeflores, explains in an interview how he obtained the yellow maize he grows. He comments that he found four ears of

yellow maize on the path, picked them up and took seed from them which he planted to see how it would perform. At the same time, however, he explains that if one comes across maize like that, one must pick it up, because "the maize cries if it is not collected". Though not a common example, this is not a unique case. For example, the women who participated in the focus group discussion in Mazaltepec said that they continue to maintain the idea their parents taught them, that "each [maize] seed has a soul and an eye". They explain that therefore one must take good care of it. By way of example the women explain that maize which is dropped on the ground must be collected. Otherwise it will feel neglected or scorned and there will be no harvest. It has not been possible to record these practices and recommendations in a systematic way, but their existence adds to other indications of the importance and value attributed to maize seed.

When interviewing farmers in relation to providing seed to others, several considered it important that the person who receives the maize seed is someone who will "take good care of it" (Badstue et al., 2003). Some of the informants, women as well as men, claimed they would not provide seed of the same kind of maize more than once to the same person, because if that person had lost that maize it must be because he/she did not take proper care of it. According to some this would also apply to their own children, 'so that they will appreciate it and learn to care for the seed'.

The seed of a particular variety or landrace maize can be seen as representing that specific kind of maize with a particular combination of traits, thought to be characteristic, and it carries links to past as well as future harvests. The way that some farmers in the study area talk about their maize seed, reflects their special attachment to their maize seed. In comparison to other crops, the fondness or appreciation expressed and the verbal attribution of feelings and human features to maize, for example, soul, eyes, heart, can to a degree be interpreted as an attempt to 'humanize' or 'culturalize' maize and maize seed. This sets it aside as something special relative to the various other crops the household produces. It is not like any other commodity.[13]

After this general introduction to the study area, a more detailed picture is presented of the physical context and life in the communities chosen for closer study, namely San Pablo Huitzo and Santa Ana Zegache. This includes a brief portrait of some of the farmers and households, who kindly participated in

[13] The 'special status' of maize in relation to the other crops, appears to have some similarity to the way in which certain farm animals, e.g. horses and bulls, which often have names and are treated with certain affection, seem to have a special status in comparison to others, e.g. chickens, pigs, goats and sheep. However, it is possible that this is also linked to the fact that horses and bulls in particular are regarded as 'men's animals', and therefore may occupy a 'priority position' vis-à-vis other animals.

the research, in order to provide the reader with a sense of the diversity and complexity of local livelihoods in the study area.

5. Santa Ana Zegache and San Pablo Huitzo

This chapter takes the reader on a tour of Santa Ana Zegache and San Pablo Huitzo to provide a sense of the social and physical context in which agriculture is practiced. Different aspects of the agricultural production system in the two villages are presented, and occasionally references are made to the other study communities. Finally, there is a chance to meet some of the farmers and to experience some of the variety and complexity of local livelihoods in the study area.

Santa Ana Zegache

Vultures take flight as we turn off the Zimatlán highway on to the dirt track. A couple of scavenging dogs look up as we quickly pass the foul smelling garbage pit and put the noise from the busy country road behind us. Turning our attention to the scenery before us, we see Cerro María Sánchez, a small mountain and local landmark rising proudly to the left in the otherwise flat, open landscape. We are in the Zimatlán – Ocotlán valley, reaching southwards from the city of Oaxaca.

A dirt road runs east-west through Santa Ana Zegache linking the community to the paved Oaxaca-Zimatlán road to the west and the paved Oaxaca-Ocotlán road to the east. There is bus service to Ocotlán (approximately 45 minutes) several times a day, and to Oaxaca every two hours during the day time, a journey of some 1 ½ hours.

The fields on our right look good. They belong to Zimatlán, a medium size provincial town on the shores of the Rio Atoyac. Some of the farmers working this land have access to irrigation, which explains the occasional plot of alfalfa among the maize. On the left side of the road, towards the María Sánchez, are maize fields and grasslands. Where the road forks we take the left track and cross the María Sánchez foothills. The difference in the fields here is noticeable. It seems dryer and cultivation appears less intensive. There are maize fields on both sides of the road, but also plots that have been left unplanted or completely taken over by weeds. Some of the maize is intercropped with beans and once in a while there is a plot with just beans. To the right, on a small hill a man is grazing a flock of goats and sheep. Up on the slopes of the *cerro* another, large herd is visible and occasionally the distant sound of a bell or a deep *baah* is carried down on the warm breeze. We pass a woman and a young child on the way to the field with the *almuerzo*, a mid-morning meal, typically of *atole* and tortillas with salsa or beans. She is wearing a clean apron over a faded print dress and the traditional *rebozo*, wrapped Zapotec-style, on her head. In her hand is a basket with the jar of *atole* and the food. We wave as

we go by and she smiles back and nods as she pulls the child to her side with her free hand.

Nearing the hamlet of San Jerónimo, one of the two *agencias* of Santa Ana Zegache, some shrubbery and bushes appear on the sides of the road, and here and there a stand of agaves. We pass a few interim-looking homes, and in a matter of moments we have crossed the little plaza in front of the collapsed ruin that used to be the church of San Jerónimo. We are now on our way to Zegache.

Some of the maize fields now also have *higuerilla* (Castor bean), and once in a while there's a field with a solitary tree in it. The sides of the road now have high edges and there are more bushes and agaves along the road and between the fields or in the dried up gulleys. A couple of times we have to stop to let a farmer with a herd of goats or sheep by. To our left, towards the *cerro*, the fields become more scattered, leaving areas of grassland and weeds and as one approaches the slopes of María Sánchez, agaves and gnarled cacti become increasingly common. We pass a couple of women with young children and dogs out looking for firewood, and an old man on a donkey – probably on his way to work. Suddenly the road narrows and the next moment we are entering the village.

As a municipality Santa Ana Zegache has two *agencias*, San Jerónimo Zegache and San Isidro Zegache, though the research presented here does not include them, but concentrates instead around the main village or municipal centre, Santa Ana Zegache.

According to INEGI (2001) the community of Zegache has a population of 2543 inhabitants and a total of 505 individually owned dwellings with an average of 5.03 occupants per dwelling.

The wide and dusty streets are quiet. A hen with her chicks has ventured out ito the street and runs for safety at the sound of the pick-up. A moanful *mooo* emanates from a backyard against a background of muted *ranchera* music from within a house, and a couple of small boys burst round a corner giggling loudly.

Each patio has a fence towards the street. Some are impressive live hedges of thick organ-pipe cacti planted closely side-by-side; others are made from *carrizo*, a bamboo-like plant that grows wild; and yet others are made of adobe or, more recently, of red bricks. Most houses are made of adobe or brick, and while some are painted, the rest have the same colour as the reddish-brown, dusty ground which seems to spread, under the tall blue sky, like an earthen carpet that continues from the street under the fences into the patios, and in some cases, into the houses.

Houses normally start out as just one room with a porch. Later on, as the family grows, more rooms may be added if resources allow. The 'kitchen' is generally set apart from the living quarters in a separate hut or covered area, in order to limit the amount of smoke that gets into the house and to reduce

the risk of fires. Every house also has a *pila,* a type of cement sink, where clothes, dishes and so on are washed and near which water is normally stored, in barrels or a cement tub.

Most houses have cement floor and a roof of cement or corrugated zinc, though a number are made from *carrizo* and have dirt floors. Some households have their own wells, however, most have piped water on the property and water is distributed a couple of times weekly. Latrines are the most common sanitary arrangement, and there is no sewage system or garbage collection.

Most patios have a few trees, some of them fruit trees. A part of the patio may be fenced off as the area where the household's animals are kept, while poultry are often left to roam freely. Near the house will often be a small garden with flowers and other ornamental plants, and maybe some herbs. Utensils are kept inside the house while bigger items, - ploughs, yokes or carriages - will usually be stored under a separate roof or under the porch.

On the way to the town square we pass several small shops selling basic household items: rice, beans, sugar, cooking oil, eggs, a few tinned foods, soap, soft drinks, sweets and maybe bread and other things. Shortly before the square we pass the school, where choruses of little voices repeating after the teacher can be heard from the street, and where, during breaks, the playground converts into a noisy chaos of laughter and shrill screams. The school has two sittings a day, one in the morning and another in the afternoon. Across from the school a little shop sells soft drinks, sweets and snacks as well as meals to the teachers or anyone passing through the village. In addition to the primary school, Santa Ana Zegache has a *tele-secundaria*, but for studies beyond this level, students must go to Ocotlán or Oaxaca.

Despite the existence of the small shops, including an agro-veterinary stockist, many people continue to go to Ocotlán on Fridays, which is market day and farmers and traders come travelling from all over the uplands of the district town to sell their wares and produce, and to buy things they need for the household. Others favour the large market in Oaxaca.

The *zocalo* or square is the heart of Santa Ana Zegache. A big, open square with a few trees and benches, it is used for various big events, ceremonies, and meetings. On the north side stands the village hall, a handsome, long one-storey building with a wide, arched porch and tile roof. The last room at one end is the community library, and next to this, in a separate, half-open building is the village market, built only a couple of years ago in a similar style to that of the town hall. Behind the town hall, across the street, is the public health clinic with one medical doctor, and the kindergarten. There are no paved streets, but the community has electricity and the streets around the *zocalo* have lighting.

On the eastern side of the *zocalo* and surrounded by a low adobe wall, stands the village's pride: the church. Built on top of a prehispanic platform,

the impressive structure dates back to 1664 and boasts several beautiful wall paintings and a splendid baroque façade. The Church underwent thorough restoration in recent years under the supervision of Rodolfo Morales, one of Oaxaca's famous painters. The result is striking: the intricately sculpted and brightly painted façade provides an explosion of colours which light up the church grounds and the town square. The remaining two sides of the *zocalo* are taken up by private homes behind tall adobe walls. These, and the town hall and covered market are tastefully painted in tones that match the colours of the church.

In Santa Ana Zegache, as in Santo Tomas Mazaltepec, the indigenous element is particularly strong. In Santa Ana Zegache 44.6 % of the population above five years speak Zapotec, according to INEGI (2001), and for many it is still their first language. The majority of the population knows how to read and write; however, according to the information provided by the INEGI (2001) approximately 29% of the population older than 15 is illiterate.

Most days the *zocalo* is relatively quiet, as people are generally busy elsewhere, in the fields or at home. There is some activity around the village hall and market, as well as the occasional visitor to the church. Women move back and forth several times a day, to the maize mill, to the market, or the shops, bringing children to and from school. Men in *guaraches* and *sombreros* can be seen on their way to the fields or doing errands. A traditional oxcart may pass by or a farmer with a herd of goats or sheep, and once in a while a truck with supplies for one or several of the local shops. Several times a day the buses to Ocotlán and to Oaxaca stop to pick up passengers or let people off. The number of privately owned motor vehicles in Zegache is very limited, though a few individuals own a truck or a pick-up, which are occasionally used to provide transport services for others for payment.

Late afternoon and early evening is when people seem to have time for recreation. At this time of day a small crowd of women gathersw outside the public telephone office at the corner of the *zocalo*, awaiting calls from relatives abroad or elsewhere in the republic. Some of them are accompanied by young daughters or children who play in the street or on the *zocalo*, while their mothers chat. They wear dresses, most with an apron on top and the *rebozo* wrapped around their heads or casually slung over the shoulder. All the married women wear gold filigree earrings. The preferred hairstyle is braids with brightly coloured ribbons, tied together on the back, or wrapped around the head in a crown. Many wear the popular plastic lace shoes or sandals, others are barefoot. If a call comes in for someone who is not there, a child is sent off to notify that person, or, alternatively, to one of the loud speaker stations to broadcast the notice. A little later and out of breath, the person in question or a relative will usually show up to answer the call.

In addition to the public telephone office on the *zocalo*, a few households in Santa Ana Zegache now have private phone lines and some have cell phones.

The loud speakers, which are placed in various parts of the community, are the most common media for general announcements. For a small payment they are used for all kinds of announcements from invitations to meetings and general announcements to birthday greetings. At times they are also the source of loud *banda* music, the favourite genre of many Santañeros.

Meanwhile, on the benches in the *zocalo* or under the porch of the town hall, men in clean shirts, but the same old *guaraches* and straw *sombreros*, chat and sort out the world, while in the shadows teenagers may try their luck at a bit of romance. On days when an evening service has taken place in the church, little groups of people gather in the *zocalo* to exchange news and gossip before they part.

Though Santa Ana Zegache is definitely a rural municipality, it is hardly an isolated community and in general the Santañeros have multiple links to other parts of the state and the country, as well as abroad. Nevertheless, of the six communities involved in this and previous studies by CIMMYT, Santa Ana Zegache is the least prosperous (see Table 4.1).

In addition to agriculture, off-farm income sources play an important role for many households. A number of persons travel every day to Oaxaca to work in construction, as watchmen or in other un-skilled jobs. Others work as agricultural day labourers in neighbouring communities.

In Santa Ana Zegache women's participation in both productive and reproductive activities is noticeable. Women also sometimes work as day labourers, for example, weeding, de-husking or de-graining maize. Some of them also sell home-made *tortillas*, *tlayudas* or *tostadas*, or other food items in the community, sometimes to order, in which case the maize is provided by the person who orders the *tortillas*. Others regularly travel to Ocotlán or Oaxaca to sell their *tortillas*, *tostadas* and other products.

San Pablo Huitzo

To get to San Pablo Huitzo, we take the federal highway from Oaxaca City north-west towards Nochixtlán. Half an hour later we pass the turn-off to Etla, the district capital and the most important regional market place for this part of the Central Valleys. We continue onwards, passing the *maquiladoras* on the outskirts of Etla, where men and women from the surrounding municipalities and upland work shifts in the factory assembling clothing items for foreign manufacturers. A couple of minutes later a string of simple sheds of crudely cut boards advertise 'bars' or 'men's clubs'. In the daylight the makeshift constructions look cheap and pitiful, but when darkness settles their neon-lights glow brightly, and ranchera and *banda* music flows loudly out through the frilly plastic bead curtained doorways.

The narrow highway is busy with cars, trucks and buses. We pass the big archway over a road going off to the left, welcoming visitors to the town of Suchilquitongo, and shortly thereafter the *cantera* quarry on the right. A

couple of curves further on, we reach Cerro de la Campana to our left. On top of the steep hilltop sits the archaeological site of Huijazoo. Estimated to be from the Classical Period of the Zapotec culture, 650-900 BC, (Fernandez de Castro, 1990), partial excavations of the site in 1985 revealed tombs, pyramids, temples and a ball court.

The highway goes round the Cerro and after a few more curves crosses a little bridge, passing the tomato green houses to the right, and we take the paved turn-off into Huitzo. To our left lie a couple of maize fields traversed by a dirt road with beautiful, large trees on either side, leading to one of the village neighbourhoods, and to our right a few houses behind which rises the hilltop where the village cemetery is located. After about a kilometre we do a sharp turn to the left, pass a block of old adobe homes and a small shop or two. At the corner another sharp turn to the left, takes us to a wide street leading from the old railway station to the *zocalo* with its little park, in front of the village hall. To the right, some 5-6 steps up, is an ample courtyard with a line of old trees and a thick, low stone wall, stretching out in front of the solemn twin towers of the impressive, centuries-old church of San Pablo with its adjoining monastery and gardens.

Human settlement in what is today know as San Pablo Huitzo has been traced back to 1200 B.C. (Mendez Martinez, 1995). In the 15th century, it was known under the name of Huijazoo, which, in Zapotec means 'war fortress' or 'place of warriors' (Enciclopedia de los Municipios de Mexico, EMM). After the Mexicas conquered the Oaxaca valley the name was changed to 'Cuauhxilotitlan' ('place of turkeys' (EMM)), and later still, in the 18th century, the village finally became formally known by the name of Huitzo, which according to Mendez Martinez (2000) is likely to be a contraction of the Zapotec word huijazoo.

When the Spanish arrived in the area around 1522, they moved the inhabitants of the surrounding hills into the flat area in the valley and established the new settlement on the banks of the river Atoyac. Dominican monks arrived in Huitzo a few years later to convert the indigenous population, and the construction of the church and adjoining monastery was initiated around 1555 (Mendez Martinez, 1995). Today the cloister and part of the monastery can be visited upon appointment, while another part houses the living quarters and offices of the priest. The church is used frequently and functions as the main church of the municipality.

The village hall is located on the north side of the *zocalo*. Part of it was built in the 1930s and the rest in 1970. The offices of the village council open on to a wide porch supported by a row of tall columns, constituting an impressive façade. Meanwhile the spacious inner patio with its various open rooms provides space for large meetings and cultural events.

When inhabitants of San Pablo Huitzo talk about their community, they often refer to 'sections' one, two and three. The first and the second sections

have grown together and it is not obvious where one ends and the other begins. However, the second and third sections are separated by the River Atoyac, and although this is merely a stream in these parts, it nevertheless makes a clear boundary, which contributes to the fact that the third section could easily be taken to be a separate village, as some inhabitants put it. At times resentment surfaces between the first and second sections and the third. Issues are usually related to local governments matters, which sometimes leave the third section feeling overlooked, or to irrigation matters, which to a degree are controlled by the third section, as this is closer to the dam than the rest of the municipality, and the water therefore has to pass through this section before it reaches other parts of municipal area. However, day-to-day the distinction between the different sections has little practical significance and in many cases is used simply to refer to different parts of the community. San Pablo Huitzo has only one *agencia*, Tenexpan, located across the river on the way to Suchilquitongo, and this community did not form part of the study.

Going round the *zocalo* to continue down the main street, one must pass a complex of paved football and basket ball courts, or, alternatively, slip into one of the various *arroyos* [narrow, dried up river beds] commonly used as streets. Dogs can be seen busily sniffing the tall grass on the sides of the *arroyo* and often a solitary horse, sheep or other animal is left here to graze. Once again on the main street we find a mixture of private homes and little shops, most of which are actually part of people's homes. This is also where we find the taxi-stand, the internet-café and a 'mini' games arcade popular with young boys. In the patios, which often stretch out behind the houses, some families keep their farm implements or a couple of animals and, during harvesting time, piles of maize. A considerable number of the households in Huitzo keep their cattle, pigs or goats and sheep not in their patio, but at the *rancho*, that is, on a piece of land outside the community centre, where the farmer often also has a shed or a couple of out-houses for farming equipment and other utensils.

San Pablo Huitzo has two public health clinics with a total of 3 physicians in addition to a couple of private practices. There is a small municipal market in the centre of town and a variety of small shops, including butchers, *tortillarias*, chemists, general stores and a couple of veterinary/agricultural stockists. The latest addition to the various other small businesses is the internet café, particularly popular with school children and secondary school students. Furthermore, things that cannot be obtained in San Pablo Huitzo can often be found in the neighbouring town and municipality of Telixtlahuaca. However, for alternative shopping, or to sell produce, many people go to Etla, which is known for its Wednesday regional market, or to Oaxaca.

A couple of blocks further down the main street we pass one of the health clinics and the school with its big trees and lively colours. There are fewer shops now and the buildings along the street are mostly private homes. It is

clear that many of the homes in Huitzo have 'grown' over the years, with extra rooms or new parts added. The patios have ornamental plants and flowers and some have large shady trees. Some households still use a traditional kitchen with an open fireplace set apart from the living quarters. However, in Huitzo, most households in the community centre also have a gas-stove and a refrigerator, and some have a washing machine.

Leaving out Tenexpan, San Pablo Huitzo has a population of 4685 inhabitants according to INEGI (2001), and a total of approximately 1003 individual dwellings with an average of 4.46 occupants each. The majority of these dwellings are made from cement, some from bricks and some from adobe. They are generally spacious; many have two storeys and the majority have floors of cement or materials other than dirt-floors. Many also have cement roofs, while others have roofs made from asbestos, corrugated zinc or tiles. Some houses have septic tanks; however the use of latrines is still the most common. In the community centre, all households enjoy electricity and piped water, if not in the house, at least in the patio, or from individual wells. The main streets in the community centre are paved and have street lights. The rest are dirt roads, though mostly in good repair.

Each of the three sections of Huitzo has a kindergarten and a primary school, and in addition the municipality has a technical secondary school. According to INEGI (2001), 94.3 % of the population can read and write. The dominant language is Spanish, and only 1.2 % of the population speaks any indigenous language (INEGI, 2001).

There are several public telephones in San Pablo Huitzo, but in addition several households have private lines or cell phones. As in the other study communities, loudspeakers are used to broadcast announcements of general interest and advertisements, though maybe to a slightly lesser degree in San Pablo Huitzo.

The pavement ends near the shallow Atoyac river but continues as a dirt road on the other side to the part of Huitzo known as the third section. The dense stands of tall *carrizo* on either side sway gently in the breeze. A couple of children are playing in the ankle-deep stream as we drive through and another, maybe their big brother, is washing his bicycle.

With its steep sides and thick layer of sand, the dirt road is more like an *arroyo*. Within minutes we approach the third section, where long strips of alfalfa stretch out on our right. In one of them a man with a sickle is working, cutting dark green, knee-high alfalfa, while his donkey is quietly grazing under the trees along the road.

It is still early, but it looks like they have finished baking at the house with the round bread oven in front of the big mango trees. We buy a bagful of bread and move on to the main street in the third section, just in time to wave to Don Neftali, bus driver and owner of the little 'bus terminal' down the street, as he manoeuvres round the curve, heading off for another round trip

to Etla. A variety of public transport is available from Huitzo, including micro-vans, buses and taxis, in addition to other transport opportunities departing from the neighbouring town of Telixtlahuaca. A number of inhabitants furthermore own private cars or trucks.

We pass a few shops again; the butcher, who has just slaughtered a pig and is getting ready to fry the *chicharrón* (crackling), and one of San Pablo Huitzo's two bicycle shops, before we pass the hill with the church and the school next to it. To the left a dirt track descends to the Atoyac again and continues along the stony, shallow stream towards the big Matías Romero dam which provides parts of San Pablo Huitzo and the neighbouring Municipalities of Telixtlahuaca and Suchilquitongo with irrigation. We are in the upper part of the valley and to both sides the mountains are easily appreciated against the morning sky.

A couple of kilometres further ahead, the road meets up with the federal highway again. On the way we pass a pair of tile-and-brick ovens where men are already busy firing up for today's baking, while others are molding wet clay among stacks of sun-dried bricks from previous days, ready now for the oven.

At the junction, where the access road for the toll-road to Puebla and Mexico City also meets up, we turn right on to the federal highway and head back towards Oaxaca. Passing a couple of road-side restaurants, popular with truck drivers and other travellers, and the turn-off to Telix, we turn down one of the dirt roads, cross the railroad tracks and head back into the centre of Huitzo.

San Pablo Huitzo has had good communication routes for many decades. The railway which passes through the community was the principal means of transportation to Oaxaca and to Nochixtlán and Mexico in the past, for people as well as for goods of all sorts. The train still runs once a week, but only on the stretch between Oaxaca and Cuicatlán. Years back, many people from Huitzo and other communities worked on the railway, thus complementing their income from agriculture with a salaried income from the railway. According several of the inhabitants, the railway brought various benefits to the community and made it possible for many to construct their own, good quality houses in the community centre.

A large number of the inhabitants in San Pablo Huitzo depend partly or entirely on agriculture, which is closely linked to social life in the community. However, off-farm income plays a very important role. Some inhabitants do not farm, but are full-time professionals, merchants or shopkeepers, but many households depend on diverse and complementary sources of income. It is quite common, for example, that some household members work in small-scale farming, while others work off-farm or in the manufacturing of products for the market. Maybe someone in the household works in the quarry or in the *maquiladoras* on the way to Etla, or they establish a little shop in one part of the household property. In a similar way, in some households the women

make tortillas or other food products for sale. There are furthermore a couple of small-scale brick and tile enterprises and a greenhouse complex in which a number of people work full- or part-time. For those who own bullocks or a tractor, ploughing and other services for other farmers represents yet another possible source of income, even if on a basis. Many households combine farming with one of these options. Finally, Huitzo is home to a small number of professionals who travel back and forth to work in Oaxaca or elsewhere, but who prefer to live in a quiet rural town instead of in a bustling city.

The production system in San Pablo Huitzo and Santa Ana Zegache

Environment and location

Located in the upper part of the Valley of Etla, San Pablo Huitzo has quite a varied topography. The land in the valley around the municipal centre is relatively flat and fertile, and a considerable part of it has some degree of irrigation. On the opposite side of the federal highway the landscape becomes hillier and eventually transforms into mountainous terrain partly covered with residual forest and rising at the highest point to 2500 masl. This makes up the larger part of the area belonging to the Municipality of San Pablo Huitzo. Most of this is comunal land and except for some of the lower foothills and the hamlet of Rio Blanco in the highest parts, it is for the most part not under cultivation. However, the Consejo de Bienes Comunales, the entity that oversees the management of comunal resources, can authorize the use of certain parts of these lands for agriculture or grazing.

Because maize is very sensitive to agro-ecological conditions, altitude can be an important factor in its cultivation. In San Pablo Huitzo altitudes vary between 1700 and 2500 masl. These altitude differences are significant enough to make the use of different, locally adapted maize varieties necessary. Similarly, steep slopes and poor soils can seriously compromise the local adaptation of any given maize. While these conditions are present in San Pablo Huitzo, they are perhaps even more pronounced in San Lorenzo Albarradas, where altitudes vary between 1400 and 2600 masl and where the land in many places is not only steep, but also has shallow, stony soils. Under such circumstances it is sometimes impossible to till the land with bullocks, and the farmer has to plant the maize using a planting stick or a spade.

In comparison, most of the land in Santa Ana Zegache is flat and even the part that is sloping, such as the foothills of the little María Sánchez mountain, is not too steep. In a way, there would not seem to be much of a problem with regards to genotype-by-environment interaction here. However, though differences in altitudes are limited, great differences in soil quality exist, making farmers very aware of where to plant what kind of maize, for example, the most sturdy on the poorest soils and the least sturdy, or the most appropriate for the market, on the better soil. The land to the north of Zegache between

the María Sánchez and the village, is for the most part considered of poor quality. South of the community, however, the valley spreads out into a flat plain of dark soils, known as *yocuela* and considered to be the best in Santa Ana.

Farm size and irrigation

According to data from INEGI's latest agricultural census[14] (1994) San Pablo Huitzo has 460 rural production units or farms, cultivating a total area of approximately 660 ha. Of these approximately 360 ha, or 219 farms have some degree of irrigation.

The majority of the water used for irrigation in San Pablo Huitzo comes from the Matías Romero dam, which was completed in the early 1970s. The construction of the dam tremendously expanded the cultivated area under irrigation in the municipality and for the farmers who benefited this produced a major change in production conditions. As Don Alejandro from the 3rd section commented: "Really, what saved us was the dam".

The land use in Santa Ana Zegache is predominantly agricultural. The total area is 1317 ha and this is divided into 527 production units of which 4 have irrigation, 515 are rain fed, and 8 a mixture of the two. The irrigation is from wells which provide 3.5 ha with full irrigation and 34.2 ha with partial irrigation (INEGI, 1994).

Principal crops

In San Pablo Huitzo, maize and beans are planted on approximately 451 and 121 ha respectively (INEGI, 1994). In addition a considerable number of farmers in the valley grow alfalfa as live-stock feed, in particular for the small-scale dairy production, which forms part of the farming system for a number of farmers in several localities in this part of the valley, including Huitzo. Some of the small-scale dairy farmers also use green maize for feed, and occasionally oats are planted as a complementary feed source. A number of farmers also grow vegetables for the market, especially squash and in a couple of cases, tomatoes. On the outskirts of Huitzo, a couple of large greenhouses form part of a commercial tomato enterprise and a couple of small nurseries produce ornamental plants.

The flat and relatively fertile land in the valley and the relatively common access to irrigation in San Pablo Huitzo favours a more intensive agriculture than in the other study communities. For those who have irrigation, it allows for two cropping cycles and for year round cultivation of alfalfa, as well as some degree of vegetable production. The second cropping cycle is often

[14] The national agricultural census was carried out in 1994 and was supposed to be repeated in 2004. However, this did not happen and at the moment of writing this chapter, it is still unknown when the next agricultural census results will be published.

called fall-winter and refers to the period from December to April. However, in San Pablo Huitzo planting is normally delayed until February in order to avoid the risk of occasional frost.

In comparison, Santa Ana Zegache has only one cropping season. The Santañeros cultivate maize on 1243 ha with an average yield of 0.3 ton/ha (INEGI, 1998). Beans, squash and *higuerilla* (Castor bean) are the next most common crops. The stems of the latter are used as firewood, as this is a very scarce resource, and the seeds are sold, although fetching only MX$ 2 per kg. Maize is commonly intercropped with any of the other three and in some cases with all of them. A few farmers also grow peanuts, and chickpea are not an uncommon sight. Finally, in the irrigated zone some farmers also cultivate other crops, flowers, garlic and onions.

When planting maize and beans together, one person walks ahead planting maize, while another person follows, planting the beans in between the maize. In the case of intercropping with squash or *higuerilla*, the squash and/or *higuerilla* seed is mixed with the maize seed before the planting begins, and they are therefore planted randomly, or, like the farmers say: "wherever it falls" [*A como caiga*]. From the squash the farmer obtains seed, which can be sold at the market or used in the household consumption in snacks, sauces, and stews. Sometimes the 'flesh' of the squash is used to prepare traditional sweets or drinks, but in general what is left of the squash after removing the seed is used for animal feed.

In San Pablo Huitzo the custom of planting squash together with maize is still practiced by a number of farmers, though normally not on all the land belonging to the same farm unit. Maize intercropped with beans can also be observed in San Pablo Huitzo, though it is not as common as in Santa Ana Zegache. It seems, in San Pablo Huitzo, the two are more often planted separately.

If maize planting under rain fed conditions is delayed due to lack of rain, or, if the plants fail early in the growing season, but too late for re-sowing and establishing another maize crop, farmers sometimes choose to plant chickpeas instead, as the appropriate planting time for this crop is considered to be July-August. Despite being a 'second choice' crop for most farmers, chickpeas often play the role of safety net under maize production. Though farmers in San Pablo Huitzo have also mentioned this practice, I do not recall seeing chickpeas here, whereas in Santa Ana Zegache it is not an uncommon sight around August-September. This could very well be linked to the fact that a much larger part of the farming population in Santa Ana Zegache depend entirely on rain fed agriculture, and if a drought hits, its consequences are usually worse in Santa Ana Zegache than in San Pablo Huitzo.

Figure 5.1 Lorenzo's field with maize, squash, and beans.

Land preparation

Both in San Pablo Huitzo and in Santa Ana Zegache land preparation is mostly done with bullocks, though tractors are also used. Not everybody owns bullocks, however, and those who do not, depend on others to till their land for a fee, having to wait their turn and thereby maybe risking late planting. Owning bullocks, on the other hand, puts a farmer in a position of control with regards to land preparation and can furthermore become a source of in-

come. Not surprisingly, therefore, most farmers who own bullocks regard these animals as among their most prized possessions.

Figure 5.2 Maize harvest being transported on oxcart in Santa Ana Zegache.

However, bullocks are expensive and need looking after and for some people it is easier to just pay someone else to till the land. This is sometimes the case for women in female-headed households, where she remains in the village taking care of the farm, while the husband is a migrant worker elsewhere in Mexico or abroad. On the one hand bullocks are big animals and many people are fearful of them. On the other, handling bullocks is clearly defined as men's work, just as making tortillas is women's work. In fact, a local saying claims that if a woman grabs the plough, she will no longer be able to make tortillas; and if a man makes tortillas, he is no longer able to plough. In addition, if one has little land, it is possible that unless one plans to also till the land of others for payment, it may even be cheaper to hire the ploughing service from others, than to invest in a pair of bullocks. This may be one reason why the use of tractors for land preparation is more common in San Pablo Huitzo in comparison to Santa Ana Zegache, even though very few people own a tractor, and the use of tractors is almost entirely on a service basis, where the farmer pays the owner of the tractor for the land preparation. Considering the importance of off-farm activities in this community, it may be that more households find it easier and can afford to simply pay someone else to do the ploughing.

Except for the use of silage-choppers for the cutting of green maize for silage production in San Pablo Huitzo, all harvesting is done manually both in San Pablo Huitzo and in Santa Ana Zegache. The transport of the harvest back home to the farm or the family home is done with different means of transport: in Santa Ana Zegache with big, traditional oxcarts and in San Pablo Huitzo with trucks or donkeys. The shelling of the maize is generally done by hand, though increasingly some people use mechanical shellers, which can sometimes be rented.

Livestock

Both in Santa Ana Zegache and in San Pablo Huitzo, most farm households also have livestock. Especially in Santa Ana Zegache, smaller animals complement household diet and income, as they are relatively easy to sell. Larger animals represent more long term savings, but can also be sold to raise money for other investments or for emergencies. Horses and donkeys are used for transportation purposes and oxen for pulling heavy loads and for ploughing. According to INEGI (1994) 283 households in the municipality of Santa Ana Zegache have cattle, 281 have pigs, 399 poultry, 219 goats, and 59 sheep, while 326 have horses or donkeys. See also Table 5.1 for comparison across the six communities.

Table 5.1 Average number of livestock per household from the baseline study

Livestock (Average number per household)	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valdeflores	Santa Ana Zegache
No. of pairs of bullocks	0.48	0.83	0.55	0.53	0.73	0.80
No of dairy cows	0.83	1.98	0.40	0.55	1.10	0.28
No of beef cattle	0.48	1.23	0.38	0.20	0.35	0.05
No. of horses	0.03	0.28	0.08	0.23	0.18	0.45
No. of donkeys	0.90	1.43	1.25	2.10	0.95	0.75
No. of pigs	2.45	1.88	0.38	0.78	2.05	1.95
No. of poultry	16.88	6.15	8.98	12.10	20.05	14.55
No of goats	2.60	2.10	1.63	5.65	1.08	0.70
No. of sheep	1.30	0.33	0.45	0.10	0.48	1.60

Source: Baseline study

With regard to livestock, in San Pablo Huitzo, dairy production stands out as most noticeable, in comparison with the other study communities, except maybe for Santo Tomas Mazaltepec, where small-scale dairy farming also plays a certain role for a number of households. Some of the dairy farmers in San Pablo Huitzo milk manually, however, others now use mechanical milking machines. In most cases these and other investments in relation to dairy production, such as stables and silage pis, have been acquired with the

support of the federal program Alianza Para el Campo[15]. The milk produce is mostly sold for local cheese production, and buyers pass by to pick up the milk twice a day. According to INEGI (1994) 185 of the farms in the municipality of San Pablo Huitzo have cattle, 141 have pigs, 235 have poultry, 119 have goats or sheep; and 186 have donkeys, horses or mules. Finally, it should be mentioned that San Pablo Huitzo has several butcher's shops or stalls, and a number of farmers in the community buy and sell cattle for meat production.

Farmer portraits

In order to provide the reader with a taste of local livelihoods in the study area, a small number of farmers from the municipalities of San Pablo Huitzo and Santa Ana Zegache are introduced. Several of these farmers and households will be referred to in following chapters. Appendix four contains a table with additional information on these and other households.

Some farmers from the Municipality of San Pablo Huitzo

Francisco and Liliana, a poor household from the sierra

Francisco and Liliana live in Rio Blanco, a small hamlet at approximately 2350 masl, which is situated in the sierra about an hour's drive from the village of Huitzo on a windy dirt road to Jayacatlán. From the road it is about 25 minute's walk through the deciduous forest down to the hamlet. The Municipality of Huitzo and the neighbouring Municipality of San Juan del Estado have a long history of conflict over land. In the 1940s violent clashes took place in which several people were killed. The conflict has never really been resolved and continues to flare up every once in a while. In the 1950s and 60s Huitzo Municipality initiated a process to populate and consolidate the settlement of Rio Blanco in order to strengthen its position in the conflict and help defend its territory. In the late sixties approximately 60 families lived in Rio Blanco and the hamlet had its own little primary school and a small church, according to Don Agustín, the hamlet elder. Nowadays only a handful of households are left. The remains of the church still stand, and though the school is long abandoned, its bell is still used whenever Don Agustín, or any of the others need to call people together.

Francisco wears his cowboy-hat pushed back. In his late forties, he is not very tall and of a slim, wiry build, with a quiet and thoughtful personality, almost a bit shy. Liliana is forty five, and though she is a bit shy at first, the look in her friendly eyes is one of curiosity and quiet interest. She is the eldest

[15] Alianza para el Campo (Aliance for the Country-Side) is the policy basis of the Federal Government of Mexico to promote agricultural and rural development. The program has been in operation since 1996. For more information, see Suvedi, 2000.

of 12 siblings, and today only five of them are still alive. Francisco is also the oldest of many siblings, but of the five that Liliana has ever met, only Francisco and his brother Alejandrino are still alive. Both Liliana and Francisco grew up in Tlasoyaltepec and whereas he has completed the second year of primary school, Liliana has only completed the first.

Their house, which is just one room, is made of boards cut with a chain saw. The floor is part dirt, part cement and the roof is made of old sheets of corrugated zinc patched here and there with plastic. A little porch offers some measure of shelter when it rains. The kitchen is located in a separate hut; this one made entirely of branches, with a dirt floor and corrugated zinc for roofing. Another, smaller hut next to the house is used as a granary and for storing diverse farming implements. Behind the house and the granary a large pergola is covered with *chayote* and around the patio are peach and apple trees, as well as a few chilli bushes and herbs. There is no electricity in Rio Blanco and all water is taken from small streams nearby.

Liliana and Francisco came to Rio Blanco approximately 20 years ago. Together with Francisco's mother, Sofia, they walked all the way from Santiago Tlasoyaltepec which is a Mixtec area some 50 km away, with a donkey carrying the cooking gear and their few other belongings. Francisco's farther had died shortly before and, according to Liliana, they left Tlasoyaltepec because the land they worked there no longer produced enough. Francisco's brother later joined them in Rio Blanco.

Liliana's first child was a girl, who died only a few days after being born. She has since given birth to 5 boys, who all lived and are now between 22 and 11 years old. The two oldest were just babies when the family arrived in Rio Blanco. These days only Lorenzo, who is the oldest and 'a bit slow', and Valente the next-youngest of his brothers, live with their parents in Rio Blanco, where they help out with the animals and the crops. During the week Feliciano, the youngest who is about to finish primary school, lives in San Pablo Huitzo with his uncle, who left Rio Blanco some years back, when the school was finally closed down. The second and third oldest live in Oaxaca where they share a room and work in the same factory or *maquila*. They go to Rio Blanco sometimes at the weekend or whenever they have time, and once in a while they give Liliana some of their earnings.

The household has a radio and a 12-volt television, connected to the battery from a car. Every once in a while, when the battery goes flat, Lorenzo takes it to Telix (Santiago Telixlathuaca) where they recharge batteries for a small fee.

Liliana is in charge of the household. Her mother-in-law tries to help as best she can, but it is not much now. A diminutive, wrinkled and frail looking old Mixteca woman, missing several teeth, she walks barefoot and carries her *rebozo* folded on top of her head. She seems to understand my Spanish, but Liliana tells me that between herself, Francisco and his mother, they speak Mixteco, and the boys all speak both Mixteco and Spanish.

The principal income source for Francisco and Liliana's household is agriculture. They have cultivated maize and beans on comunal land for many years and though they do not hold title to any of the land they work (approximately 3 ½ ha), it has by now come to be regarded as theirs. The small herd consisting of a pair of bullocks, 7 heads of cattle and 3 goats is taken out daily to graze in the forest around the hamlet, while a number of chickens are left to roam freely in the shrubbery around the house and patio.

Francisco and Liliana cultivate three kinds of maize (white, yellow and black) and two kinds of black beans. The production is first of all for their own consumption and secondly, any surplus production is sold in order to generate money with which to cover other needs and to buy sugar, oil, soap and other items. Taking produce to the market is not an easy affair from Rio Blanco. A bus from Jayacatlán to Huitzo and Etla passes by on the dirt road in the mornings, and returns in the late afternoon, but there is a limit to how much one can carry on the bus. The alternative is to walk to Huitzo, or like old Don Augustin, ride. When Francisco goes to the market in Etla, he usually catches the bus and takes a sack or two of maize with him to sell, and depending on the season, some *chayotes* or peaches.

Figure 5.3 Franciso and some of his family outside the kitchen.

Because of the altitude, the climate in Rio Blanco is cooler and wetter than in the valley. When the clouds hang low they sometimes completely envelope the area and as the heavy mist settles and the humidity collects and falls from

the leaves, the big, fat drops can be heard as they hit the forest floor. The cool air smells of forest and the silence is only broken by a bird singing or the occasional sound of a cow-bell.

In Francisco's household the maize is stored on the cob with the husk on, in the granary - one half of a shed where the floor is lifted off the ground. Whenever they shell maize for their own use or to sell at the market, they put aside for seed the ears that are particularly large. These ears are then stored with the husk on in sacks, until the time for seed selection arrives.

Everybody in Francisco and Liliana's household participates in the selection of maize seed which takes place in the month of March on the day of the full moon, or one day before or after. They explain that selecting seed during full moon is said to ensure that the ears, produced from this seed, will fill well. They select only the large and healthy kernels from the centre of the cob and avoid kernels with a dark *tronquito* (the pedicel, where the kernel is attached to the cob). Liliana explains that plants germinating from such seed will have twisted growth.

After seed selection, the seed is stored in sacks inside the house. Francisco comments that he has heard about medicines (i.e. pesticides) to cure (protect) seed, but he has never tried it.

Lucio, an educated dairy farmer from San Pablo Huitzo

Lucio is 32 years old. He is tall and a bit heavy set with light skin, a chipped front tooth and brownish hair and moustache. The oldest of five siblings, Lucio is a bachelor and lives with his parents Reynaldo and Irma and his two youngest sisters, on the main street in Huitzo's 2nd section. Don Reynaldo (68) grew up in the village and completed the third grade of primary school. He values education very much, but 'In those day, that was all there was', he says. Don Reynaldo has a twin brother and four other brothers, all of whom are alive. His youngest brother Alfonso, however, who is just a few years older than Lucio, his nephew, had more opportunities. After finishing school he acquired an engineering degree, and since the technical school opened in Huitzo, he has worked there as a teacher. Today Reynaldo is proud that all his own children have an education. Lucio has a degree in agronomy. Eduardo who has recently finished his degree in accounting lives together with his common law wife next door to his parents, in a small house of his uncle's. They recently had their first child and as Eduardo has not been able to find a job as an accountant yet, he is starting to talk about going to the US. Gloria is a laboratory technician. She is married and has one child, and lives and works in the Valley of Zimatlán. Pilar has studied tourism and business administration and has recently found work at a big hotel in Oaxaca. Both she and Paulina, who is studying informatics, still live at home, and she is proud that now she can also begin to contribute to the household income.

Lucio is particularly interested in animal husbandry. When he finished his degree he turned his attention to the family farm, which is the principal source of income for this household. Though his parents are still active and help out with the work in many ways, he has now taken over the main responsibility of running the farm.

Together with his parents, Lucio owns 12 dairy cows, 3 young bulls, 2 calves, 4 sows and around 50 sheep and goats. With the dairy cows and the production of other animals this farm household has a large need for good quality animal feed, and their choice of maize reflects this. In total Lucio and his family grow 5 ha of maize in the valley and several plots of alfalfa. Part of the maize is a landrace which Lucio acquired in one of the demonstrations of the CIMMYT project. It is characterized by tall growth and abundant foliage, which makes it particularly appropriate for green matter feed production, and indeed, this maize is grown especially for feed production in the form of green maize silage. With this maize, Lucio has now completely substituted the hybrid maize he used for feed production. It is just as good, he says, but in addition because it is a landrace variety, he can produce the seed himself and does not have to acquire fresh commercial seed for every planting. The maize for feed production is planted with very little distance between the plants and harvested before grain filling. Except for the roots the whole plant is chopped and processed for silage to be used as feed at a later stage.

The other maize they grow is the white maize that Lucio's grandfather used to plant and passed on to his children, and which Reynaldo, in turn, has passed on to Lucio. This maize is grown primarily for household consumption, and secondly for animal feed in the form of grain and dry stover. As Lucio explains, since this maize is not primarily for green feed, but rather for grain production, they plant it at a larger plant-to-plant distance and under rain fed conditions, keeping the plots with irrigation for the feed maize and the alfalfa.

The majority of the land Lucio and his family work is private and belongs to himself or his father, while another part of it, also under private land tenure, is rented from other people in the community. Furthermore, most of the land, but not all of it, has some degree of irrigation, either from the dam or from wells.

All the animals are kept at the rancho, about a 1 ½ km outside of the village centre, on the opposite side of the federal highway. Here, Lucio has developed the heart of the family's farming enterprise: a small-scale, but modern dairy farm infrastructure. The stables for cattle simply consist of a screened area, divided into sections and with a cement floor to facilitate cleaning. One section is for the cows currently being milked, another for pregnant cows with a smaller section for calves. A separate enclosure holds the young bulls. For milking Lucio uses a mechanical milking machine, and several times a week he checks each cow for mastitis. The cows are artificially inseminated with

semen from genetically improved bulls, which is delivered in a thermos with liquid nitrogen on a regular basis by a company that specializes in this. The milk is collected in 20 litre jugs and picked up twice a day by the buyer.

In front of the stables is a large cement silage pit, dug into the ground, and opposite that is a longish construction consisting of one room with a large porch to one side, where the various farming implements are stored. Connected to this is the pigsty and next to that, one of the two enclosures that hold the goats and sheep, while the other is behind the stables. In the middle of it all is an open space where the tractor is often parked, and on the other side of that, the orchard with a variety of fruit trees, including pecan nut, guayaba, plums, avocado and pomegranate. Under the fruit trees an old man and a bull can often be seen. According to Lucio, the old man has been there for more than 15 years. He arrived one day on foot, presumably from the Mixteca region, and politely asked permission to tie his bull up at the rancho. Lucio's father granted him permission thinking it would be a temporary thing: however the man never left. Nowadays, after Lucio's associate pulled out of their arrangement and left for the US, the old man with the bull sleeps in the room next to the porch with all the farming equipment, and thereby functions as a sort of watchman of the rancho for Lucio and his family.

Lucio has been involved in several efforts to organize together with other farmers in order to establish collective projects. At one stage, for example, several of the households who have dairy cows decided to associate and solicit funds from the federal program Alianza Para El Campo, which is directed at agricultural development. They succeeded in obtaining funding for their project and began the construction of a collective production infrastructure. However, even before this was completed disagreements arose and finally the association collapsed. Since then Lucio has worked together with his parents, and another associate farmer, until the latter decided to go to the US and Lucio bought his share of the enterprise. Now the farm is run entirely by Lucio and his family, except for the tractor.

Acquiring a tractor was a joint venture. When the Alianza para el Campo program approves an application for financial support to a project, the program agrees to contribute 50 % or more of the overall investment, on the condition that the farmer or farmers mobilize the remainder of the total resources needed. To access this opportunity, Lucio formed an association with five other farmers and together they succeeded in obtaining the support of Alianza Para el Campo for the acquisition of a tractor. Lucio's milking machine was also obtained with financial support from Alianza para el Campo, but on an individual basis, as the total investment was much smaller. Two members of the group later left the group for various reasons. One of the others bought their shares and the remaining four associates continue the joint ownership which seems to work relatively well. The tractor is used to till the land of the group members. In addition the group provides tractor services to

other farmers for a fee. Lucio and one of the others have created a home-made sowing apparatus, as a time-saving alternative to the traditional manual maize planting, which, when attached on the back of the tractor, allows for simultaneous planting and covering of the seed from the tractor.

Once a week Lucio fires up the big round oven under the porch of the family's home and bakes bread. According to Lucio the bread baking is a family tradition passed on in the male line and it was his father who taught him. A room next to where the oven stands is dedicated entirely to the purpose of baking, with a huge wooden trough for kneading the dough and shelves for raising and cooling off bread. The bread is sold from the patio and sometimes people place special orders.

In order to ensure the production of feed maize seed for the following planting, Lucio leaves a number of rows in the field in order for these plants to complete the growing cycle and mature. These rows are later harvested by hand using the traditional *pizcador*, that is, a big basket on the back into which the maize ears are thrown over the shoulder. The biggest and healthiest of the maize ears are then separated and shelled by hand leaving the kernels on the top of the cob for other purposes, for example, consumption or feed. Finally the seed is stored in oil drums and treated with phostoxin tablets[16]. If the containers do not have tightly fitting lids, Lucio seals them with tightly tied heavy duty plastic. The other maize, which traces back to Lucio's grandfather, is left to mature in the field, and harvested in the traditional fashion with *pizcadores*, and the seed is selected following a similar process as in the case of the feed maize.

Lucio has experimented with various types of maize. For example, he has done various comparisons planting two kinds of maize, for example, a commercial hybrid together with his current feed maize, or the latter and his other landrace, on the same plot in order to see which does best under the specific conditions of the particular plot. He has also mixed the white *criollo* of his grandfathers, which he finds to tolerate drought well, with the *criollo* of another farmer from Huitzo, Rufino, whose white maize he liked very much, hoping the crossing would result in a maize that would have the characteristics he liked in each of them. He considers the experiment to be successful and today the maize he refers to as his grandfather's, in reality also contains a certain amount of the maize of Don Rufino.

Ana María and Rodolfo, an extended family farming enterprise

Ana María's house is built in lean-to fashion against a bare adobe wall that shields the patio from the street. The wall thus constitutes the back wall of the

[16] Phostoxin: Insecticide based on aluminum phosphide. Its common form is as solid tablets, which, once unwrapped, react with the natural air humidity creating a toxic gas.

house. Access to the street is down a narrow passage between their house and that of the neighbour's, which ends in a corrugated zinc sheet that serves as a door to the street. This is also the main door to their patio and home.

The house is built in an angle and has three relatively large rooms with no windows, but each one with a doorway to the patio, cement floor and a roof of asbestos sheets. The walls are adobe, except for the third room which looks like an add-on of cement blocks. Besides Ana María and Rodolfo, their son Horacio, and their daughter Monica and her husband and four children, as well as Rodolfo's brother, Noe, also live here.

The kitchen is outside, up against the house under a corrugated zinc roof and shielded on two sides by a low wall and on the third by a partition made of *carrizo* to keep chickens and dogs out. Near the house among a handful of small trees and a couple of bushes is a well, but piped water from the Huitzo network is also installed in the patio next to the kitchen.

The whole patio is surrounded by a wall, which shields them from the street and from the neighbour's plots. At the far back corner of the patio is a smaller house, where one of the sons, Aron, lives with his wife Beatriz and four children. There is a latrine in the patio which is shared by the two houses, and at the far end of the wall towards the street a low gate leads to a part of the patio where Don Rodolfo or any of the others sometimes leave a couple of donkeys or a small cart.

Ana María is educated to the second grade of primary school, but Rodolfo did not attend school and does not know how to read and write. They have 15 children, who are all alive, except for one who disappeared. Ana María has given birth to 14 of them and the 15th , Javier, was taken in at the age of seven and brought up as part of the family and given the family name. They have more than 50 grandchildren, several of whom they have never met, as eight of their children live elsewhere in Mexico, while the rest of them are either in Huitzo or Telix.

Rodolfo farms together with Don Noe, Horacio and Aron. In total they work approximately 11 ha of comunal land on the slopes close to the road to Rio Blanco and Jayacatlán. Seven hectares of this land are registered with the federal program PROCAMPO (see Chapter 4). This land is where they have their rancho, which also includes a house made of wooden boards with corrugated zinc roofing, where the men will often stay for several days in a row, thereby avoiding the 2 hour walk or donkey ride between the rancho and the village twice a day.

All the animals are kept at the rancho. These include 18 head of cattle (counting cows, calves and bulls), around 110 goats, 6 donkeys and two pigs. In addition they breed fighting cockerels to sell and to use in competitions. Each household member owns a number of animals, including Ana María and Monica as well as Monica's sister, Rosario, who lives in Telix. The 18 head of cattle include one pair of bullocks and 2 pairs of cows, which they also some-

times use as work animals. Horacio explains that for land preparation, they work with two pairs of animals continuously every day for an entire month. The bullocks, which are the strongest, are used daily, while they alternate the use of each pair of cows. Only for the plots that can be accessed by tractor do they sometimes rent the tractor service for preparatory ploughing. For the planting itself they work with just the bullocks, every day for a month in order to complete it all.

About half a hectare is planted to beans only, while all the rest of the land is planted to the same white maize, and part of it is intercropped with beans or squash. They do not apply chemical fertilizer. For fertilization they only use the manure from the farm animals. Don Rodolfo explains that the first weeding is done with bullocks by passing the plough between the rows, while the plants are still small. In the Central Valleys, many farmers furthermore do a second weeding with bullocks, which is sometimes also called *orejera*, and which has the double purpose of weeding and opening the furrows further, which piles up soil around the plants to diminish any risk of lodging. However, Rodolfo explains that they do not do *orejera*, because the soil on the slopes is too shallow. After the first weeding, all subsequent weeding is done manually with machete or sickle, and the weeds they remove are used for feed. He adds, that it is important to remove the weeds, because this allows the maize plant to 'warm up', which makes it grow faster. According to Rodolfo it is furthermore important to plan the various farming activities according to the movements of the moon. For example, activities related with cutting or harvesting should be done when the moon is reducing, whereas activities related to planting and growth should be done while the moon is growing.

In addition to the farming activities the members of Ana María's and Rodolfo's household also have other sources of income. Don Noe, for example collects firewood in the woods around the rancho, which he bundles and brings down on the donkeys to sell in Huitzo. Meanwhile, Monica's partner, Pablo, works full time as a construction worker, and Ana María and Monica make and sell tortillas. The breeding of fighting cocks also complements household income and once in a while the family will sell some of their animals.

The maize harvest is stored with the husk at the rancho, where all the stover is also collected to be used for feed during the year. Whenever they run low on maize at the house in Huitzo, they simply load the donkeys with sacks of maize ears and take it with them back to town. The first few loads are shelled entirely for consumption. Come January, Ana María and her daughter Monica begin to separate the largest and most beautiful ears from the rest. These they put aside for seed. Little by little, when they have time, Ana María and Monica shell these. From each ear they shell two thirds to three quarters for seed. The rest of the kernels, on the upper tip of the cob, are shelled for con-

sumption. Ana María also explains that all the cobs from which seed was selected are gathered and kept in closely tied sacks until the seeds have been sown and the maize has germinated and is well on its way. Only then are these cobs burnt, like other cobs, as fuel for the baking of the tortillas that the family consumes and that Ana María sells locally.

According to Rodolfo they do not pay special attention to the moon phases in relation to the shelling of seed maize. He explains that as long as this was taken into account when the maize was harvested, it is not important with regards to the selection of seed for the next planting cycle.

Rodolfo explains that he used to *curar*, that is, treat the seed with folidol[17], but this seemed to make the seed go very hard. Another farmer told him that it was better to treat the seed with lime. Rodolfo tried this and, sure enough, the seed did not go so hard. However, after the planting, birds pulled out a lot of the seed, and this is usually not the case when they have used folidol. Furthermore, he commented that the seed was still attacked by *palomillas*[18].

After the treatment, the seed is stored in tightly tied sacks inside the house, in the room next to the kitchen. In total, in Ana María and Rodolfo's household, they prepare 6-7 sackfuls of maize seed for each planting season.

Bernardo, the small-scale cattle trader

Bernardo is married to Irma and together they have 6 children. Their youngest daughter, Inez, and two of her brothers as well as the wife and children of one of them, live with them on one of the arroyos in Huitzo. The house has several rooms and is made of cement blocks with cement floors and roof. The other daughter is married and lives elsewhere in Huitzo, and the other two sons left for the US several years ago. Bernardo completed primary school and his wife completed third grade of primary school. He has 10 brothers and sisters, and several of them live on the same arroyo or very close by.

Bernardo works approximately 6 ha together with his two sons. All of it is private land, but one part of it belongs to a brother of his who has lived in Mexico City for many years, and who lets Bernardo use it in return for looking after his land. Another, smaller, irrigated part with alfalfa belongs to another brother and Bernardo works this part on a sharecropping basis. Apart from the alfalfa, most of the land is planted to a white maize landrace that Bernardo inherited from his father, and the rest is used for beans only. Some of the maize is intercropped with beans and some with different kinds of

[17] Folidol is a methyl-parathion product, classified by the WHO as being "extremely hazardous to human health" (WHO, 2004).

[18] Palomilla: Grain moth, can be either of the following varieties: Angoumois grain moth (*Sitotroga cerealella* (Olivier)) and Indian-meal moth (*Ploidia interpunctella* (Hubner)), (Ortega C., 1987).

squash. Although they have bullocks, Bernardo normally pays someone else to prepare the land and do the furrowing with a tractor. The planting is done manually using the *tapa-pie* method in which the planter drops a few seeds in the furrow, covers the seeds with soil using his/her foot, stamps and takes another step repeating the procedure. They apply fertilizer just before they do the first weeding with the bullocks, and later do the *orejera*. Any further weeding beyond that, is done manually with machetes or sickles.

Every Wednesday Bernardo goes to Etla, to the cattle market. As a complementary activity to agricultural production, he buys, fattens and re-sells cattle for a profit. His buyers are mostly the butchers in Huitzo and Telix. The animals in his stable therefore change continuously, except for his pair of bullocks, his horse and a pair of cows which he refers to as his savings. In addition, the women in the household sell soft drinks, sweets, snacks, eggs and a few other things from a little wooden construction at the entrance to the patio.

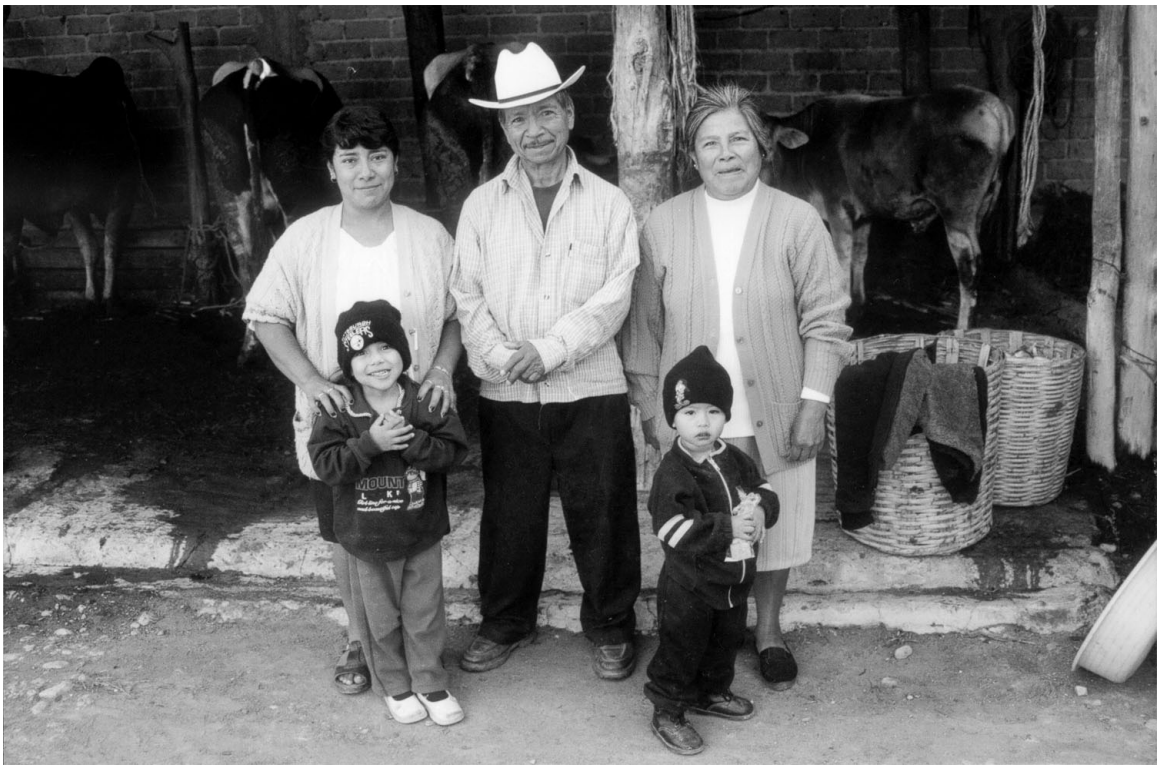

Figure 5.4 Bernardo and Irma, their daughter and two grandchildren.

Bernardo is very interested in politics. He is a member of the Partido Acción Nacional (PAN) and laments the strong hold of the PRI (Partido Revolucionario Institucional) among Oaxacan farmers. He comments that because the municipalities depend on financial support from the State Government, which by tradition has been PRI-dominated as long as Bernardo can remember, people are afraid that if they do not vote for PRI the municipality will no longer receive funds from the State government. Despite his political affiliation and taste for discussion, Don Bernardo is generally well liked in San

Pablo Huitzo for his sense of humour and his friendly personality. He is also known to have good maize and to be one of those who always have seed.

Bernardo stores his maize in the granary as whole ears with the husk intact, applying folidol to protect it against insect damage. As he accommodates the ears in the *troje* (granary), he separates the largest ears, which he then stores in sacks for approximately three months for later seed selection. Around February-March he de-husks and shells these ears. Bernardo explains that his wife does not really know how to select seed, and that therefore he is the one who does this. He looks for ears with slim cobs and takes seed from the lower part of the ear only, shelling the kernels on the top part of the cob for consumption.

Once the seed is shelled, Bernardo stores it in sacks. He does not apply any treatment. The only time he treats seed is if there is seed left over after the planting, which he considers worth keeping for the following season, in case anything should happen. In that case he treats the seed with phostoxin tablets, keeping it tightly covered only for the first two weeks after which he uncovers it so the air can get to it.

Some farmers from the Municipality of Santa Ana Zegache

Pablo, respected farmer and entrepreneur

Don Pablo is a respected man in Santa Ana Zegache. He is generally regarded as a competent farmer and a resourceful person. He manages a total of nine hectares of land, all of it on the flat plain to the south side of the town, where the soil is generally regarded to be the best. All the land is private and either in his or his wife, Emilia's, name.

Don Pablo grows white and black maize, both of which he inherited from his father, and sometimes he also plants a smaller plot of hybrid maize to sell for corn-on-the-cob. He intercrops with squash and to a certain extent with beans. In addition Don Pablo has experimented with and regularly plants other crops destined for the market. For example, every year he plants *Zempazuchitl*, the bright orange flowers popular all over Mexico for the celebration of the Day of the Dead, as well as *Pico de Gallo*, also popular for the day of the dead and *Nube*, which is used throughout the year. He also grows several types of herbs, including thyme, coriander, oregano, as well as onions, cucumbers and husk tomatoes and *guacamote* or cassava. Don Pablo has a well which provides irrigation to the vegetable plots as well as some of the maize, and as he says, without the well he would not be able to grow any of these alternative, higher value crops. The vegetables are often grown on a shareholder basis, where Don Pablo provides the land and the irrigation and the shareholder does the actual planting and weeding and so forth. In these cases, when the crop is ready to harvest, Don Pablo simply sells his part to the sharecropper, who then deals with the marketing and transport issues.

Don Pablo pays for a tractor to plough the land on the larger plots. On the smaller plots he does this himself with his bullocks. In fields that he works himself he does the furrowing using the bullocks, and the planting is done using the traditional *tapa-pie* method. Don Pablo also does the first weeding and the *orejera* with the bullocks. Additional weeding after the *orejera* is done manually with a machete. As for the fields he puts up for sharecropping, the *orejera* and the general management depend on the sharecropper. During the period of the year where the work load increases he pays a farmhand to help out on a daily basis, and when they have time, if needed, Doña Emilia and her youngest daughter and daughter-in-law also come along to give a hand.

Figure 5.5 Don Pablo ploughing.

The family home is in the western part of Zegache. Towards the street a high red brick wall with a big black metal gate protect the family's privacy. Beyond the gate lies a relatively narrow, but very long patio. The house is painted and is made of cement blocks, and has cement floors and roof. It is of a modest size and stands lengthwise along one side of the patio, equipped with a spacious new porch with tile-roof at one end. Further back on the opposite side of the patio stands a small barn where a big oxcart and other farming utensils are stored, and where the silo is placed. The latter is a simple, hermetically sealed metal cylinder, designed for grain storage. Don Pablo's silo can hold 1 ton of maize grain. Additional grain is stored in *sacas*, large baskets made from woven mats, in the barn and this is also where Pablo keeps most of the stover to be used as feed during the year. At the very back is a pigsty with a

handful of grown animals and a roof under which the horse and the bullocks are tied up and fed.

Don Pablo and Emilia have eight children, two sons and six daughters. These days the household consists of Don Pablo and Doña Emilia, his old mother, Doña Brígida, the youngest daughter Ursula, who attends the *telesecundaria* in the village and a daughter-in-law, Gisel and her two children. Gisel is the wife of Pablo and Emilia's oldest son, Juan, who has been in the US the last five years. According to Don Pablo, Juan has not made much of his time in the US, but appears to have spent most of the time drinking and getting into trouble. To his father's deep regret, Juan is currently serving an 18 months sentence in the US for beating up another man. Though he does not say so explicitly, it is clear that Don Pablo is deeply troubled by the behaviour and way of life of his oldest son.

His other son Antonio is also in the US, and has also been involved with the authorities there. After an incident involving a firearm, Antonio served a sentence in the State of Oregon. When he was released he moved to another state, but according to Don Pablo the experience does not seem to have made him change his lifestyle. Says his father: "He continues to spend his money without building up anything, and when he comes to visit he tells me not to work so hard (!), but it is not that he ever helps out [economically]." It is obvious that this is not something that is easy for Don Pablo to talk about or to accept.

The oldest daughter is married and lives in the village with her two daughters. She trained as a nurse and works at the health clinic behind the town hall. Her husband is in the US and sends money every once in while. Another daughter, Hermelinda, is a housewife and lives alone in the village with her three children, since her husband also went to the US five years ago. According to Don Pablo, Hermelinda's husband is the one who has done best in the US. He saves up and sends money back to Hermelinda and the children. They now have their own house and are doing well economically. Another of Hermelinda's sisters, Antonia (26), has also recently left for the US. Carmen is unmarried and lives in Oaxaca, where she works as a domestic servant, and Bertha, the next youngest, also lives in Oaxaca, where she works and studies business administration at the university.

Don Pablo says that he has always admired the people from San Antonino, a village between Santa Ana Zegache and the district capital of Ocotlán. "With so little land, how do they manage to live so well?" he says. "I wanted to understand this, and that's when it occurred to me to create an association of farmers and negotiate the expansion of the network of wells for irrigation". The association succeeded in achieving significant resources from the state government and the work went ahead. However, internal disagreements in the association led to an official audit of the association, but no irregularities were discovered. At the time Don Pablo had been elected municipal president, but, as he says, being both municipal president and president of the

farmers association at the same time created too many problems, and he decided he could only represent one of the two. According to him, the village inhabitants asked him to continue as municipal president, and that is what he did.

After finishing his term as head of the municipal government, Don Pablo founded another association, 'Piedra del Coyote', in 1987. Since then six members have dropped out, but the remaining 14 associates continue working together. Among other things the public transport routes to and from Santa Ana Zegache are to the credit of this group's negotiations with the authorities in charge of public transport issues. The group has also been involved in other issues of great importance for the community, including the establishment of secondary school education in Santa Ana Zegache.

Don Pablo comments that approximately 15 years ago farmers from a particular part of Santa Ana Zegache began to change their way of harvesting. Today Pablo also harvests differently. Instead of using the *pizcador*, the traditional big basket on the back, he now cuts the entire maize stalks with the ears while they are still not entirely dry. These are then left in piles in the field to dry further, after which the ears are removed from the stalks and the latter are tied into bundles for easier handling and transport, and everything is brought home and unloaded in the patio.

In Don Pablo's household the maize seed for the following season is selected after the entire harvest has been brought home. From harvest until January all the ears are de-husked and in this process the most beautiful and uniform ears, but not necessarily the largest, are gathered for subsequent seed selection. Meanwhile the rest of the maize is shelled and stored as grain.

In January the women shell the ears selected for seed, both in the case of the white and the black maize. They take kernels for seed from the whole ear except the top part. According to Don Pablo, they select beautiful, healthy and well filled kernels that are not hollow. They do not necessarily select kernels for their size. The seed is then finally treated with phostoxin tablets and stored in sacks inside the house.

Catarina, looking after the farm on her own

Catarina lives with her three youngest children in the house that the family has built and expanded little by little over the years. Margarita is 14, Jaime 9 and Ana is 5. Catarina has two sons, Emilio (18) and Manuel (16) who are with their father in the US. Her husband, Carlos, has been in the US for almost six years, and the boys joined him about a year ago after they had both finished the *tele-secundaria* in Zegache. All three of them work at a large meat processing plant, and send money back to Catarina on a regular basis, often with instructions regarding its investment. Over the years, with the money from the US, the family home has changed considerably. From being just one room made of bricks, several other rooms and a large porch have been added.

In addition a new latrine as well as a small cement water cistern and an enclosure built of cement blocks and with a cement floor for bathing, have been constructed and a gas stove and refrigerator acquired. A large wall with a big metal gate has been built towards the street, and a small pigsty. Though she now has a gas stove, Catarina only uses it for certain things. For others, like the *nixtamal* and the tortillas as well as the roasting of chillies and cocoa beans, she continues to use her open fire place in her traditional kitchen across the porch.

The patio, which originally was very large, is divided into two sections, still large, by a *carrizo*[19] fence with an opening in the middle. Catarina and the children live in the red brick house at one extreme. In the other half of the patio live Catarina's parents-in-law, Doña Liliana and Don Teodoro. Their home has also seen various improvements, although on a smaller scale, from the resources sent by their son in the US. Both homes share the same entrance and the tap for the piped water, and though in some respects these are two separate households, in others they blend in and are difficult to distinguish.

One part of Catarina's patio is fenced off. This is where she keeps her little flock of goats and sheep, and where the small pigsty is located. In the middle of the patio, under one of the big trees, she has a small enclosure where she keeps her five turkeys. The chickens are left free to peck in the patio. Closer to the wall towards the street, stand the remains of the old adobe house where Carlos grew up and where he and Catarina lived at first with Doña Liliana and Don Teodoro. Several years ago, part of the adobe house burnt causing the rest to collapse. This is when Don Teodoro and Doña Liliana's current small brick house was built.

Margarita attends the *tele-secundaria* and Jaime is in primary school, while Ana is still in the kindergarden next to the health clinic. Catarina herself has completed primary school. Carlos finished third grade as a child and completed the rest as an adult, when he was in the army. Though Catarina herself and her three youngest do not speak Zapotec, both hers and Carlos's parents, as well as Carlos himself, speak Zapotec as their first language.

Ever since Carlos left for the US, Catarina has been in charge of agriculture. Using the *tapa-pie* method, she plants white, yellow and black landrace maize, intercropping it with squash, beans and *higuerilla*. She normally hires a tractor to do the initial land preparation. For the furrowing, the weeding and *orejera*, however, they use bullocks, and with some of the remittances from Carlos, they have been able to acquire their own pair of bullocks. However, while women do various kinds of farming work, managing bullocks is regarded as definitely men's work. Carlos and Catarina therefore keep the bullocks on a

[19] Carrizo (*Arundo donax* L.) Giant reed of the grass family (Poaceae), also known as wild cane, is a tall, perennial grass that can grow to over 20 feet in height (Benton et al., 2005).

shareholder-basis: they own the animals, but the latter are looked after and fed by another farmer, who does the furrowing, and the weeding and/or *orejera* for Catarina, when needed. In return he can use the animals on his own land and to plough or furrow for others for a fee. However, according to Catarina the man who looks after the bullocks and is supposed to plough for her, is always busy elsewhere and on several occasions she has finally had to hire someone else to do the job instead. "And all this about acquiring our own bullocks, so that I would not have to fight to get someone to work the land for me!" she complains, shaking her head. One day, when helping Catarina plant, she and another woman whom she had hired as additional help, talked at length about the difficulties in contracting reliable and timely help for the furrowing and other tasks. According to the two women, the men who do land preparation, furrowing and so forth for others for a fee, prioritize and pay more attention to male customers than to female customers, and as a result female farmers must often wait longer before they can plant.

Figure 5.6 Catarina roasts cocoa beans on the clay *comal.*

Catarina explains that with an intercropping of up to four crops (maize, beans, squash and *higuerilla*) the harvesting is done in several stages. The first to be harvested are the beans, in the month of August. The second is the maize. She comments that before, every body harvested in the same way using *pizcadores*, that is with big baskets on the back. Now some people do it differently, including her, cutting the entire maize stalks with the maize ears still on, leaving them in piles in the field. Afterwards, pile by pile, the maize

ears are separated from the stalks and the latter bundled, and everything is brought home to the patio. After the maize stalks have been cut, the squash is easily collected at the same time as the ears are separated from the stalks. The *higuerilla* is left in the field until February or March, when it is finally collected. The seed pods are dried in the sun, after which the shells are crushed and separated from the seed. Meanwhile the rest of the *higuerilla* is used as fuel. Catarina also does work in the field, such as planting and fertilizing and sometimes weeding with a sickle, collecting the weeds for feed. However, for the heavier tasks, such as harvesting the maize and sometimes also the beans, if the harvest looks good, she will normally use hired help, which her father-in-law, Don Teodoro usually helps arrange. Sometimes Don Teodoro also helps bring maize or stover back from the field with his oxcart, or Catarina pays someone else to do this.

Catarina normally selects the maize ears from which she will take seed, when she de-husks the maize. Later she shells the seed maize by hand, leaving the kernels at the top of the cob for consumption. She treats the seed with phostoxin tablets and stores it in sacks inside the house. In 2003 she left the seed of her *belatove* [red maize] uncovered in the outdoor cooking shed, and when she was preparing for the planting and found the seed, it had been completely destroyed by weevils. Since then, she has not recovered the red maize, but continues to grow white, black and yellow maize.

Rosa and Jose, poor and elderly in Santa Ana Zegache

Rosa and Jose, both in their early 70's live alone in a humble little house made of *carrizo* and branches. The roof is made of old sheets of corrugated zinc, and the floor is of dirt. Outside is a cement sink next to the tap that brings the piped water into the little patio. The yard is surrounded by a fence made of *carrizo* and branches. In front of the little house is a cement cistern. It still looks new, but the water in it has a greenish colour and algae cover the surface. There are also signs that a new little house was planned at one stage. The cement foundations for one room are visible at one end of the patio, but appear to have been abandoned. In one corner of the patio is an abandoned pigsty and in another an old well,

Rosa and Jose had seven children, three sons and four daughters. One son died when still an infant, and another son drowned in the well at the age of 18, a tragedy from which it took the parents a long time to recover. According to Rosa, she lost her mind after the funeral. Several times she walked off in a daze and would later 'wake up' far away, not knowing how she got there. Don Jose took her to a *curandero* (healer) to be cured. However, in order to pay for the treatment they had to sell the bullocks, and it took a while before they managed to acquire a new pair of bullocks.

Two of their daughters who have lived most of their lives in Mexico City, are widows. A third daughter lives with her family in Oaxaca City. The fourth

daughter left home to go to Mexico to look for work when she was just 14. For 20 years the parents had no news about her at all, until one day she suddenly turned up in the village asking for Doña Rosa and causing great emotion in both her parents and herself.

A year ago Rosa managed to convince Jose to sell their latest pair of bullocks. The previous year one of the bullocks had attacked Jose and hurt him so bad, he couldn't work and spent several months in bed. Rosa was afraid it would happen again, and they finally sold the animals. Currently they have only 3 horses. Until recently their youngest son Antonio and his common law wife and young daughter lived with them. However, after several times falling-out with his parents, Antonio left with his family and moved in with his mother-in-law. Rosa and Jose travelled to Mexico City to visit one of their daughters there for the first time ever, leaving their house in the care of a friend. When they came home everything was gone, including the horses, the chickens and the young pigs as well as most of the few things in the house. It turned out Antonio had simply taken everything with him to his mother-in-law's. "Even the television that my daughter gave us, and my plates that I bought with the money from the manure!" said Rosa, still with disbelief. Rosa had collected the manure from the horses. Having gathered several sackfuls, which she had sold at a few pesos each, she had treated herself to a little set of matching plates, of which she was particularly proud.

Jose finally had to ask the village authorities to intervene in order to get the horses back, and a few days later Antonio finally also brought back the television, the plates and a few other items on a wheelbarrow. The parties have since calmed down, but still have not made their peace. However, Rosa and Jose both have trouble accepting the continuous conflicts with their son, who is the only one of their children still living in Santa Ana Zegache.

Jose and Rosa own approximately 4 ha of land. Now, that they no longer have bullocks, they only plant part of it themselves, putting the rest up for sharecropping. For many years they have always planted white and yellow landrace maize. They do not use fertilizer of any kind and they do all the work with bullocks or manually. When he was younger Jose also worked for others and at one stage, many years ago, he also went to Veracruz as a seasonal migrant to work in sugar cane. Rosa makes tortillas, which she sells at the market in Oaxaca, and once in a while they also take a few sacks of maize with them to sell. Both of them treasure their horses and speak fondly of the animals, in particular the mare which has given a series of offspring over the years.

Antonio makes a living as a construction worker, and according to Rosa, when he lived with them he would sometimes contribute to the household expenses, but in general it is mostly one of the daughters in Mexico City, who has been most helpful over the years, once in a while sending clothes or other things, including the television.

In addition to their difficult times and hard experiences, Rosa and Jose believe themselves to have been the victims of envy and bad magic on several occasions. When they have been ill or affected by tragic events they have often sought the advice of herbalists and other local or regional *curanderos* for treatment or other solutions to the problems in question. However, despite a life with several tragic events and numerous other adversities, the little elderly couple always greets visitors with heartfelt pleasure and cheerfulness.

When Rosa and Jose harvest they bring the whole maize stalks, including the ears, from the field to their house. In the patio they tear off the ears, gathering them in a pile, while the stalks are left to dry further leaning up against the fence. Next they start de-husking during which they also sort white and yellow maize into separate piles. At the same time they select the biggest ears of each kind of maize from which they will later select the seed for next season's planting.

The shelling of the seed maize is done by hand. Rosa and Jose do this together. They only take seed from the lower 2/3 of the cob. The remainder of the kernels are shelled for consumption. The shelled seed is kept in sacks lined with thick plastic sacks, and phostoxin tablets are applied.

Lorenzo, skilled, hardworking and traditional

Lorenzo is a skilled and hardworking farmer, who likes what he is doing. He is trim and leathery from working in the field, with fast and precise movements. While he likes to joke and play tricks and always has a spark in the eyes, it is also obvious that he regards himself as the head of the family and expects his orders to be followed. He clearly loves his daughters, but his views on gender issues are very traditional. For example, though Dinia, who is a bright and very motivated girl, has asked her father again and again to let her continue to study in Ocotlán or Oaxaca, he has not given in, not seeing what use this would be. In local terms, he is a 'jealous man' trying to always keep a close watch over his wife and daughters. However, despite Lorenzo's efforts, his daughters are strong minded and independent and though he may pretend otherwise, his attempts to control them have not always been successful.

According to Lorenzo he did not go to school himself - a few weeks or a couple of months at the most. He remembers his mother saying to him then, that instead of going to school he should take the donkey out to graze. His wife, Frida, a kind and quiet woman, never went to school at all. Frida dresses in the typical style of the local women: a dress with an apron over it, gold filigree earrings, hair braided with brightly coloured ribbons and the *rebozo* casually wrapped around the head whenever she goes out. Lorenzo and Frida are both Zapotec and speak Zapotec with each other. Both of them speak Spanish fluently, though Frida appears to feel more comfortable in Zapotec.

Most of their children understand some Zapotec, but none of them really speak it.

Lorenzo and Frida have seven children. One son lives and works for the army in Guadalajara. Two daughters live with their husbands in Zegache, another lives in Mexico City and one is in the US with her husband, as is the second son. The youngest daughter, Dinia (18), still lives with her parents, but wants to join her brother and sister in the US.

The little household has recently moved to a new house on the outskirts of Zegache. The house they lived in before, where the children were born and brought up, was a one-room adobe building with a dirt floor and a tile and straw roof and with separate cooking hut in the patio. They still have that house, but have now moved into a brand-new house, which belongs to Luís, the younger of the sons, and which was built with money he has sent back from the US over the last couple of years. The house is made of bricks and cement and consists of two large rooms with a full length, wide porch in front. The floors and roof are made of cement and all around the large patio is a tall brick wall with a big metal gate towards the street. The first part of the patio is used for keeping the animals and storing the feed, while the second is where the house stands and an extra, separate room currently used as granary, and Doña Frida's outdoor cooking shed. Luís who, according to his sister, works in a restaurant in the US and sends money back regularly for the construction and completion of the new house and for his parents, has asked them to move into the new house rather than leaving it unused while he continues in the US.

Don Lorenzo recounts that Luís always wanted to go to the US, ever since he was a little boy. The parents, however, insisted that he finish school first. On the same day he finished the *tele-secundaria* in Santa Ana Zegache, Luís announced that now that he finished, they either had to let him go, or he would simply go without their permission. To help him gather the money he needed in order to realize his dream, Don Lorenzo sold the pair of bullocks he had at the time. Luís promised he would save money for the construction of a new and better house, and Lorenzo is proud to say that by now his son has completed his promise. Not only does Lorenzo have a new pair of bullocks, but the house has already been built.

The most important source of income for Don Lorenzo and Frida is agriculture. In total Lorenzo works approximately 5 ha of land in different parts of Santa Ana Zegache. Two of these are his own private property. On one of them he grows white maize intercropped with beans, squash and *higuerilla*, and on the other he has planted only white maize. On one part of this plot he harvests the maize extra early, for corn-on-the-cob and plants chickpeas immediately thereafter. A third hectare belongs to his son Luís. There he has planted maize intercropped with peanuts. In addition he works 1ha of land that belongs to his brother-in-law on a shareholder basis, and another which

belongs to his son-in-law, also on a shareholder basis. Finally, he sharecrops black maize on 2 ha that belong to a widow from the village. The latter two are located in El Bajío, where the soil is good and capable of retaining more moisture than elsewhere. Lorenzo explains why he plants black maize here, when most other people would use this land for the white and plant the black, which is regarded as sturdier, on the poorer soil. "When I plant the white maize there", he says, "it grows very tall and easily lodges. If, on the other hand, I plant my black maize there, it grows to its normal height, and it does not lodge. Furthermore, as the black is faster (has a shorter cycle) than the white, I can plant this one last (thereby favouring the establishment of the crops on his own land and that of his son). Finally, because the black maize is faster and the land there conserves moisture fairly well, if I hurry, I normally have time to harvest part of it and establish a second crop of chickpeas on this part immediately thereafter."

As we do a tour of the different plots he works, the difference between Don Lorenzo's fields and many of the neighbouring plots is striking. Whereas Lorenzo's fields are almost completely free of weeds, in most of the surrounding fields only a minimum of weeding has been done. Lorenzo, who has very strong opinions on what it means to work properly, explains that he learnt to work like this from his uncle Fausto. He goes on to say that it is not that the land changes just because one moves from one plot to the neighbouring one. What may change as one moves from one to the other, is the management, the way of working, he says. "That's what makes a difference in the crops!" According to Lorenzo, it is easy to make the land produce; the only thing it takes is willingness to work. Some people, says Lorenzo, do not know how to work and others are lazy – they don't want to work! "But these lands" he says opening his arms with a sweeping movement, "what they need is men! This soil wants balls; it wants men to work it!"

Lorenzo and Frida have three bullocks, a horse and a donkey with a foal, as well as around a dozen turkeys and ten chickens. The manure from the animals is collected and incorporated in the soil on one of their own hectares. In addition, he also applies chemical fertilizer on his own land before the first weeding with the bullocks. For the initial land preparation he normally hires the service of a tractor and then completes the preparation with the bullocks. The furrowing is done with the bullocks, as well as the first weeding and the *orejera*, which he does if there is time. Any subsequent weeding is done manually with the machete, and the planting is done by the traditional *tapapie* method, except for the chickpeas. He explains that the chickpeas are simply dropped in the furrow after which he passes the plough a second time, thereby covering the seed. Chickpeas, he comments, need a bit of humidity to germinate, and then from there on, they can develop almost entirely with the dew that falls at night time. He points out that in case the humidity of the soil

is not enough for the chickpeas to germinate, then at least he has already passed the plough twice, thereby advancing the following land preparation.

Lorenzo is very industrious and spends most of his time in the fields, always weeding and checking on the crops. Dinia helps him a lot, a fact he values highly. For example, she helps out in the planting, the weeding and the fertilization, and sometimes Doña Frida also gives a hand. When he needs extra help, for example with the harvest, he calls in a favour from a *compadre* or hires the extra help he needs.

In most cases Lorenzo harvests the maize by cutting the whole stalk including the ear, arranging them in piles, and putting any stalk that did not develop an ear in a separate pile so that he does not have to review those again. Pile by pile the ears are removed from the stalks and the latter are tied into bundles, which are stood up in the field to dry a little further. By putting them upright, he explains, any humidity or light rain that may fall will not damage the feed. Meanwhile the maize ears are brought home in the big ox cart and later the bundles of stover are collected as well.

When Lorenzo brings the harvest home from the field, he gathers all the maize ears in the patio in separate piles according to colour. The family begins de-husking in December and afterwards, at the most a month later, they move on to shelling the maize.

In the de-husking they sort the maize ears: all the very small ears and those that are damaged by insects or other factors go to animal feed. All the good ears are moved to a separate part of the patio for the shelling. As they shell the good ears for grain, they pick out the largest ears for seed selection, until they have filled two of the largest *pizcadores* with husked ears of maize for seed selection of each colour (white and black).

The seed maize is shelled by hand. In Lorenzo's household they shell the whole ear for seed, that is, leaving neither top nor bottom part of the cob for grain. According to Lorenzo, 'this is why he took the trouble of selecting the ears for seed so carefully'. He comments that on one occasion they measured that from a top-loaded *pizcador* of husked ears, they shelled 23 *almudes* of seed (approximately 92 kg).

Once the seed is shelled, Lorenzo treats it with phostoxin tablets and stores it in sacks in a separate room next to the out-door kitchen.

6. Local maize seed knowledge and practices

Local seed practices are often referred to as making up or being part of informal seed systems. This implicitly suggests that they make up some sort of system and that it should be possible to document this system in relatively clear terms. However, as indicated in Chapter one, this can be misleading. In the study in Oaxaca a wide range of disciplines and methodologies were involved in efforts to document many different aspects of local maize seed practices, ranging from participant observation, structured or semi-structured surveys of socio-economic factors and seed practices, to using molecular markers to analyse maize diversity in the study area. This multitude of disciplines and approaches gave rise to many stimulating discussions on what is the local seed system, and how we can describe it. However, often we had the feeling that the more we learned, the less able we were to describe it in words, drawings, schemas, and likewise the increased knowledge questioned the notion of seeing it as a system. This chapter attempts to describe local seed practices in the study area. However, I also argue that doing this in a linguistic medium (i.e. writing), and attempting to use precise terminology can at best be very partial, and that the limited verbalization should be an important consideration when choosing methodologies for studying seed practices. This argument will be built on theories of local knowledge and in particular on the cognitive aspects of knowledge.

The discussion of seed practices includes the following elements

- A local knowledge perspective
- Concepts of grain, seed, and variety
- Varietal choice
- Choice of seed source
- On-farm seed management practices
- Moral dimensions of seed management

Local knowledge

Local knowledge is a resource and an area of great relevance both for research and for applied development. In relation to local knowledge, the two are often closely linked or seem to flow together and it can be difficult to establish a clear line between them. Indeed, as Sillitoe argues in a recent article (2006), local knowledge is a field which brings together the academic and the practical. In this section I follow this line of thinking. When using examples from both development and research, the attention paid to separating the two will therefore be limited. Local knowledge is introduced from a more theoretical perspective, addressing issues related to terminology and relevance of local knowledge, ownership, as well as the negotiation and communication of local

knowledge. A presentation and discussion of findings regarding farmers' seed concepts and practices in the study area follows.

Barth (2002) offers a broad definition of knowledge as "what a person employs to interpret and act on the world", or, "all the ways of understanding that we use to make up our experienced, grasped reality". As Barth subsequently notes, different people's stock of knowledge varies notably and is highly influenced by a variety of factors, such as ethnographic, social, educational and developmental diversity. It is generally in order to emphasize one or several of such contextual factors, that some authors refer to 'indigenous knowledge' (Sillitoe, 1998, 2006; Warren, 1992); 'local knowledge' (Bentley and Baker, 2005; Pottier et al., 2003); 'cultural knowledge' (Shepherd, 2005); or 'traditional knowledge' (Hunn, 2006).

Though these terms should not be considered as synonymous, and while no standard definition of local or indigenous knowledge exists, it is generally understood as referring to theories, beliefs, practices and technologies, which are distinct from those usually associated with what is known as 'Western' or 'conventional' scientific knowledge (Brush, 1993; McCorkle, 1989). However, as Sillitoe notes (1998), the appropriateness of each of these various terms, and the meanings with which each author invests them (e.g. whether they are regarded politically correct or not), has been subject to much debate, though no clear agreement has apparently been reached (Sillitoe, 2006). For example, for some, 'traditional' knowledge invokes an image of something static, thereby ignoring people's creative experimentation and innovation. Similarly, the terms 'folk knowledge' or 'folk science' have been considered to be pejorative in comparison with modern science or knowledge (McCorkle, 1989).

The view informing the work presented here is an understanding of knowledge as complex, fragmented, continuously evolving and subject to negotiation (Long, 1992c, 2001; Pottier et al., 2003; and Sillitoe, 1998, 2006). I have chosen to use the term 'local knowledge' here, because the ideas and practices of farmers in the Central Valleys of Oaxaca regarding maize and maize farming are very much influenced by factors related to the local socio-cultural and agro-ecological context.

The relevance of local knowledge in research and development

After a chapter in its history, which featured a series of quite problematic attempts to establish a field of practical application of anthropology, including some unfortunate association with colonialism, most anthropologists stayed close to the discipline's 'safer', academic side for many years. As Sillitoe notes (2006), this distancing of the 'pure' from the 'practical', or the 'academic' from the 'applied', has influenced the field of anthropology over several decades, causing a certain ambivalence in relation to the fields of development and local knowledge.

However, as participatory approaches have become part of mainstream development over the last decades, so the awareness of local people's knowledge and its potential as a resource for research and development has increased significantly (Sillitoe, 1998, 2006). Appreciating and drawing on local knowledge and practices when planning and implementing development interventions and research can help make these initiatives more useful and sympathetic to local contexts and contribute greatly to their chances of achieving longer term sustainability. Hence, the realization among large segments of the development community of the value of drawing on and incorporating local knowledge, has, in recent times, generated a remarkable increase in research on various forms of local knowledge and on knowledge processes more generally (e.g. Barth, 2002; Boef et al., 1993; Long and Long, 1992; Moock and Rhoades, 1992; Pottier et al., 2003; Pretty and Smith, 2003; Richards, 1985; Scoones and Thompson, 1994; Shepherd, 2005; Sillitoe, 1998; Warren, 1992). As Sillitoe expresses it, this development provides a much needed opportunity within anthropology to bring the 'academic' and the 'applied' closer together, since it presents "a better opportunity to show our mettle than ever before" (Sillitoe, 2006: 120).

Sillitoe (2006) identifies five areas where applied local knowledge research is likely to be relevant. Firstly, he suggests, in relation to the introduction of new technologies, that local knowledge research can be useful in order to increase the relevance and adaptation of new technology to local cultural and agro-ecological contexts. Secondly, he sees a role for local knowledge research in relation to initiatives that explore the potential of developing local solutions to specific problems, based on local people's own resources and practices. Thirdly, Sillitoe asserts that applied local knowledge research also has a role to play in what he calls 'the furthering of cultural diffusion' (Sillitoe, 2006: 119). That is, in assessing the relevance of introducing knowledge and practices from one context to another where they may also be useful for local problem-solving. Fourthly, Sillitoe mentions the use of research for identifying local elements and practices which may have a commercial potential, such as bio-prospecting. Finally, he highlights the use of local knowledge research for supporting, what he calls 'alternative development'. That is, development initiatives which are not necessarily part of 'conventional' development programmes which often focus on technical matters, but address instead political issues or consider alternative perspectives, such as interaction between humans and nature, and local people's own visions of their futures (Sillitoe, 2006).

Another interesting contribution on knowledge processes is Shepherd's (2005) discussion on the valuation of local knowledge. He argues that, though participatory approaches are now very much part of development 'vocabulary' and recognition of the value of local knowledge has grown significantly, meaningful attempts to incorporate local knowledge into rural development

initiatives remain weak. In Shepherd's opinion, agricultural development remains heavily influenced by the narrative of deficiency in local livelihoods and indigenous knowledge. He goes on to state that by virtue of its foundation in 'modern' science, development expertise lays claim to an objective assessment of local problems. Indeed, at times, local knowledge and practices are even regarded as "part and parcel of the problem of low productivity, gender inequality, poverty, etcetera, in the expectation that these adversities will be alleviated given the right technology and expertise" (Shepherd, 2004).

According to Shepherd, such narratives of deficiency that permeate development policy and practice seriously constrain the appreciation of the importance of culture and local knowledge for development and conservation. For this to change, it is necessary to shift away from positivist approaches to knowledge still inherent in orthodox rural development circles, although, it remains unclear to what degree Shepherd argues for a complete rejection of 'scientific' knowledge in relation to development.

As Sillitoe (1998: 230) points out, "making indigenous knowledge accessible to other scientists and relevant to their research raises considerable methodological problems which should not be underestimated." Drawing an example from the highlands of New Guinea, he demonstrates the complex interweaving of local agricultural production with a diversity of socio-cultural factors, including labour considerations, social relations, gender ideology, sexuality and bodily substances. Sillitoe's point is that, from a local perspective, specific development problems should not be understood as isolated constraints, but as involving multiple factors from both natural and socio-cultural realms. However, he warns against "taking the socio-cultural embeddedness too far", thus implying that some ethnographic accounts may strike scientists as "esoteric records which they are unable to relate to their work" (1998: 229). In the end, this may put off those very scientists that one needs to engage. Hence, in agreement with Warren (1989), he stresses the importance of ensuring that indigenous knowledge is conveyed to scientists in such a way that they can appreciate its relevance.

Yet, despite the realization and growing appreciation of the value and significance of local knowledge, studies have also shown that local knowledge can be imprecise, incomplete or mistaken. Indeed, several authors have stressed the need to be careful not to romanticize or falsely glamorise local knowledge (e.g. Bentley, 1989; McCorkle, 1989; Sillitoe, 1998; Thrupp, 1989; Trutman et al., 1996).

As noted by several writers, efforts to demonstrate the value of local knowledge and increase its recognition and incorporation into research and development have been suspected of trying to undermine the scientific establishment and of promoting 'second-best' solutions to local problems, thereby depriving people of access to the 'best' and newest technologies. However, as Sillitoe asserts, the push for increased understanding and use of local know-

ledge is not about undermining science. In fact, it is generally agreed that science has a lot to offer farmers. The debate is less about this, and more about how to make the outcomes of scientific research and knowledge production more effective, accessible and relevant to people in their local contexts.

According to Sillitoe (1998), the objective of indigenous knowledge research is to create dynamic linkages between local people's perspectives and practices and those of researchers and development professionals, in order to contribute over the long term to positive change for local people via the promotion of culturally appropriate and environmentally sustainable adaptations.

Citing Sardan, Paquot and Paquot (1991) Sillitoe argues that if indigenous knowledge is to be successful in linking local people's perceptions and aspirations, and scientific technocrats' research agendas, then it is necessary to promote facilitatory modalities which allow for the complementary combination of anthropological skills on one hand, and technical and scientific knowledge on the other.

Issues regarding the ownership of local knowledge

As both Ellen (2006) and Sillitoe (2006) point out, local knowledge research has many links to ethnobiology, which in turn has roots in the exploration of 'useful' flora and fauna of potential economic interest (Ellen, 2006). Ethnobiology has since found a role in the development debate and, to a large degree, has become "absorbed into the rhetoric of 'indigenous knowledge' and 'indigenous rights'" (Ellen 2006: 12) along with other disciplines. Not surprisingly, with the recognition of the value of local knowledge and its potential prospects for scientific or economic gain, the issue of its study and use has become highly politicised and, increasingly, controversies over rights and ownership have arisen (Barth, 2002; Brown, 1998; Ellen, 2006; Gepts, 2004; Sillitoe, 1998). The issues in question typically concern the commercial exploitation of biodiversity and local knowledge, often referred to as 'bio-prospecting', or 'bio-piracy', and, most notably focusing upon the use of ethnobotany by the pharmaceutical industries (Greene, 2004; Chadwick and Marsh, 1994 in Ellen, 2006).

This debate concerning the ownership of local knowledge has spread and now involves a wide range of aspects of bio-diversity, including crop genetic resources and related local knowledge (Brush, 1993; Cleveland and Murray, 1997; Gepts, 2004). Meanwhile, despite the conflicts and unresolved questions regarding intellectual property rights of farmers and indigenous peoples, ethnobiology and local knowledge research are contributing to the development of guidelines for responsible research and use of these resources for the benefit of both national and commercial interests (Posey, 2000 in Ellen, 2006, see also Sillitoe, 1998). At the same time, these initiatives have significantly contributed to the promotion of participatory approaches in research and de-

velopment, as well as the protection of farmers' and indigenous people's rights, although much still remains to be done in this regard[20].

These problems relating to the use of genetic resources and local knowledge vis-à-vis local people's rights to their cultural heritage, and opportunities for useful and profitable, exploitation of these resources, constitute a cause of unease for many researchers (Barth, 2002; Sillitoe, 2006). Active involvement in these matters can be controversial. Some find it paternalistic and interfering, while others consider it a responsibility that cannot be ignored. Sillitoe's (2006) five areas where local knowledge research could play an important role have different degrees of 'purity/applicability'; two of them approach this challenge from opposite sides - the commercial use of knowledge, versus support for alternative development - however, all of them are problematic.

The negotiation of local knowledge

Much of the earlier literature on knowledge was based on the assumption that knowledge is something unitary and systematized (see Box's (1999) and Pottier's (2003) critical overviews). But over the last decades this has begun to change. It is now broadly accepted that knowledge is not uniform and evenly distributed among specific populations (Fairhead and Leach, 1994; Hunn, 2006; Long, 2001; Long and Long, 1992; Long and Villareal, 1994; Scoones and Thompson, 1994; Sillitoe, 1998). Gender, age group, ethnicity, religion, occupation and training, for example, often mark differences in people's stocks of knowledge and perspectives, even among those who live and work under seemingly similar circumstances. Likewise, the way that different people and groups interpret shared knowledge will vary according to their respective interests (Long, 2001; Long and Villareal, 1994; Sillitoe, 1998). Nevertheless, as Fairhead and Leach point out (1994), losing oneself in the details of these differences runs the risk of overlooking other levels of broadly shared understandings. It may also result in neglecting the negotiations, manoeuvrings and alliances that take place between different social groups.

However, in many contexts knowledge remains fragmentary and diffuse, and dynamic and negotiated, since it emerges as an "outcome of the interactions, negotiations, interfaces and accommodations that take place between different actors and their lifeworlds" (Long, 2001: 170). To fully grasp the nature of this requires an exploration of the processes by which knowledge becomes part of particular practices (Barth, 2002).

Studies of the social aspects of knowledge have also focused on issues relating to power: That is, on how power influences what is considered knowledge and how discourses on knowledge reproduce power relations (Fou-

[20] For a broader overview of the issues related to ownership of local knowledge as well as the role of anthropology in this regard, see for example Brown, 1998; Brush, 1993; Cleveland and Murray, 1997.

cault, 1979). Interface analysis has been used in a series of studies of the multi-layered and contested nature of knowledge along with local people's negotiations over resources, meanings and control, for example, with government officials or representatives from private companies (e.g. Arce, 1993; Argenti-Pillen, 2003; Long and Long, 1992; Rack, 2003; Sillitoe and Wilson, 2003).

Citing Long and Long's '*Battlefields of Knowledge*' (1992) Sillitoe comments, that the issue of local knowledge is often "caught in a battle of perspectives as practitioners argue over right versus left, natural versus social science, hard versus soft systems and so on" (Sillitoe, 1998: 224). However, these battles do not belong only to development practitioners. The negotiations of meanings and discourses take place within and among various groups of actors, thus engaging both local people, social activists, extensionists and other professionals, as well as policy makers, donors and researchers. Often these actors are involved in multiple 'projects' at the same time. Writing of an agro-biodiversity project in Peru, Shepherd reflects on the divisions and negotiations among the farmers themselves, which run parallel to the discourses of various local development organizations. He notes that "The desires and needs of campesinos, however, presented a much more ambiguous picture than the parameters of discourse and counter-discourse would have us believe. There were no stable or unchanging alliances" (2005: 41).

Drawing on ethnographic data from the Batak of Pälawan, in The Phillipines, Novellino (2003) illustrates some of the challenges in working with local knowledge in the context of rural development. For example, he comments on the Batak's strategic situational representations of local knowledge to outsiders. For example, in order to avoid being considered shifting cultivators, which is illegal, they often omit certain relevant details or share cultural information selectively by emphasizing the gathering of non-timber-forest-products while omitting or down-playing their slash-and-burn activities. In a similar manner, an 'idealised' version of the Batak as hunter-gatherers is sometimes used by conservationist groups, despite the fact that shifting cultivation is an important Batak practice. Novellino goes on to argue that the use of miscommunication constitutes a form of negotiation: That is, it creatively uses ambiguity, omission, deception and seduction to avoid conflicts, or for stalling a process.

Novellino reflects critically on the use of formal questionnaires as an example of miscommunication between Batak and external experts. Batak interviewees were asked to locate themselves according to categories that do not exist in their own language and thus were found meaningless. Similarly, Batak community members were asked to indicate which of three possibilities were their most urgent local needs: drinking water, irrigation or electrification, when none were recognized as 'needs'. As Novellino remarks, interviewees had no option but to "reply to wrong questions with wrong answers" (Novellino, 2003: 277).

Another of Novellino's examples relates to the confession of local knowledge. This refers to situations where the development professional first makes Batak 'confess' their local knowledge, for example, by pretending to be genuinely interested in learning about their ways, only to follow this up by 'reproaching' the confessant for his unsustainable practices and suggesting a 'better' alternative in the form of imported agro-forestry practices. Citing Dreyfus and Rabinow (1982), Novellino comments: "The more they talk (or are forced to talk), 'the more science knows [and] the one who listens and interprets becomes a master of the truth'" (Novellino, 2003: 287).

As should now be clear, the field of local knowledge and development carries with it certain inevitable political dimensions (Long, 2001; Long and Long, 1992; Novellino, 2003; Shepherd, 2005; Sillitoe, 1998). Local knowledge is closely linked to the wider acceptance and incorporation of participatory approaches and to the recognition of the advantages of technologies that are accessible, relevant and effective to people in their particular socio-cultural and agro-ecological settings. However, as Pretty and Smith (2004) note, the problem for authorities and decision makers is that "they both need and fear people's participation". While the acceptance and support of the population is necessary, too much participation and involvement from 'beneficiaries' is difficult to control, and may threaten power relationships at all levels, whether local regional, national and international. This is undoubtedly one of the major constraints on conducting research on local knowledge processes aimed at achieving more equitable and effective development interventions.

Challenges in the communication of local knowledge

Knowledge can be articulated in many different and complex forms. However, both in the literature as well as in the course of social life, a strong emphasis is placed on the use of language for communicating and learning about knowledge. The assumption that language is the principal means of knowledge communication has led to a strong focus on verbalized knowledge, which, in turn, makes it easy to overlook other forms (Marchand, 2003). Indeed, one could say that it appears that knowledge only comes into existence once it has been expressed in words, whether verbal or written.

In anthropology the importance of drawing on cognitive theories of knowledge has been convincingly argued by both Bloch (1991) and Marchand (1999, 2003), but they stress the limitations of relying too much on linguistic models of knowledge. The argument proceeds as follows: Thinking, or the mind-brain relation, should not be modelled according to a 'sentence-logic'. Rather, it should be based on concepts which are formed through experience and practice in the external world (Bloch, 1991). The concepts in our minds do not correspond to specific definitions, but are provisional, and are gradually being constituted by life experiences that lead to acquiring the particular concept (Marchand, 2003).

In fact, much knowledge is non-linguistic, as is the case with embodied, performative knowledge, and much knowledge is acquired by non-linguistic processes. Many daily practical tasks or skills relating to particular trades are learned without receiving verbal instructions (Bloch, 1991; Marchand, 1999). Reflecting on the limitations of written language, Hunn comments on the ways children in local communities come to know hundreds of plants and animals and associate names in their native language with them. This process involves various sensory modalities and "powerful social contexts, [and learning] from their parents, elders, and peers, though typically without formal instruction" (Hunn, 2006: 152). Similarly, much practical knowledge eludes being rendered into language, and is therefore lost in descriptions (Marchand, 2003).

Under some circumstances non-linguistic knowledge can be fixed into language, but this implies a transformation and not merely a translation of the knowledge (Bloch, 1991, see also Long, 1992c). The issue of translation/transformation between verbalized and performative knowledge is very real. As Bloch (1991) comments, we could simply not carry out our most practical tasks such as driving a car, or make decisions about which fallow constitutes 'a good swidden' (Bloch, 1991: 187), if we were thinking about them verbally. Similarly, reflecting on fieldwork as a construction worker in Yemen, Marchand (2003) describes how his verbal thinking of how to make a brick initially interfered with his practical ability to do this, and how he could not effectively make bricks until he was able to do this without thinking about it. However, he also points out that the transformation process may be beneficial in the sense that going back and forth between verbalized and performative knowledge may increase the knowledge in both areas (Marchand, 2003).

Knowledge blocks can be strung together into increasingly complex bodies of knowledge. This is illustrated by Marchand (1999) when he describes, how the building worker apprentice gradually moves on to constructing increasingly complex parts of the building. However, he also underlines that 'performative' knowledge does not share the grammatical and syntax rules that characterize verbal knowledge (Marchand, 2003). The ways that elements of knowledge within a particular knowledge domain can be combined, can vary from one domain to another, and the way performative knowledge is combined is different from that of verbalized knowledge. This implies, for example, that it is problematic to transform each element of a complex performance into an equivalent verbal representation, and then recreate the complex process from the verbal pieces according to verbal rules.

Marchand distinguishes between 'propositional' and 'performative' knowledge, or, as he also puts it, between *knowing that* and *knowing how*. Using his own experience as a building worker in Yemen, he discusses the differences between the knowledge of brick making on one hand, as theoretical or analytical knowledge gained, for example, from observing others making bricks

and having the different steps in the process explained to him; and on the other hand, knowledge of how actually to make bricks, which is acquired and internalized or embodied through practice. Marchand reflects on the carving of bricks of the type 'x': "The initial theory, or *knowing that*, that (awkwardly) guided my first attempts at carving 'x's (in co-ordination with what my body already 'knew' in terms of positioning and performance) was succeeded by a skilled and efficient performance, or *knowing how*. Retrospectively, it was apparent that this *knowing how* had likewise modified my 'conscious' *thinking about* how to make'x's, and that the two may be considered to be in dialectical relation with one another via an interface mechanism which selectively interprets information between them" (2003: 48).

In addition to the challenge of 'translating' performative or tacit knowledge into language, the way we understand the world and interpret new knowledge is heavily influenced by what we already know, that is, by one's current stock of knowledge (Barth, 2002). This means that it is not possible to isolate 'a piece of knowledge'. In many cases one must possess a particular knowledge background in order to make sense of it. Thus, different people with different stocks of knowledge (e.g. a city dweller compared to a scientist or a local farmer) will absorb and interpret new information in different ways. This adds to the challenge of researching local knowledge. It can be difficult - and inevitably involves additional 'transformation'- to communicate, for example, local agricultural knowledge to an urban and/or academic audience, or to communicate plant breeders' knowledge to a social scientist audience and vice versa.

Seed concepts

Seed practices are examples of local knowledge, and so in the remainder of this chapter I will present different aspects of these seed practices, and afterwards analyse them using concepts drawn from theories of local knowledge. The first section relates to the farmers' concepts concerning seed management.

The concept of seed and its distinction from 'grain'

From a biological perspective, any healthy maize kernel can serve as either seed or grain for consumption. Yet, both farmers and plant breeders tend to distinguish between them. Within the realm of formal crop improvement, certain criteria generally exist which define the category 'seed'. These criteria are normally subject to formal regulation and implementation and generally include specific procedures for seed production and certification, as well as certain minimum quality standards (e.g. regarding moisture content, germination rates and varietal purity).

Farmers in the study area may distinguish kernels as *seed* for planting or as *grain* for consumption or sale: a practice that has also been reported from other parts of Mexico (Aguirre, 1999; Louette and Smale, 1998), and which is

confirmed by this research. Smallholders in the Central Valleys of Oaxaca often refer to maize kernels in the general sense as *grano* (grain) or *maíz* (maize) without specifying its intended use. 'Grain' can be used for human consumption, animal feed, or sale. It has not (yet) been classified according to its intended use. Its destiny is, therefore, not unequivocal. By contrast, once 'seed' has been selected it is destined specifically for planting, and, in most cases, treated in a different manner. 'Seed' represents a portion of the kernels from the farmers' harvest that has been selected as such, based on a set of criteria, according to which farmers decide from which ears to select the kernels to be used as seed, as well as which specific kernels on these ears to define as seed. Hence, maize seed is maize kernels that have been selected as possessing certain traits associated with a high potential for producing good parent plants capable of expressing certain favoured traits.

Once redefined as seed, the value of these kernels also changes. Like any valuable object or good, farmers safeguard their seed and store it in the best possible conditions, often separated from the rest of the maize. In the Central Valleys of Oaxaca, maize seed also has greater exchange value than grain. Reporting on prices of maize grain and seed across all six study communities, Smale et al. (1999) found the price of maize grain to be between 2.18 and 2.27 MX$/kg, while the price level for maize seed was between 3.77 and 3.95 MX$/kg. These price differentials between seed and grain contrasts with a review of studies in Africa showing that the price charged for seed is often the same as that for grain, while in more market-oriented agriculture, seed producing farmers are able to charge a premium (Tripp, 2001: 62). In the communities of the Central Valleys, the price differentials are general and not associated with a group of particular farmers (e.g., seed producers), suggesting that farmers value the general ability to select seed and the additional care taken when storing it.

In spite of the seemingly clear distinction between seed and grain, farmers may sometimes use grain as seed. This occurs mainly when farmers try out other kinds of maize; or during circumstances when it is difficult to obtain seed, for example, due to lack of resources; or to make up for the lack of just a small part of the seed needed (i.e. partial seed loss). Under these circumstances, a farmer may decide to acquire grain rather than seed, and subsequently select seed from this. However, as grain is generally managed less rigorously than seed, this procedure can entail additional risks with regard to seed quality.

> Camilo's wife Gregoria sometimes takes orders for hand-made tortillas. In some cases the person who places the order will bring her a particular kind of maize with which to make the *nixtamal*. Gregoria recalls one such occasion when she received an order for tortillas and the client brought her a bucketful of beautiful black maize from

which she wanted the tortillas made. "I liked it so much; I put a little bit aside and asked Camilo to plant it".

Ana María and Rodolfo grow a white maize which originally was acquired to make tortillas. Ana María sells hand-made tortillas from their home on a daily basis. On one occasion, she had run out of maize and, though they still had maize at the rancho, there was not time to get it. One of the local shopkeepers had recently brought several sacks of white *criollo* maize from Ocotlán, and having checked the quality of the maize, Ana María quickly decided to buy a sackful to make tortillas from. She liked this maize and showed it to Rodolfo, who decided to select a small quantity of seed from it, and plant it in order to see how it would perform on their land. They first tried it out on a smaller piece of land, while they continued to grow their own white maize on the rest. However, after a few years they liked the maize from Ocotlán so much, that they abandoned the type of maize they grew before. Now the maize from Ocotlán is their only maize.

The definition of a variety

The concept of a 'variety' as understood in the context of industrialized agriculture and as defined by the UPOV[21] is different from the way farmers in the study area use it. When the smallholder farmers in Oaxaca talk about different maize varieties, in most cases they simply mean different kinds of maize (i.e. different crop populations that they recognize as distinct). This may include landraces as well as creolised and modern varieties and mixtures of these. Farmers distinctions between different kinds of maize may be based on any number and kind of characteristics of the particular maize populations in question, such as the colour of the maize kernels, their shape or the shape of the ear, the characteristics of the cobs or the husks or any other part of the plants, the length of their growing cycle or their agro-ecological adaptation. Nevertheless, in many cases farmers also leave room for considerable variation within a 'variety'. For the outsider this can cause confusion: maize which looks the same to the outsider may be referred to as distinct varieties by the farmer. On the other hand, on several occasions the farmer would laugh, saying "No! That's the same variety!" referring to what I believed to be ears of different kinds of maize. In addition, the farmer concept of 'variety' appears to be flexible, and at times the difference between one variety and another can be quite 'fuzzy', depending on the circumstances. Phrases such as "Those two are the same, only, they're different" or "No, that one is different, but it's the same" seemed frequent during the fieldwork.

[21] Union for the Protection of new Varieties of Plants.

While farmers in the Central Valleys of Oaxaca distinguish between different 'varieties' of maize, they often do not have specific names for them beyond, for example, the colour of the kernel. A farmer may plant two varieties of white maize. He or she may recognize and manage them as different, but not have a specific name for each of them, besides calling them both whites (blancos), adding other information to distinguish between them when needed. Don Fausto and Doña Clara (Albarradas), for example, have three kinds of white maize, which they refer to as criollo blanco (white landrace), blanco acriollado (creolized white) and criollo blanco de olote morado (white landrace with purple cob). Another example is Tiburcio (Albarradas) who grows two white landraces, referring to them as *criollo blanco de 3 meses* (white landrace of three months) and *criollo blanco de totomoxtle morado* (white landrace with purple husk).

Occasionally maize with a particular characteristic will be recognized and referred to in a particular way by various farmers. For instance, Don Juan (San Lorenzo Albarradas) grows three different white maize landraces. He refers to two of them simply as *criollo blanco* (white landrace) and *criollo blanco de tierra fría* (white landrace of cold land, meaning cold climate) respectively. The third is characterised by its 'pointy' or 'spiky' kernels. This type of maize is referred to by Don Juan and other farmers in the community as '*maíz piña'* (pineapple maize).

The practices of mixing and complementing seed

It should be noted that, although farmers select their own seed year after year, they may also, occasionally, substitute entirely, complement, or mix their own seed with seed from other sources. Initially a farmer might state: "I have planted this white [maize] for 20 years". However, further conversation may reveal that on one or more occasions the seed was complemented or mixed with other maize seed. With regard to the study communities, these practices have also been noted by Smale et al. (1999) and similar practices are reported from other regions in Mexico (Aguirre, 1999; Louette et al., 1997). Over time, these and other management practices (e.g. how the farmer selects seed, as well as naturally occurring pollen flow[22] from other farmers' maize fields), may well change the genetic make-up of his/her maize.

Farmers sometimes replace their maize seed, partially or completely, with seed from other sources than their own harvest. For example, they do this in the case of shortfall due to a poor harvest, or storage pests or, alternatively, for the purpose of experimentation (e.g. trying out other types of maize) or in order to use seed of other kinds of maize as a tool to deliberately influence or

[22] As an open-pollinated crop, maize is subject to cross-pollination (Morris, 1998).

change the characteristics of a particular type of maize. The replacement seed can be from farmer or modern varieties or any combination of the two, and it can be acquired from a number of different sources, including other farmers, commercial seed sector stockists, local market sellers, or organizations.

Seed replacement can be total, meaning a complete replacement of the seed of a particular variety, by a new seed lot of the same or a different variety (e.g. in the case where the farmer loses all the seed of a particular variety and therefore needs to replace it; or where the farmer decides to acquire 'fresh' seed as recommended for many modern commercial varieties). However, seed replacement can also be partial. This is when the farmer only replaces part of the seed lot with seed from other sources (e.g. because only part of the seed lot was destroyed by storage pests) and the need for additional seed was just to 'complete' the amount of planting material needed. The partial replacement can also be for the purpose of testing another kind of maize; or for the purpose of deliberately influencing or changing the characteristics of the farmer's own maize by mixing or crossing it with another kind of maize. Examples of these different instances of seed replacement include:

> *Partial seed replacement to make up for partial seed loss during storage:* For more than 25 years Don Heriberto (Huitzo) has grown the same white maize his father gave him when he started to farm on his own. Two years ago he found himself short of seed and in order to finish the planting he had to complement it with seed of other white maize, which he bought from two other farmers.
>
> *Partial change in order to try out another kind of maize, followed by mixing:* Elpidio and Natalia (Albarradas) have grown different types of maize over the years. For the past 15 years they have planted a *pinto* which they acquired locally from the father of a friend. Elpidio works part time in a brick making plant (kiln) in Tlacolula. A couple of years ago, at the market in Tlacolula, he saw a *belatove* maize (red maize) which he liked a lot, and so he bought 1 kg with the intention of planting it to try it out. The first year they planted it separately and it performed well. They harvested it together with the pinto maize and took seed from both, but mixed them, because they liked them both. Since then they have continued with the mix of *pinto* and *belatove*.
>
> *Total seed change, later followed by partial seed replacement and mixing with the purpose of deliberately altering the characteristics of the maize in question:* In a bad year when the maize harvest failed, Benito and Hipolita (Mazaltepec) lost the seed they had used until then. At the market in Oaxaca they saw a maize, which was 'very clean and had big kernels', and they decided to use this as seed for the following planting (total seed change to replace previous maize). The maize

performed well and they liked the grain, but found the ears to have very big cobs. After some years, therefore, they mixed the seed with seed of another type of white maize in order to get a maize with a slimmer cob.

Revisiting the original data from the CIMMYT-INIFAP 1998 baseline study in the 6 study communities, Table 6.1 shows the frequencies of complete or partial seed change in relation to the number of maize seed lots registered in each of the communities in the baseline study. Though the numbers and percentages vary from one community to another, it is noticeable that on average 49 % of all seed lots had never been changed, while an average of 51% had been subject to either partial or complete change in the past.

Table 6.1 The occurrence of partial and complete changes in farmers' maize seed lots across 240 households from the six study communities.

	Total # maize seed lots	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valde-flores	Santa Ana Zegache
Farmer seed lots that have been subject to partial or complete seed replacement.	355 (51%)	29 (29%)	25 (25%)	47 (53%)	112 (67%)	24 (27%)	118 (75%)
Farmer seed lots that have never been subject to seed replacement.	343 (49%)	71 (71%)	74 (75%)	41 (47%)	54 (33%)	64 (73%)	39 (25%)
Total # farmers maize seed lots	698	100	99	88	166	88	157

Source: Baseline study.

For each of their different kinds of maize, farmers were asked whether they did partial or complete seed changes. Overall, 28% of the different kinds of maize grown by the farmers who participated in the baseline study (240 households), had been subject to complete seed change at some stage, while in San Lorenzo Albarradas the number was as high as 50% (see Table 6.2). Meanwhile, the incidence of complete seed change carried out frequently is between 0 and 2 % in all study communities except for San Pablo Huitzo where it is 12% or more than 10 times as high as in the other study communities. In San Pablo Huitzo there is more use of hybrid varieties and also of using maize for silage, both of which may explain in part this difference.

As for partial seed change, an average of 32% of the different kinds of maize grown by the households that participated in the baseline study, had been subject to partial seed replacement in the past (Table 6.2). The highest inci-

dence of partial seed replacement (61%) was found among the participants from Santa Ana Zegache, whereas the lowest (5%) was in San Pablo Huitzo.

The participants in the baseline study were also asked why they would carry out either partial or total seed change. On average, 96% of all *complete* seed replacements were carried out in order to replace seed, and not a single incidence was reported in which complete seed change had been done in order to try out a new kind of germplasm. An average of 59% of the *partial* seed replacements were carried out in order to test another kind of maize or reduce the risk of testing other types of maize, and the rest of the cases of partial seed change (41%) were due to partial seed loss.

Table 6.2 Frequency of total and partial seed replacement in farmers maize varieties across the six study communities.

Total and partial seed replacement in farmers varieties	Percent of all	Study communities: San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valdeflores	Santa Ana Zegache
Total replacement				Percentages			
Never	72	73	87	78	50	79	76
Sometimes	26	15	12	22	48	20	24
Frequently	2	12	1	0	2	1	0
Partial replacement				Percentages			
Never	68	95	86	59	59	94	39
Sometimes	31	4	14	41	40	6	58
Frequently	1	1	0	0	1	0	3

Source: Baseline study.

Discussion of seed concepts

Farmers generally clearly differentiate between which part of their maize they consider seed, and which part is grain. Seed is managed with more care than grain, which also is reflected in a higher value when selling it, though this added value only applies if the receiver recognizes it as seed. The distinction between grain and seed is, however, not rigid or static, and, depending on the circumstances, a farmer may decide to use what was initially considered grain as seed, just as, for example, unused seed may revert to be used as grain. The concept of seed is, therefore, dynamic and negotiable, depending on the circumstances, though a farmer in any given moment will have a clear idea as to whether a given bag of maize kernels contains seed or grain.

The formal seed sector concept of maize variety is that of a maize population with particular genetic characteristics, which is distinct, uniform and stable (UPOV, 1991). If the genetic makeup changes, then, by definition, it is no

longer that variety. Though farmers use the term variety [*variedad*], theirs is a very different concept, which is much more flexible and dynamic than the formal seed sector variety concept. One kind of maize may be mixed with another. If the flowering coincides, this effectively means they will cross, and the resulting germplasm will be a mixture of the two. However, the farmer may not necessarily regard this as another variety. Or he may even completely change the seed and use seed from another farmer in the community instead; though it may still be considered the same maize. Furthermore, the farmer may consider two ears with (to me) seemingly clear morphological differences as the same maize. While this ambiguous and fuzzy varietal concept works fine for the farmers in this study, it does not correspond with the clear-cut definition used in the formal scientific context.

Marchand (2003) explains how mental concepts are not simply definitions but dynamic representations that are constituted by the kind of experiences that lead us to acquire the particular concept. This 'sameness' to the farmer is, therefore, not a question of definitions, but is part of the farmer's experience with maize. Likewise, the farmer's concept of a maize is part of his or her stock of knowledge relating to maize practice. What appears to the outsider to be a fuzzy or ambiguous concept may not appear so to the farmer, who encounters no problems in applying this knowledge in his or her management practices.

For the scientist, ambiguous or dynamic concepts present an important methodological challenge. For example, one may consider the question "How long have you cultivated this maize" a clear and straight-forward question. The farmer may answer; "Ever since I started farming on my own". Regardless of how many years this refers to, and whether he has mixed it, or completed the seed with other maize during this time, the farmer may consider the maize in question to be the same. In any case, he is not likely to mention any such issues, as this is not how the question was put. However, from the maize scientist's point of view, it is not the same maize, if its genetic make-up has changed in any noticeable way. Hence, it is important to be aware of differences in concepts or understandings in order to avoid misinterpretations.

These issues highlight the problems in assuming that one can isolate and transfer particular concepts or pieces of knowledge from one 'knowledge context' to another. In other words, a local knowledge concept will not necessarily transfer directly to a scientific knowledge context without problems. Outside the context from which it is taken, the concept or practice is likely to be reinterpreted against another set of background assumptions. The result is misunderstandings or nonsensical conclusions. This works both ways: the farmers' variety concept does not correspond with the way this concept is used among scientists. Likewise the scientists' concept does not correspond with that of local farmers. This has implications for research, for example, in relation to the use of formal questionnaires and specialist categories.

Here I have examined in detail the local concept of maize 'varieties' as compared with that of the formal seed sector. This underlines Pottier's (2003) point concerning the need for a more general awareness of the problems of making local concepts, which are often polysemic, undergo a process of significant simplification or 'disambiguation' before they are used in development or research contexts.

Factors influencing farmers varietal choices

Farmers' choice of variety is one of the most important decisions in the cultivation of a crop, since inadequate choice of variety may cause the crop to fail. On the other hand, if the variety performs well, then its specific traits will broadly influence the quality and quantity of the harvest.

Various factors influence farmers' choice of maize varieties. Even though many farmers in the study communities live and farm under apparently similar conditions, individual preferences, production conditions, and production objectives may vary considerably from one farming household to another. Bellon (1996 and 2004) lists a series of factors and concerns that may influence farmers' demand for crop and varietal diversity. These include agroecological heterogeneity; concerns regarding risks and uncertainty; resource constraints; concerns regarding labour bottlenecks; management of pests and diseases; maize for the elaboration of special products and foods, and the fulfilment of ritual or social obligations and ties. All of these are also relevant, albeit to varying degrees, in the case of the smallholder maize farmers in the study communities. In the following I comment on three major categories of factors influencing farmers' varietal choices: production and consumption objectives, as well as production conditions, and provide examples of how these manifest themselves.

Production and consumption objectives

For all of the farmers who participated in this study, the intended use of the maize produced is an important factor when looking for seed. Often the maize production has multiple objectives. First of all, it may be a question of covering the household's own needs, both in terms of human consumption needs and preferences and animal feed. However, for many households maize continues to play a role as a source of income generation, and in that regard market issues are relevant.

As Bellon reports from Chiapas (1996) and Smale et al. from the Central Valleys of Oaxaca (1999), different types of maize occupy different niches. The combination of traits inherent to a particular type of maize will make it appropriate for certain production objectives or conditions and less appropriate for others. For example, certain maize is preferred for certain special dishes, while other varieties are considered to have advantages in other respects - for fodder production, for selling as grain for consumption at the market, for be-

ing easier to shell, for producing good husks, for reaching maturity faster than others, and so forth.

> With the dairy cows and the production of other animals Lucio's farm household has a big need for good quality animal feed, and the choice of maize reflects this. Lucio and his family grow two kinds of white maize landraces. One of them is characterized by tall growth and abundant foliage, which makes it particularly appropriate for silage production, and indeed, this maize is grown especially for feed production in the form of green maize silage, while the other maize is grown primarily for the household members own consumption, and secondly for animal feed in the form of grain and dry stover. The feed maize is planted with very little distance between the plants and harvested before grain filling. Except for the roots the whole plant is chopped and processed for silage to be used as feed at a later stage.

Market issues can influence farmers' choice of maize varieties in different ways. For farmers who sell surplus production or processed maize products, grain colour is sometimes an issue:

> The daily production and sale of hand-made tortillas by Ana María and her daughter Monica provides an important contribution to the household income. However, except in the cases where she receives a special order for tortillas made from another colour of maize, Ana María only makes tortillas from white maize, because this is what sells best. According to both her and Rodolfo, this is an important reason for growing white maize.

Likewise, the grain of some varieties weighs more than that of others; or yields more tortillas— a feature that may also influence farmer's variety choice. Traditionally in Oaxaca, maize was traded by volume, and the *almud*[23] measure which is still very common in the communities is in reality a volume measure. Over the past decades, however, the kilogram measure has spread widely, especially in the commercial sector, where it is now the dominant measure. For the small-scale maize producers in the region, this resulted in an unfavourable change in many cases, and several farmers have indicated this as an element that influences variety choice.

> Don Luis Z. (Huitzo) explains that for many years his only white maize was the one he had received from his father when he started

[23] One almud of maize roughly approximates 4 kilograms.

> working alone and formed his own family. This maize yielded well and had a thin cob, however it was not heavy. Some 15 years ago he therefore acquired from his uncle another white maize, which also yields well, but most importantly, it weighs more than the other and furthermore showed certain tolerance to drought. In the beginning Don Luis planted and managed the two white maizes separately. However after a few years he had come to like the one he acquired from his uncle so much, that he decided to simply mix it with his own, the one he had received from his father.

Finally, farmers' appreciation of a particular kind of maize may also have nothing at all to do with markets. This may simply be a question of personal preference, special attachment or the need to produce food very fast:

> In Bartolo's household they do not grow white maize at all. For more than 20 years their maize of choice has been *belatove*, and for the past 6-7 years they have furthermore planted yellow maize. In Bartolo's household they really like the tortillas made from *belatove*, and he speaks of this maize with obvious fondness and pride, demonstrating how to properly pronounce its name in Zapotec (bel-de`touvd). According to Bartolo, this means 'maguey worm' [*guzano de maguey*], clearly making reference to the reddish- purple colours that this particular maize and the maguey worm (*Hipopta agavis*) have in common. "It is not squeamish" he says about the *belatove* ["*No es chillón*"], meaning it is sturdy and will withstand harsh conditions. Bartolo recalls that they acquired the *belatove* because the previous harvest had failed. Maize was scarce and they needed seed that would produce maize fast. Ever since they have held onto the *belatove*, using it for the same things that other people prefer to use white maize for.

Data from previous research in the study area by the CIMMYT-INIFAP project, showed significant differences between female and male farmers' interests with regards to maize variety characteristics (Bellon, 2001; Bellon et al., 2003). While both men and women rated tolerance to drought, yield stability and low cash investments among the top five maize variety characteristics, male farmers furthermore included storage ability and appropriateness for feed production among the top five, while the female farmers valued yield by weight and *nixtamal* quality as the remaining two of the five most important maize variety characteristics. In general, there was a tendency for male farmers to emphasize production aspects, whereas female farmers showed strong interest in both production and consumption related characteristics. In the CIMMYT-INIFAP project's growth trials and farmer ratings an example of

this was a relatively light white maize with a purple husk that attracted attention by receiving many votes by female farmers. The scientists were intrigued by this, as the same maize did not score high with male farmers and showed no interesting characteristics from an agronomic point of view. However, when asking female farmers why they liked this maize so much, it turned out that its popularity had to do with its purple husk, and the fact that tamales made with this type of husk, acquire an attractive pink colour.

Production conditions

Many of the farmers in the study area are aware of the genotype-by-environment characteristic of maize. This is often expressed in comments reflecting the view that, even though a maize variety performs well under certain agro-ecological conditions, it may not necessarily perform equally well under different conditions (Chapter 3; Badstue et al., 2003b). This was also clearly reflected in the focus group discussions, when adaptation to local agro-ecological conditions was one of the first things farmers in all study communities mentioned as important when acquiring maize seed (Badstue, 2004; Badstue et al., 2003).

> In Zegache Don Teodoro and his wife Liliana stressed the importance of the maize seed coming from the same region. As Liliana pointed out, in the opposite case "One doesn't know how this maize will perform; therefore one runs a risk planting this maize". Like most other farmers, Teodoro and Liliana like to make their own experiments planting seed of different crops and varieties. Teodoro recalls, how, many years ago, he brought back with him from 'the North' [USA] a big and beautiful maize cob. He planted the seed from it but the experiment was not successful. Liliana comments, that she has tried to plant "this long maize" that the travelling maize vendors sell from their truck, whenever they pass through the little town. "I once planted it here in the yard. It grew a lot and it had hairs on all the leaves. When the maize from around here already had *elote*, this one was still just growing and growing, but then the rains stopped, and it didn't get any further, it didn't fill. It is not the same".
>
> Camilo (Huitzo) comments that the various kinds of maize tend to perform differently in relation to adaptation to different production environments. In his household they like the tortillas of different colours of maize, and in the past they always planted the white maize in the valley and the others, whether black, yellow, pinto or red, in the foothills or even higher up on the slopes above the house. The coloured maize, he explains, will withstand the thinner soils and generally harsher conditions on the slopes better than the white. In

> 2003, when the maize plants were well on their way, a drought set in causing severe damage to Camilo's maize crop. He now regretted having planted all his land in the valley with a new white maize, leaving only a small plot of yellow maize up on one of the hill sides. This was also severely affected by the drought and Camilo reckoned he would not even gather enough to preserve the seed of the yellow maize. "I regret to have lost it now, because that one would always succeed, my land had already appropriated itself of this maize. This time I planted this white maize and it is not the same. It did not succeed; it didn't go well with the type of land". In order to recuperate his yellow maize Camilo says: "I am going to see the people I have sold seed to in the past and see if they still plant it."

Though, on one hand, most farmers are aware that maize can be very sensitive to variation in the agro-ecological conditions, on the other, many of them also believe that it is sometimes possible to adapt a 'foreign' maize to local production conditions. Camilo's comment that his land "had already appropriated itself" of his yellow maize reflects this latter point, and what he was really saying was that the yellow maize had adapted well to his land. Other frequent ways in which farmers refer to this include: 'the maize 'settled with the land', 'the maize has become / now belongs to the land', 'the maize adapted, acclimatized, became accustomed to/ used to the land'. Most of the farmers in this study have experimented with this in different ways, and often, when farmers try out a new kind of maize 'to see if it works' [on my land], it is really a test of adaptability.

Discussion on varietal choices

Together with the intransparency of maize seed, the issues related to production and consumption objectives and production conditions constitute a main concern for farmers in the study area, when selecting seed or acquiring seed from other sources. Because these issues vary from one household to another, farmers value multiple crop traits and require varieties with different combinations of them, depending on the needs and constraints of the individual farming household. For most, the issue is really about reducing the risk of planting inappropriate seed, that is, maize that does not correspond to one's production or consumption objectives, or which is not adapted and therefore performs poorly under local agro-ecological conditions. The lack of transparency in seed is a major obstacle to knowing the characteristics of a particular kind of maize. I discuss this in more detail below under farmer experimentation (this chapter) and in the section on transaction costs (Chapter 9).

The above selection criteria are all presented as single verbal criteria. Similarly, the maize scientist is trained to break down the plant into technical, clearly defined, verbalized 'parts' (e.g. traits), which are then analysed indi-

vidually. Meanwhile, there is little doubt that farmers' varietal selection is much more based on what Marchand (2003) calls performative knowledge. When, for example, a farmer moves around in the local farming area, the different kinds of maize in the surrounding fields undergo continuous evaluation based on performative knowledge rather than individual, scientifically defined criteria. The farmer knows at a glance if a maize stand is good, without recourse to a process of verbalizing these selection criteria. Similarly, with maize ears and kernels, these are evaluated by performative knowledge.

When asking about the process of selecting a variety, a farmer would often explain something like: 'I saw it and liked it, so I decided to try it.' This may appear a superficial decision. However, what is happening is that we are listening to the verbalized version of a decision based on performative knowledge. As he inspects the maize, the farmer is simultaneously comparing that particular maize against his own concepts of good maize seed, along with perceptions of the seed supplier, and his interpretation of the information provided, factors relating to his farm, or out of simple curiosity, and all of these results are summed up in a decision of whether he likes it or not. The process does not occur in a linear way, according to a clearly defined, chronologically organized methodology, involving clear definitions and categories. Bloch (1991: 194) goes as far as to suggest that, when investigating motives for a particular action and receiving very clear and well-formulated explanations from informants, "we should be suspicious and ask what kind of *peculiar* knowledge is this, which can take such an explicit, linguistic form?"

Likewise, when farmers in the study area speak about maize with other farmers, the words or the language they use is fundamentally different from the way scientists talk about maize. In this situation their conversations take place within a shared epistemological framework, whereas in a farmer-scientist situation, the conversations take place across different epistemological frameworks.

Obviously this raises the question about how information about crop varieties is normally conveyed to farmers (e.g. from scientists, extensionists or shopkeepers). If any information is provided, which is not always the case, whether spoken or written, it is often in a technical, verbalized form. For example, while interviewing agricultural stockists at the market in the City of Oaxaca, I acquired an information sheet for farmers with information about maize varieties from one of the major seed companies. A table in it describes 8 improved maize varieties, according to 27 criteria, the first of which is 'type' of maize [*formación*]. Of the eight varieties in the table, one is categorized as a 'synthetic' [*sintético*], while the remaining seven are categorized as 'HCSM'[24]. Another criterion is 'adaptability (masl)' [*adaptabilidad (msnm)*], and under

[24] HCSM is an abbreviation of *Híbrido de Cruce Simple de Maiz* (Single cross maize hybrid). However, this is not explained on the information sheet, much less what it might mean.

each variety a certain span is indicated with numbers (e.g. for the variety SB-101: 1,400-2,300). Though smallholder maize farmers in Oaxaca are very much aware of the sensitivity of maize to its agro-ecological environment, they generally are not familiar with the masl-concept, but rather classify different ecological zones as 'cold', 'warm' or 'temperate' or according to soil types or vegetation. Though some criteria used in the table would be easily interpreted by farmers (e.g. colour of kernel, shape of kernel), I have little doubt that others would make little sense for many of the farmers in the study area.

As mentioned earlier, knowledge processes are often subject to negotiation between different actors. This is also the case, for example, in relation to seed supply or the introduction of new varieties, and farmers are aware of this; a fact which is reflected both in the strong focus on trust in seed transactions in general and in the widespread distrust, for example, of commercial seed providers in particular (see Chapters 7-9). Possible strategies for the introduction of new materials, which could contribute to the mitigation of this issue, could be on-farm trials, demonstration plots with seed fairs, or simply, as in the CIMMYT-INIFAP project (Bellon, 2004) to invite farmers to try or experiment with the germplasm, rather than attempt to promote direct adoption.

Finally, from a methodological perspective and in relation to the study of local knowledge on crop genetic resources, it would be important not simply to rely on verbally expressed criteria and preferences, but also to use methods (e.g. participant observation), where farmers' performative knowledge comes into play and where they may reveal their other preferences. In relation to formal sector agricultural research and technology development, this could include, for example, on-farm trials, farmer-led-experiments, farmer-demonstrations, and so forth.

Sources of seed

Using one's own seed

It is estimated that 80% of the area planted to maize in Mexico is done so with recycled seed (i.e. seed selected from the previous harvest by farmers, see Morris and López Pereira,1999). Selecting seed from one's previous maize harvest and carefully saving it for the next planting season is also a widespread practice among farmers in the study communities, as documented both in the CIMMYT-INIFAP 1998 baseline study and the seed flow tracer-study carried out in 2002. Of all the farmers who participated in the seed flow tracer study, 75.8% relied (in 2001) entirely on their own seed. Furthermore, as Table 6.3 shows, of the 240 households that participated in the CIMMYT-INIFAP baseline study (1998), all respondents claimed to practice seed selection from their own maize harvest.

Table 6.3 Saving seed from one's own maize harvest.

Do you save seed from own harvest?	Total no. of households	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valde-flores	Santa Ana Zegache
Yes	235	37	39	39	40	40	40
No	0	0	0	0	0	0	0
Did not respond	5	3	1	1	0	0	0

Source: Baseline study

Selecting and saving seed from one's own maize harvest is clearly a common practice at the household level. Similarly, with regards to the individual seed lot level, Smale et al. (1999) still reported that approximately 90% of all seed lots in the study communities were selected by farmers from the previous harvest, while the remaining seed was acquired almost entirely from other farmers, see also table 6.4.

Table 6.4 Source of seed for varieties planted, in percentages.

How did you acquire seed for last planting?	Average percent	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valde-flores	Santa Ana Zegache
Selected from own harvest	89	80	95	86	87	86	97
Bought	9	20	3	9	10	13	2
Other	2	0	2	5	4	1	1

Source: Baseline study

Interestingly, according to Table 6.4, the two communities with the highest percentage of indigenous population, Santa Ana Zegache and Santo Tomas Mazaltepec, are also the communities that show the least frequency of buying seed (2 and 3 % respectively), while San Pablo Huitzo, which has the lowest percentage of indigenous population of all the six study communities, is where the frequency of buying seed is the highest of all (20%). Table 6.3 shows that all respondents save seed. Seed acquisitions are therefore likely to have been in order to complement the farmers' own seed at the time of planting, for experimentation purposes, or, simply to add another kind of maize to one's repertoire.

According to the data from the CIMMYT-INIFAP 1998 baseline study, the main reasons for saving seed from one's own harvest appears to be to secure the seed supply for the following planting and to save money on not having to buy seed from other sources, see Table 6.5. Again San Pablo Huitzo deviates from the general pattern of the six study communities. Though the combination of seed security and savings also makes up the most important reasons for saving seed in San Pablo Huitzo, respondents in this community appear to be less preoccupied with the combined concerns of seed security and savings. San Pablo Huitzo is also the community where most people save

seed because they like to do so, or, alternatively, do not save seed at all. It is likely that these aspects can be linked to the fact that of the six communities, San Pablo Huitzo is the most prosperous and the community with the largest percentage of irrigation. The latter diminishes the risk of seed loss from a general perspective, and the former means that, even in the case of seed loss, freeing up the resources necessary for seed acquisition is likely to be less of a problem for people in here, as compared to some of the other study communities.

Table 6.5 Reasons for saving or not saving seed, in percentages.

	Average percent	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valde-flores	Santa Ana Zegache
			Reasons for saving seed				
Secure seed supply	68	51	73	65	94	36	88
Saving on not having to buy seed	19	5	23	24	3	56	4
It is customary	3	1	1	6	2	1	6
Likes to select seed	6	19	3	6	0	4	2
			Reasons for not saving seed				
Too little seed left	4	7	5	5	1	7	0
Buys seed and/or plants hybrid maize	3	17	1	0	0	2	0

Source: Baseline study.

Farmers have various reasons for saving seed from their own maize harvest. One of the things which farmers mentioned first when talking about maize seed practices, whether during focus group discussions or individual interviews, was 'confidence' or 'trust' in one's own maize. This refers to the farmers' notion of trust in the seed they have selected themselves. That is, the belief that the plants germinating from this seed will live up to a certain standard under the particular production conditions present on the farmers' land.

These circumstances are also reflected in local seed management practices: Farmers chose maize varieties according to a set of characteristics that they perceive as favourable in terms of their own particular needs, knowing the performance of the plants the seed came from under particular agro-ecological and management conditions. For social, cultural and agro-ecological conditions, a variety that may be appropriate for one farmer is not necessarily appropriate for another. Furthermore, by using seed that one knows and trusts, the risk of crop failure due to inappropriate seed is minimized. Hence, what better option to fit one's needs and preferences and to minimize risk, than the seed that one knows and selects oneself.

All the farmers who participated in this study, whether in the focus group discussions, individual interviews or case studies, seemed to share the view that saving seed provides a sense of security, as well as a chance to save money. In Table 6.5 this combination comes out as the most important of motives for saving seed from one's own harvest. As many of the farmers commented, once the seed is selected and safely set aside, one can rest assured that the seed for the next planting season is secure. What is more, the seed will be available when it is needed and the farmer will not incur planting delays. When the time comes, one can therefore avoid spending money and / or time acquiring seed at the last moment before planting, which is when prices typically go up and many small-scale farm households struggle to raise the means necessary for land preparations and planting.

Many farmers set aside more seed than they calculate they will need for their own planting. This provides a buffer against seed loss in storage as well as the possibility to provide seed should another farmer approach them with this request. In the case of sharecropping, which is a common arrangement, the standard procedure is that the landowner provides the land and the seed, while the sharecropper does the work.

Furthermore, for some of these farmers, the family's maize seed is associated with a certain affection value (Badstue et al., 2005). The seed may be an inheritance, passed on from parents to children when the latter start farming independently. Usually, the seed is given to a young couple by the man's parents. In some cases, however, they may receive seed from both parents, and occasionally only from the woman's[25]. Some farmers furthermore regard it as their duty as parents to provide maize seed for their children when they decide to begin farming independently. As one male farmer said: "There has to be seed for the children! That is one's obligation as parents."

This aspect surfaced many times during individual interviews, but it was also mentioned by farmers during focus group discussions. On these occasions both male and female farmers talked about receiving maize seed from their parents together with instructions about how to maintain it and care for it. Some of the participants saw this as a betrothal [*'un gran compromiso'*], because this maize acts as a memory of their parents, who asked them always to maintain it. For example, one woman described an occasion when as a young child she went with her mother to the market in Ocotlán where they bought white maize for planting. Afterwards her mother said to her: "Remember this maize, that we bought together, do not let it disappear." She promised her

[25] In the cases we know of, where this occurred, it was either because he did not have any relatives in the community, because they did not have seed to give, or because of bad relations between the couple and the man's family. The case of Lucio and Felicitas is an example of the latter. Lucio's parents did not want to acknowledge the marriage between the two. They did not offer seed to the young couple, who on the other hand, did not want to ask for it. Instead they received seed for their first maize crop from Felicitas' parents.

mother, and now, many years later, her mother long since passed away, she still preserves the white maize they bought together in Ocotlán.

In some cases farmers even said that they only continue to plant a particular kind of maize in order not to lose it. This is, for example, the case of Valentino and Florentina, a couple in their sixties, who grow mostly *pinto* maize and some yellow, in addition to beans and *maguey*. Valentino says he doesn't really like the yellow maize because it is very late [*tardón*], that is, he considers its growing cycle to be relatively long. However, he explains, they still plant it so as not to lose the seed, because his parents gave it to him and he promised them never to stop planting it.

Thus, for many of the small-scale farmers in the Central Valleys, maize seed is something they have in trust, which links them with previous generations, and which they, in turn, must pass on to their descendants. Often, the seed has been in the family for many years during which it has provided the sustenance of family members, whereby it acquires an inherent affection or symbolic value beyond its immediate utility in the farming system. Saving seed, therefore, becomes a way of conserving and honouring important personal ties. If the parents have passed away, other relatives or foster parents will normally provide maize seed for the first planting.

Finally, saving seed is strongly associated with being 'a good farmer'. In their own way, each of the above mentioned aspects represents part of what constitutes the local concept of 'a good farmer', a notion which, to a certain extent, is comparable to the concept of '*bonus pater familias*' [26] of Roman law. A good farmer is expected to take good care of his/her seed, and people who do not save maize seed are sometimes frowned upon. As the female farmers in one of the focus groups stated when explaining that a good maize farmer should not lose the seed: " [losing seed]… is like hurting one's pride for being a good farmer – it is like a humiliation!" On the other hand, though, it is acceptable and legitimate to obtain seed from other farmers in a bad year, or for want of trying out other kinds of maize germplasm, provided the farmer receiving the seed is generally thought to "take good care" of his/her seed. In this case, the person is someone who has a justifiable need for the seed and not someone, who prefers to rely on others for seed, rather than make the effort of selecting and storing seed from the previous harvest. In other words, this person 'deserves' the seed and will appreciate the favour.

Interestingly, while the practice of selecting and saving seed from one year to another can be compared to a social norm in the case of maize, of which

[26] *Bonus Pater Familias* ('good father of family') is a legal concept referring to a certain standard of reason and conscientiousness applied when estimating a person's guilt. A bonus pater familias is expected to act with reason and care. The concept can be applied to practically all categories of persons, professions, and ages in terms of whether or not the person in question behaved in a reasonable and conscientious way under the given circumstances.

disregard is associated with a certain stigma (see above), this does not appear to happen in the case of other crops, such as beans or chickpeas. In other words, whereas losing one's maize seed can be embarrassing, especially if it happens several times, losing one's bean seed does not seem to matter. Similarly, some farmers attach a special value of affection to their maize seed (Badstue et al., 2003a, b), which does not seem to apply to other crops.

Sometimes farmers will talk about people who do not save seed as lazy. However, in most cases, not saving seed is not a voluntary or deliberate decision. For example, in situations where this is linked to crop failure, the farmer did not decide not to save seed. Nevertheless, under certain circumstances not saving seed can be a deliberate or conscious decision by the farmer, and may even form part of his/her normal management practices. For example, when planting maize for feed production such as silage or specifically for the production of *elotes* or corn-on-the-cob, the farmer will often harvest everything while the plants are still green, not leaving anything for seed production. Furthermore, in the cases where hybrid maize is used, the farmer may be aware of the benefits of buying fresh seed for every planting. However, except for these aspects, it is few farmers in the study area who deliberately decide not to bother with seed selection and instead prefer to buy seed from others every year. As Table 6.5 shows, this is only the case for between 1 and 2% of the farmer maize's in the study communities, except for San Pablo Huitzo. According to Don Eucario (Huitzo), the persons who come back year after year to buy seed from him, do not want to invest time in seed selection and they do not appear to care much about what kind of maize they are planting. Most of them, he says, plant only a very little maize and mainly work in other things, such as construction or other waged work.

Once in a while farmers also decide to abandon a particular kind of maize; that is, they decide to deliberately stop growing it. This can be motivated by different reasons or considerations, including change of agro-ecological conditions, such as the sale of a plot of land with particular agro-ecological conditions; changes/degeneration over a period of time in the characteristics of the maize in question, for example, the development of a thicker cob, change in colours etc.; or maybe the farmer decides to substitute it for another kind of maize which he/she considers superior. The case of Ana María and Rodolfo and the white maize from Ocotlán, mentioned above, is an example of the latter. Market considerations may also play a role in farmers' abandonment of varieties:

> Don Miguel and his wife Hortensia used to grow several types of maize: white, yellow, pinto and black. Now they only grow white maize. Don Miguel explains that they stopped cultivating the other kinds of maize because of the lack of market for the sale of coloured maize ["…*perdimos la semilla porque no tienen salida*"].

Seed acquisition

The alternative to saving one's own seed is to acquire seed from a third party. Seed acquisition is an opportunity to obtain maize with desired traits, but, as discussed elsewhere, it also entails risks; either of outright crop failure due to poor or inappropriate seed, or the risk of the maize having less desirable traits.

Table 6.6 Reasons for acquiring maize seed (% of acquisitions).

Theme	Reasons for acquiring seed (% of acquisitions)	
Experimentation	Liked the seed	26.5
	'To see if it works'	4.1
	Bought grain for consumption, but so nice they selected seed from that	1.6
	Subtotal	32.2
Commencing to farm	Commencing to farm	27.8
Lack of sufficient seed	Complete seed loss	5.4
	Did not save seed from last year	4.7
	Partial seed loss	3.8
	Harvest loss	3.8
	Sold it all	0.6
	Seed loss due to pests in storage	0.6
	For replanting	0.3
	Subtotal	19.2
Others' initiative	Someone else asked for a seed exchange	2.2
	Someone brought the seed as a present	3.2
	Subtotal	5.4
	Other	15.5
Total number of recorded seed acquisitions		317

In the tracer study the motives for acquiring seed were investigated and Table 6.6 presents a summary of the answers based on 317 seed acquisitions. It is notable that 32 % of the transactions were due to the farmers' interest in trying out new maize, with another 5 % being brought on through the initiative of another farmer.

The testing of new types of maize is almost exclusively done using a small quantity of seed on a small piece of land. Seed quantities were recorded in 386 transactions in the tracer study (see Table 6.7). While the average quantity

was 12.5 kg, half of these transactions involved only 8 kg or less. In the CIMMYT/INIFAP research project 2,726 kg of seed of diverse maize varieties were sold to a total of 371 farmers, and the average quantity purchased was 4.3 kg (Bellon, 2004). In comparison, farmers in the region normally calculate 4 *almudes*[27] of seed, approximately 16 kg, to plant 1 ha maize. In spite of the fact, that most plots are very small in the Central Valleys and therefore seldom require large amounts of seed, the high percentage of seed transactions involving small quantities of seed suggests that a considerable part of all seed flows are motivated by elements of farmer experimentation, or take place to complete the required amount of seed in the event of partial seed loss.

Table 6.7 Quantity of seed involved in transactions.

Seed quantity per transaction, kg[a]	No. of transactions	%
≤ 4	100	25.9
5 - 8	93	24.1
9 – 12	59	15.3
13 - 16	43	11.1
17 – 20	42	10.9
21 – 40	45	11.7
41 – 48	4	1.0
Total	386	100

[a] Unknown for 130 of the 516 transactions.

When trying out another kind of maize, the farmer may cultivate the new maize for one or more seasons before a decision is made on whether to adopt it. If the new maize is to the farmer's liking it may either be adopted as new maize for cultivation and added to the farmers repertoire of individual maizes being cultivated; or, alternatively, it may substitute an existing maize, or the seed of new maize may be mixed with seed of one of the existing maizes. The latter was mentioned above as partial seed replacement, and is often used by the farmers in an effort to obtain one maize with a combination of desired traits from several maizes. Below the issue of experimentation is discussed in more detail.

The second most common reason for acquiring seed is when a farmer commences to farm, which accounts for 27 % of the seed acquisitions in Table 6.6. This is obviously the case when a new farmer starts farming on an independent basis. However, it may also be the case when farmers, who for some reason, for example, temporary migration, decide not to plant maize for some time. Due to the relatively fast decline in maize seed germination rate and vigour (Morris et al., 1998), the person who wants to take up maize farming again may have to start over again, acquiring maize seed from other farmers, family or yet other sources. However, in many cases it is only some of the

[27] An *almud* is a commonly used volume measurement for grain or seed in the Central Valleys (Smale et al., 1999). One *almud* of maize is approximately 4 kg.

household members who migrate (e.g. the husband and/or grown up children), in which case the wife and other relatives often look after the farm and continue planting the land, for example, with the assistance of hired help or a sharecropper. Lorenzo Benito's case is an example of the latter:

> After several years as a farmer in Zegache, with a break in which he worked briefly in the US, and another during which he served as the interim President of the Municipality, Lorenzo Benito Ventura went to Mexico where he found work as a gardener. He worked in Mexico for more than 25 years, returning to the village in 1998. Ever since he formed his own household around 1950, Lorenzo has planted a white and a yellow maize, both of which were passed on to him from his father. During the years he lived and worked in Mexico City, he continued to grow the same two maize landraces with the help of a sharecropper from the same village. Therefore, he says, he did not lose the seed until some 15 years ago when the harvest failed completely and he lost both the yellow and the white maize. However, as his brothers cultivated the same maize, passed on from their father, Lorenzo acquired new seed of both the yellow and the white type from them, and because it traced back to the same origin, namely their father's white and yellow maize, Lorenzo considers that he recuperated the same two varieties, that he had just lost. Since he returned from Mexico City and took up farming again, Lorenzo has added to his maize repertoire a black landrace, which he also obtained from relatives in the community.

Finally, seed acquisition may be motivated by the lack of sufficient seed, but as shown in Table 6.6, this only accounts for 19 % of the acquisitions registered in the seed-flow tracer study. Seed loss may occur because of low yield or total harvest loss, due to drought, water logging, insect attacks, weeds, hail, lodging, or poor management. In addition, seed may be lost during storage due to insects or rodents. A farmer may not save seed, or at least not enough, because he or she has had to sell or eat everything that was harvested including the seed set aside, as a result of insufficient production, an emergency or a crisis, such as a health problem, an accident. Farmers who produce maize for animal feed may harvest before seed is produced. Obviously, seed loss may also occur as the result of several converging factors.

The relatively low percentage of acquisitions related to seed loss is interesting and less than originally expected. However, when combining with some of the more qualitative data, a possible explanation may be provided. According to informants, seed loss is sometimes associated with laziness, lack of knowledge and inappropriate working practices. Thus, losing one's maize seed readily translates into a social stigma, even though the cause for seed

loss may be beyond the farmer's control. This stigma appears to be linked to the notion of 'good farmer', which I mentioned above. Likewise, never to have lost one's seed is a cause for pride for many farmers. Obviously, this does not motivate people to talk about the occasions on which they may have lost their seed, and it is possible that this influenced the answers to the seed flow tracer study. For example, on some of the occasions, informants said they acquired seed because they really liked the seed they were offered; however, it is quite possible that this was not the only reason, and that some of them may not have acquired the seed, had they not also had a real need for it.

Seed loss can be partial or complete. Partial seed loss is when only part of the seed needed for the next planting is lost, and therefore only a portion of what is needed has to be acquired outside the household. Complete seed loss is when all the seed of a particular type of maize is lost. If the farmer wants to replace this maize type, new seed must be obtained. The case of Felipa and Santos presents examples of both partial and complete seed loss, and thus, partial as well as complete seed replacement:

> Felipa and Santos live in Albarradas together with two of their grown-up sons. They grow two hectares of maize and squash, and one of beans. They also own ten donkeys which they use for carrying firewood and other transportation purposes, and occasionally they rent the animals out to other farmers, for example, to carry the harvest home from the field, or as transport in the harvest of *magueys*. Felipa and Santos plant only white maize now. They used also to grow a yellow maize, but lost it one year when there was a particularly bad drought. Although she says the yellow maize takes longer to *nixtamalizar*[28], Felipa likes it very much for the quality of tortilla it makes and she therefore acquired another yellow in 1999. However, this one was lost too, after only two cycles. They did not even manage to take seed, she explains, because the drought hit when the plants were still very young and they dried out before even setting flowers.
>
> Since then they have continued only with their white maize. Santos received this maize from his parents, and he and Felipa have grown it ever since they married. Normally, it is Felipa who sorts the maize ears, separating out the largest and healthiest for seed, and Santos who 'makes' the seed [*hace la semilla*], that is, selects and shells the kernels to be used as seed from the ears that Felipa selected. After this, they mix the seed with dried chilli seed to protect the maize seed from storage pests.

[28] '*Nixtamalization'* is a step in the process of making tortillas. It refers to the process in which the maize is boiled with lime, before it is ground and tortillas can be made from it.

> In the same year as they lost the second yellow, they found themselves short of seed for the white, and to complete the quantity of seed needed to finish planting they bought two kilos of white seed maize from Sra. Juana. During the course of the conversation Felipa reveals that actually this was not the only occasion on which she has bought seed from Juana; two years before that, a similar situation had arisen, and they had acquired one *almud* of white maize seed from the same lady. Felipa adds that she is friendly with Juana, and should it happen again in the future, she is confident that Juana would provide the seed they would request.

Experimentation

The widespread use of experimentation is by no means limited to the farmers in the study communities, but has been documented as a common practice in many places (Box, 2000; Chambers et al., 1989; Richards, 1985; Scoones and Thompson, 1994; Wu and Pretty, 2004). Though the term 'experiment' is being used, it is important to consider that smallholder experiments are organized quite differently from those of formal research. According to Dusseldorp and Box (1993) this is linked to the different worldviews in which scientific as opposed to local knowledge is generally rooted. Scientific knowledge is largely construed within a voluntaristic worldview based on an assumption that it is possible to understand the processes of nature and express its underlying causalities in theory, in order to subsequently manipulate the environment. Meanwhile, local knowledge is generally rooted in what the authors call an adaptive worldview, in which it is assumed that certain parts of nature and the environment are controlled by forces that are beyond human influence. Rather than manipulate the environment, the approach is to accommodate to it (Dusseldorp and Box, 1993).

Bentley and Baker (2005) compare smallholder experimentation with that of agricultural scientists across a number of criteria. While scientists' experiments are always square or rectangularly shaped, using the same size for each treatment and various repetitions, farmer experiments can be of any shape and of different sizes from one treatment to another with no repetitions. Similarly, while in scientists' experiments careful design and planning is considered essential, and the use of numbers for quantification of findings is important, previous planning of experiments is only sometimes the case in farmer experiments, and analysis is primarily visual with limited use of numbers. Most importantly, however, is the comparison of the purpose or the beneficiary(ies) of the experiment/research. Bentley and Baker note that scientists' research is done for others, that is, not for the scientists themselves, whereas farmers' experimentation is done for the farmer's own use. In the 'scientific knowledge system' the primary aim of experimentation is the advancement of knowledge. Validation comes from active communication of

experimental results to fellow scientists and researchers. By contrast, farmers' experimentation and knowledge is distinctly use- and user-oriented. In addition, farmers' knowledge generation is validated by the final technology users, whereas scientists' research is validated by other researchers (Bentley and Baker, 2005; Biggelaar, 1996). Biggelaar notes that farmers in Rwanda did not consider experimentation as separate from everyday agricultural activities, as is the case in the 'scientific knowledge system'.

Box draws attention to the importance of curiosity and play in technological change. With reference to farmers' experiments in the Dominican Republic, as well as in the Netherlands, he points to curiosity and playfulness as far more important in the generation of knowledge than is often assumed (Box, 2000). Box claims that this aspect of knowledge generation has not been given due attention by researchers. "The reason we know so little about it, is that many experiments are not discussed, either because they are secret, or because they are considered 'play'" (Box, 2000: 3).

Arguing that agricultural knowledge often is generated in the interaction between curiosity and utility, Box calls for what he refers to as a 'non-utilitarian approach to knowledge', that is, an approach which is not focusing only on utilitarian factors such as yields, income or food security, but which includes the notion of fun and playfulness (Box, 2000: 6). This is not to say that the utilitarian aspects of experimentation are not important, and farmers' primary concern is still their livelihood. However, the point is that a lot of the experimentation that leads to knowledge generation and technological change, whether by farmers or by researchers, originates in people's curiosity and fascination with 'gently playing with nature – for the fun of it' (Box, 1999: 1).

While farmers often experiment because they find it interesting and 'fun' (Box, 1999, 2000), for small-scale farmers in many parts of the developing world, it is also an important element in the efforts of adapting to an ever changing context (Quiroz, 1996). For example, reporting from an in-depth study on knowledge generation processes in agroforestry systems in Rwanda, Biggelaar notes that farmers' experimentations were an integrated part of their strategies to overcome ecological and economic uncertainties and a way of exploring opportunities for a better and more secure livelihood. The author even comments that "there was an implicit understanding that not experimenting with new ideas would lead to stagnation and would compromise an already precarious existence" (Biggelaar, 1996: Executive summary).

Discussion of sources of seed

Clearly the reasons to save maize seed are multiple and complex. They cannot be seen just as a simple narrow decision to save money, but must be understood as a practice that has different cultural, economic and agroecological components. As has been pointed out in this and the previous sections, seed is a flexible and negotiable concept. According to local standards it is important

to take good care of one's maize seed and for some it is a matter of personal pride. Maize seed, in particular, seems to be loaded with special symbolic values for many farmers in the study area.

A fundamental difference between using one's own seed and acquiring seed from other sources is knowledge. By using seed, which one selected from one's own previous harvest, one has first hand information about the characteristics of the maize in question as well as its management and performance under the particular circumstances where it was cultivated. Furthermore the farmer knows exactly when and how the seed was selected, and how it was stored, and finally one can assume that even the consumption related characteristics of that particular maize are well known by the farmer's household. In contrast, seed from external sources is often associated with different degrees of limited knowledge, though it can provide a solution to urgent seed needs. In addition, seed from other sources can provide new and interesting traits.

Due to the lack of transparency, external seed will always be accompanied by a lack of information. The supplier may know the quality of the seed and provide reliable information on, for example, the ability to germinate. If the supplier is local then he or she may also be able to provide information on the environmental adaptation and production characteristics. But many production traits of a maize can only be expressed verbally in very general terms, and as such the accompanying information is limited unless the farmer has seen the maize cultivated, which is sometimes the case with seed from local sources.

Experimentation is a knowledge building process (Biggelaar, 1996). During this process new observations, experiences or findings are added to, challenge and/or further contribute to one's current knowledge base. Farmers' experimentation is not something that is limited to a few innovative farmers. Just as Biggelaar (1996) found that experimentation was part of normal farming practices for Rwandan farmers, it is a wide-spread practice among farmers in the study area. In fact unless a maize comes from a very well known source, such as close family, and the farmer is already very familiar with the maize, then the most common form of introducing a new maize is to plant it in a small area first, that is, to make an experiment.

Informal experimentation provides farmers with firsthand information about the characteristics and the performance of particular maize types under specific agro-ecological and management circumstances. This information is largely based on performative and not verbalized knowledge. As such it is more comprehensive and more easily absorbed and adapted to the farmers other farming knowledge and practices. Upon evaluating the experiment, the farmer has a relatively good basis for deciding whether the maize type in question is appropriate in relation to his or her production objectives. This coincides with the point made above, that farmers' informal experimentation is use- and user oriented.

From the various examples of farmers' seed acquisitions and experiments, it is clear that regardless of their economic or educational standing, many of the farmers who participated in this study enjoy experimenting and 'trying out' different kinds of maize, even in circumstances where chances of good performance are unlikely. At the same time, farmers' experimentation contributes to local knowledge generating processes. Furthermore, though farmers' small-scale experiments may imply a certain risk, at the end of the day they serve to reduce the risk of major failure. In other words; while they are often motivated by curiosity and playfulness (Box, 1999), farmer experiments also serve the purpose of both knowledge generation and risk control: that is, their purposes are both utilitarian and 'for fun'.

On farm seed management practices

From a population genetics point of view, in the seed selection process farmers exercise selection pressure in an attempt to enhance favoured traits in their maize and lessen the influence of undesired ones. This ensures that certain traits are passed on to the next generation at a higher frequency. Furthermore, these traits are what define a variety in the eyes of farmers, and studies have argued that this selection process plays an important part in what structures diversity in farmers' fields (Bellon and Brush, 1994; Louette et al., 1997; Pressoir and Berthaud, 2004). As demonstrated by Pressoir and Berthaud (2004) the dynamics of maize genetic diversity in the study area is a combination of geneflow and selection; without farmers' seed selection, maize populations in this region would not show the great morphological diversity observed.

Farmers' seed selection

Farmers' maize seed selection can take place at any time between harvest and the next planting. The period of time in which seed selection takes place can vary greatly; in some households it is an intense, focused activity of relatively short duration. However, in many households it is an activity that takes place little by little over a long period of time, that is, for several months. Finally, some farmers organize their seed selection in a more step-wise fashion, which can take place over different periods of time, according to the convenience and traditions of the individual farm household. Both men and women participate in the different steps of the seed selection process, although, in some cases, depending on the household, it is regarded as the responsibility of someone in particular.

In the baseline study an attempt was made at quantifying the use of different seed selection practices and the results of this are shown in Table 6.8. Farmers' use of plant characteristics in relation to seed selection has been reported from other traditional agricultural systems, for example sorghum and pearl millet in Africa (Berg, 1993; Louette and Smale, 1998; Mushita, 1993).

However, in Table 6.8, it is noticeable that only some 3 % do any preharvest selection, which means that most are only selecting on the traits of the ear and kernels, but not, for example, on the characteristics of the plant (or the length of the cropping season). This appears to be the common practice for farmer maize seed selection in Mexico (Aguirre, 1999; Louette and Smale, 1998). These traits may, however, have been included when the seed was acquired in the first place (see Bellon, 2004).

The baseline study investigated the use of four post-harvest selection practices:

1. The separation of the harvest in piles designated for seed or grain
2. The selection of ears for seed and the subsequent shelling
3. Selection of seed in connection with using the maize for consumption
4. Selection of seed just before planting

The post-harvest selection can be undertaken in different ways. However, a general feature that all have in common, is that selection is done as a two-stage process, first selecting the ear, and then selecting the seed kernels within the ear (see below for more details). One way is to separate the harvested ears into two groups: one for seed and another for grain. The farmers may store the seed as ears with the husk intact until shortly before planting; or, alternatively proceed to dehusk and shell it and store the seed as kernels. Rather than carry out the seed selection as a separate process it may also be done little by little, as the harvest is being used. In this case, as the family members use of the stored maize, they will separate out the best ears for seed selection. Finally, the actual selection of the individual kernels to be used as seed may be done just before the planting. The frequencies of use of the different procedures are indicated in Table 6.8.

Table 6.8 Percentage of farmers using a given practice[a].

Seed practice	Total	San Pablo Huitzo	Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valde-flores	Santa Ana Zegache
Pre-harvest selection	3	3	0	3	15	0	0
Separate piles	56	79	15	100	43	100	3
Selects ears, then shell	45	13	33	100	18	100	5
Selects in connection with use	79	8	90	98	90	92	98
Selects just before planting	16	15	20	0	48	5	5

Source: Baseline study.

[a] Note: a farmer may use more than one practice for seed selection.

On average a farmer uses two of the above practices for seed selection and they are used in 19 different combinations. In San Agustín Amatengo and

Valdeflores, the predominant combination is to separate the harvested ears into two groups and then shell them before storage. This is complemented by selection as the maize is being used. In Santa Ana Zegache the predominant selection method indicated is during use, and in San Pablo Huitzo the main method is the separation of ears into two groups. Finally, in Santo Tomás Mazaltepec and San Lorenzo Albarradas farmers often select seed when using the harvest. However, this is combined with other methods, and no single method or combination of methods is predominant. It should be noted that the processes of post-harvest seed selection and management often take place during a time span of several weeks or even months, and despite several efforts at categorizing or systematizing, in many cases it is not a neatly ordered process that can easily be divided into separate phases.

Selecting the ears

In local seed management, seed selection depends on the individual farmer's perception of what are desirable traits, and what makes good seed. These criteria are socially constructed, based on local knowledge and passed on between people. It is information, which over time, has been challenged, discussed and maybe modified according to the experience of the individual farmers. Like any other form of technological knowledge, it is a product of social processes in the community (Campbell, 1996; Friis-Hansen, 1999).

Some households store their maize as ears, leaving the husk on for protection. Others remove the husk and yet others both de-husk and shell the maize. Initially, all the harvested ears are usually piled up in a certain part of the household or patio, often separated by maize type, if the household in question grows several kinds of maize. A common practice is to undertake a first sorting that separates damaged or badly developed ears from the healthy and well-developed ones. If squash was planted together with the maize and harvested at the same time, it is now put in a separate pile.

The next step is de-husking. On every single ear, the husk is forced open, pulled free and removed from the ear. This is done by hand, leaving the maize ear bare. The quality of the ear is now readily assessed, and in general the farmers who dehusk the maize before storage also use this moment to separate out any badly developed or damaged ears, which in most cases are then set aside to be used for animal feed. Often the farmer also uses this moment to separate particularly 'good' seed ears, for example, for subsequent shelling and storage.

In many cases farmers have a clear idea of what the 'ideal' ear of their particular maize looks like, and when selecting seed ears they often try to get as close to this 'ideotype' as possible. Similar practices and criteria have been reported from Oaxaca by Mendoza, 2000; and Smale et al., 1999, and from elsewhere in Mexico by Aguirre, 1999, and Louette and Smale, 1998.

Figure 6.1 Bringing the harvest home.

As mentioned above, seed selection is carried out almost exclusively at post-harvest and as a result the selection criteria are related almost entirely to the ear and kernel characteristics. The baseline study investigated the different selection criteria applied by the farmers in the region, and a summary of this is presented in Table 6.9. The vast majority of farmers select for large clean ears with all grains filled. They also look for large clean kernels and grain uniformity. In San Pablo Huitzo, San Lorenzo Albarradas and Santa Ana Zegache

they are also concerned with ear weight, but less so in San Agustín Amatengo, Santo Tomás Mazaltepec and Valdeflores. Cob size is also a concern for just over half of the farmers. Husk cover, which is important both to prevent infestation by pests as well as being an ingredient for example for cooking tamales is of much less concern to farmers. A possible explanation is that the maize types cultivated in the study area generally all have good husk cover, and as such is not an issue in seed selection.

Table 6.9: Percent of farmers using criteria for seed selection.

Selection criteria	Percent of all farmers	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valde-flores	Santa Ana Zegache
Ear size	90	95	95	68	95	93	98
Ears clean and healthy	93	98	100	98	100	78	85
Ear weight	56	93	35	23	95	18	75
Degree of grain filling	83	98	98	90	88	25	100
Number of rows	37	50	8	63	30	25	45
Husk cover	18	8	25	23	45	5	0
Husk thickness	7	0	0	20	23	0	0
Clean husk	18	13	20	40	30	5	0
Kernel size	91	85	93	80	98	93	100
Kernel uniformity	75	90	78	68	95	33	88
Kernels clean and healthy	96	93	100	100	98	93	95
Cob size	55	60	15	53	78	83	40
Cob colour	13	8	3	10	15	10	33

Source: Baseline study

Selecting the seed

The selection of seed from the individual maize ears also has many similarities across households, although, at the same time the details or sequences may vary quite considerably from one farmer to another. Who is in charge of seed selection also varies from one household to another.

Similar to the selection of ears from which to take seed, many farmers favour large, clean and healthy looking kernels that live up to the individual farmer's idea of what characterizes his/her particular maize, for example, shape, size and colour of kernels. Another common criterion is that kernels that are selected for seed should have intact and spotless pedicels, as damaged or dark pedicels is interpreted as a sign of poor seed quality or doubtful germination ability. As Doña Miriam, explained: "As long as it has its little heart, the white part in the middle, it has to germinate. Look, like this little maize grain, this little heart, and this is where the little maize plant will start ….." Likewise another woman commented that one must make sure that the seed has been specially selected, is clean and undamaged by insects. Like Miriam, she points out that the 'heart' of the maize seed must be intact. "That one will germinate", she says.

Many farmers follow a practice of only selecting kernels from a particular part of the ear, for example, only the lower 1/2 – 2/3 of the ear or only the middle part of the ear. When asked about this practice, farmers normally explain that these kernels make the best seed. Farmers in the study area are often influenced by a logic of 'like produces like'. For example, according to Don Emilio (Zegache), the maize plants take after the seed it germinates from: if you select only big and beautiful kernels for seed, this is how the maize will be. However, says Emilio, if you use seed that is g*uioxito* (small), the maize that will grow from it will be equally *guioxito.* The kernels at the top of the ear (and often also those at the bottom) are slightly asymmetrical and smaller than the rest, and in general, farmers in the study area appear to believe that these kernels make a poorer seed and produce inferior plants. A similar thing takes place in relation to the selection of ears for seed selection; farmers choose beautiful, well-developed ears in order for next season's harvest to be one of beautiful, well-developed maize ears. On the other hand, farmers also sometimes experience difficulty in explaining the rationale behind their practice of choice. In that case many simply explain that this is what they were taught about selecting good maize seed, and this is how they have always done it.

Furthermore, the practice of taking seed only from certain parts of the ears appears to be a common practice, not only in Mexico, but also in other parts of the Americas, as well as elsewhere outside the centres of origin of maize (Louette and Smale, 1998). The basis of these practices are not entirely understood. However, according to Louette and Smale (1998: 11) "the kernels from the ear tip are usually smaller, have poor reserves, and are often damaged by birds, insects, and fungi, which may justify their exclusion". The authors also mention that unpublished results from their own germination tests indicate that the kernels from the upper part of the maize ear demonstrate a slower and a lower germination rate than the kernels of the centre and the base of the ear. With regard to the kernels at the base of the ear, no clear justification for leaving these out from the seed selection exists from a scientific perspective. However, according to Louette and Smale (1998: 11), as the first silks to appear emerge from the base of the ear, these kernels may be subject to a greater probability of self-pollination and therefore inbreeding, than other kernels.

Seed selection is another area in which maize stands out in comparison to other crops, such as beans or chickpeas. It is common practice among farmers in the study communities to save seed of various crops. However, whereas maize seed is specially selected and generally carefully stored separate from the rest of the maize, thereby constituting an altogether different category from maize grain, a similar practice does not seem to apply for beans or chickpeas. Miriam explains: "Seed maize is bigger. The little maize kernels, the second class maize, are for eating, but in beans they are the same, there is only one class." This corresponds with Catarina's comment: "Beans (seed) are

mixed, they are not selected, you throw (sow) it even if it is small" or as Liliana said: "Even though it is mixed. Yes. It is not selected." In comparison, Eduardo explained that neither beans(seed) nor chickpea(seed), are selected – '*revuelto*' (mixed) he stated, adding that "If you want to plant chickpeas, you just get it from anywhere."

Harvest and seed storage

Storage temperature and seed moisture content are very important for maintaining maize seed quality in terms of germination rate and vigour. In many developing countries, farmers' own seed storage facilities may not be able to control temperatures and moisture levels effectively. As a result seed quality may deteriorate significantly after only one year or less (Morris, 1998). Under average local storage conditions in the study area, maize seed can be stored for one to two years and still retain an acceptable germination rate and vigour, provided the maize seed is not damaged otherwise by storage pests, pathogens or fungi. Nevertheless, knowing that seed quality declines with prolonged storage, farmers clearly prefer to use seed that is as 'fresh' as possible.

Most farmers do not store maize seed longer than one or a maximum two seasons and poor germination rate is seldom a problem in relation to the seed the farmer selected him-/herself. However, seed quality remains a point of concern, especially in connection with seed acquisitions from other, unknown sources.

The harvest can be stored either as ears with or without husks, or shelled as kernels. Table 6.10, based on data from the 1998 baseline study, shows that in San Pablo Huitzo, Santo Tomás Mazaltepec, San Lorenzo Albarradas, and Valdeflores, the preferred form of storage is as ears, whereas in San Agustín Amatengo and Santa Ana Zegache farmers predominantly store the harvest as kernels. For the latter it is somewhat surprising that on the question of seed selection they also indicated that this was done when using the grain. This must mean that the respondents understand 'use' as including the shelling of the ears before storage.

Table 6.10 Harvest storage form used by households from the baseline study.

Storage form	Total	San Pablo Huitzo	Santo Tomás Mazaltepec	San Agustín Amatengo	San Lorenzo Albarradas	Valde-flores	Santa Ana Zegache
Ear	149	36	37	8	36	32	0
Ear and kernel	6	0	2	0	3	0	1
Kernel	80	1	0	31	1	8	39
Total	235	37	39	39	40	40	40

Source: Baseline study.

The problems farmers rate as most important in relation to seed as well as grain storage, are storage pests, principally *gorgojos* [weevils] and *palomilla* [moths], in addition to mice and rats.

Table 6.11 Methods farmers use to protect seed against storage pests.

Storage protection used	Total farmers	% of all	% of all using seed treatment	San Pablo Huitzo	Santo Tomás Mazaltepec	San Lorenzo Albarradas	San Agustín Amatengo	Valdeflores	Santa Ana Zegache
Agro-chemicals	121	51%	83%	4	6	12	29	38	32
Agro-chemicals and others	2	1%	1%	0	2	0	0	0	0
Natural (sunning, airing, etc)	8	3%	5%	2	2	4	0	0	0
Other (lime, ashes, herbs)	15	6%	10%	1	9	1	0	2	2
Total	146	62%	100%	7	19	17	29	40	34

Source: Baseline study.

According to the baseline survey, 62 % of the farmers use either agrochemicals or artisanal methods for protecting their seed against insect damage in storage. As can be seen in Table 6.11, the treatment of seed is widespread in San Agustín Amatengo, Santa Ana Zegache, and Valdeflores. In Santo Tomás Mazaltepec and San Lorenzo Albarradas slightly less than 50 % treat their seed, and in San Pablo Huitzo it is only 18 %. The baseline data also show that of the farmers who store their harvest shelled, 81 % treat their seed with agrochemicals and for the farmers who store their harvest as ears, only 36 % use agrochemicals to treat their seed (Table 6.12). Conversely, the use of artisanal treatments is confined almost exclusively to the farmers who store the harvest as ears, but even in that case it is limited to 14 % (Table 6.12).

Table 6.12 Storage of harvest compared to protection of seed.

Way of protecting maize seed against storage pests	Total no. households using seed treatment	Stores harvest as ears	Stores harvest as ears and shelled	Stores harvest shelled
No treatment	89	73	3	13
Agro-chemicals	121	54	2	65
Agro-chemicals and others	2	1	1	0
Natural (sunning, airing, etc)	8	8	0	0
Other (lime, ashes, herb)	15	13	0	2
Total	235	149	6	80

Source: Baseline study.

Farmers in the study area apply a variety of pesticides to protect the maize seed during storage, containing various kinds and concentrations of toxic substances. These include phostoxin, folidol and occasionally, lindane. Of these, the most widely used are the phostoxin tablets, and when used correctly this is also the least harmful to human health. The tablets react with air, dissolving slowly as a gas. The tablets are left among the maize to be stored; however, for the product to be effective, an airtight container must be used in order to contain the gas. Not all farmers who use this product are aware of the way it works. Many store their grain or seed in ordinary sacks or large finely woven baskets; however, as these are not airtight, the effect of the tablets is significantly reduced unless lined with plastic. At the same time, it is quite common that farmers exceed the recommended dosage per volume of maize – sometimes deliberately in order to counter what appears to be a weak effect of the tablets. Nevertheless, some farmers are concerned about the poisonous effect and do not treat the maize intended for consumption. As a female farmer from Zegache exclaimed: "No! If even the gorgojos will not eat it like that – then neither will I!".

When folidol or lindane is applied, it is usually in a powder version. If the farmer stores the seed as whole ears it is common to simply sprinkle the ears with the powder. If the seed is shelled the powder is added and mixed well with the maize.

These methods of protecting seed against storage pests are sometimes also used in grain storage. For example Bernardo explains how he applies folidol when storing the maize harvest: "I store it in the *troje* with the husk and all, and we shell it little by little as we use it. When I fill up the *troje*, I first sprinkle folidol over the bed (wooden bottom of the granary). Then I arrange a layer of ears, sprinkle a bit of water over it and then another sprinkling of folidol. Then I continue with another layer of ears and so on until the *troje* is full or there are no more ears left."

Among artisanal methods, the most commonly mentioned is the application of lime, or in some cases, ashes, which is simply mixed with the shelled maize seed, and provides a certain level of protection against insects. Some farm households also use chilli or herbs to protect the seed against storage pests, for example, Felipa and Santos, mentioned in the section on seed acquisition.

Farmers use a variety of containers for seed storage, although plain nylon sacks are the most common. Some farmers recognize the disadvantages of just using plain sacks and devise their own solutions to grain/ seed storage. For example, Pablo Lopez (Huitzo) stores his maize seed in a tightly sealed barrel/oil drum, and Doña Rosa (Zegache) uses nylon sacks, but lines them with heavy-duty plastic sacks in order to contain the effect of the tablets she applies against storage insects. Others use heavy-duty plastic buckets with tightly fitting lids, and for very small seed quantities I have also seen emptied soft-drink bottles with screw-lids used.

A smaller number of households in the study communities own a small-scale metal silo specifically designed for small-scale farmers' grain storage. During initial phase of the CIMMYT-INIFAP project farmers complained about the high rates of grain and seed losses in storage. As a response the CIMMYT-INIFAP project staff provided training on a series of practices and technologies which could help improve storage conditions and diminish storage losses, including a simple type of metal silo that some farmers in San Agustín Amatengo were already using. The silos were tested in the other study communities and a rotating financial scheme was set up in order to help interested farmers acquire a silo of the preferred dimensions. The principle of the silos is to effectively prevent mice and rats from having access to the maize stored in it, while at the same time protecting the grain against insect infestation. The latter is achieved by making sure that the grain is not infested at the moment when the silo is filled, and subsequently by the lack of oxygen in the full silo.

Where farmers store the maize seed is yet another detail. The granary or *troje* is normally outside the house, but somewhere in the patio where household animals cannot easily get to it. Shelled grain is often stored on the porch, in an outhouse or in connection to the cooking shed/kitchen. However, the prepared (i.e. shelled and possibly treated) maize seed is often stored inside the house or, alternatively, somewhere else considered equally secure.

Some farmers will check the state of their maize seed once or twice during the storage period, cleaning it and removing any infested kernels and maybe re-applying treatment against storage pests. Rosa explained the process in the following way:

> "I take the seed out of the sacks and use the *arnero* to clean it of all the dust" says Rosa, showing me the *arnero*, a big sieve-like utensil consisting of a round wooden frame over which a piece of leather is strung with multiple perforations small enough so that maize kernels will not pass through any of them. With the *arnero* in her hands she demonstrates its use pretending to be sifting. "Like this!" she say, "one cleans the seed and the dust falls through the *arnero*!" the 'dust' referring to the powdery evidence of insect infestation. "Then I put it in sacks again and I apply another tablet".

Some farmers use the same methods to clean maize grain and remove any insect-damaged kernels before taking maize to the market to sell.

Discussion of on-farm seed management

The widespread practice of selecting seed based on ear and kernel criteria alone, means that traits, which maintenance depends on selection related to other parts of the plant, are left out of the selection process. Obviously, this

would also exclude selecting for traits which cannot be seen with the human eye or otherwise easily observed, for example, the contents of lysine and tryptophan in the case of QPM-Maize[29]. Other traits - length of production cycle, or other aspects of the plant - are taken into account at the time when the farmer decides what maize to plant. It is important to keep in mind that this decision, that is to say, varietal selection, has a considerably larger impact on production and consumption characteristics, than does seed selection from one cycle to the next.

On-farm seed management practices are based on performative knowledge, and the above description illustrates a range of issues in trying to verbalize this knowledge. Especially, when looking at the data from the surveys, these problems become obvious. For example, the ambiguity of the term 'in use' made it difficult to understand seed practices in Santa Ana. Almost all answered that they selected the ears for seed when using the maize (Table 6.8); however, they also store the maize as kernels meaning that they shell it before storage (Table 6.10). The use therefore refers to the shelling rather than to the use for consumption. This also illustrates the problem of taking a complex activity, such as seed management where the farmers draw on a wide range of knowledge, and apply different options in a flexible manner according to the circumstances, and trying to break this down into a series of yes/no questions.

In Table 6.8 the seed selection process has been broken down into a number of practices, and organized in a presumed systematic and chronological way, but this does not seem to appear particularly relevant to farmers and is not in accordance with their perception of seed practices. However, interviewees often tried to accommodate and answer within the options provided (see Novellino, 2003: 277, quoted above). It should be emphasized here, that the data in Table 6.8 was collected as part of the initial baseline study at the very beginning of the CIMMYT-INIFAP project, and that as such the data available at the time concerning farmers' local seed management was limited.

Later in the research process, it became clear that many farmers in the study communities did not organize their seed management practices in a systematic sequence of clearly defined and separate steps. Rather, seed management is done in a parallel and multi-tasked fashion and forms an integral part of harvest management. Many of the initial steps are not seed management ac-

[29] Compared to other types of maize, Quality Protein Maize (QPM) contains nearly twice as much of two key amino acids - lysine and tryptophan – which make protein usable for humans and monograstric animals. Quality Protein Maize is considered able to improve the diets of people who consume mainly maize. Furthermore, used as feed, it is assumed that QPM can provide poor farmers with a means for improving livestock production, and thereby, for new income-earning strategies. QPM is grown on more than 0.5 million hectares in 22 developing countries (CIMMYT, 2004). To my knowledge, it is currently not grown in the study area.

tivities as such, but simply harvest management, where seed selection may occur in an opportunistic manner, whenever one has a moment or comes across particularly good seed material. Seed selection as such is not carried out as one continuous activity where each step is completed in a relatively short, coherent time span. Several parts of the process may be initiated simultaneously and interrupted various times over a total period of several weeks or months. The interruptions are often not motivated by technical issues or seed management considerations, but are much more of a resource management issue, where work is undertaken when time between other tasks and events permits it.

The situation is similar with regards to seed storage practices. The tables presented here (6.9 – 6.11) could be said to convey a 'deceptionally clear' picture of local seed storage practices. However, as with other harvest and seed management practices, the preparation and organization of seed storage is often undertaken in parallel with, or according to how, other activities or events unfold, much along the lines of Richards' reflections on agriculture as a performance (Richards,1989; Richards, 1993 in Pottier, 2003; see also Scoones and Thompson, 1994).

The issues raised in this section illustrate the problems that were repeatedly mentioned in relation to efforts to 'translate' performative into verbalized knowledge and vice versa. The results of such efforts often include categories that appear unclear or ambiguous, and the loss of internal logic as complex processes are broken down into separate elements. In short, as pointed out earlier, efforts to 'translate' one kind of knowledge into another necessarily imply a transformation and often also simplification of the knowledge involved.

The aspects presented here also highlight some of the problems in trying to systematize local knowledge. In a review of the development of the study of local knowledge, Pottier (2003) explains that early efforts to recognize and incorporate local knowledge into the development debate tended to assume that it could be conceived of as a 'system', a fact which often led to the simplification of local knowledge. As Pottier notes, it has since become increasingly clear that knowledge changes and evolves continuously, not necessarily in a systematic way, nor is it necessarily organized as such (Pottier, 2003; Scoones and Thompson, 1994; Sillitoe, 1998). As a result the notion of 'knowledge systems' and their presumed boundedness is increasingly challenged (Pottier, 2003).

Attempts to organize farmers' seed practices in terms of a seed system encounter difficulties both with regard to the need for defining the constituting elements of the system, such as seed, varieties, and management practices, as well as in relation to defining the boundaries of the system itself. In the findings above I have discussed how both seed, and especially varieties, are flexible concepts that cannot easily be 'fitted into' a clear definition related to an

element of a system. Likewise, in presenting the seed management practices, it was clear that many different ways of doing similar tasks exist, and these may be combined in different ways. The specific choice of practice is often influenced by factors such as availability of labour or the personal preferences of the farmer at a given moment. The seed management practices are also difficult to pin down. Seed selection, for example, has considerable flexibility in terms of when it is carried out, and this flexibility is used by the farmers to complete it as *ad hoc* parts of other practices over an extended period of time. This means that several activities, which in fact are integral parts of other practices, such as post-harvest management, contribute to the same end, for example seed selection. As such, these practices cannot easily be separated from other practices and this leads to difficulties in delimiting the seed system.

In short, several aspects of on-farm seed management practices, including seed selection, form part of general post-harvest management, or are carried out in relation to using the harvest for consumption. Thus isolating or separating seed selection is problematic. Furthermore, as I argue in Chapters 7 and 8, seed exchange practices are also embedded in more general social relations, and must be analysed in relation to this more general social network. As such, both on-farm and off-farm seed practices are difficult to isolate as individual, clearly delimited parts of a seed system.

It is possible to construct a system for just about anything and thus it is also possible to consider the Oaxacan farmers' seed practices as a system. However, doing this inevitably implies a gross simplification of local knowledge and a process of 'disambiguation' of farmers' seed concepts. It also leads to difficulties in delimiting the seed system in relation to other practices both on- and off-farm. The widely used term 'informal seed systems' or 'farmers' seed systems' implies that these should be analysed as systems, but this research questions the very notion. Instead, it is proposed to focus on seed practices, and to ensure that the analysis takes the ambiguities in farmers' seed concepts, as well as the flexibility in their seed practices, into proper account. Furthermore, it considers farmers' seed practices as integral parts of other on- and off-farm practices.

The good farmer

Performative knowledge is not only a question of technical and practical skill in relation to undertaking a given activity. As pointed out by Marchand (2003), the knowledge required often also includes moral dimensions such as, for example, how to promote one's own status, obligations and responsibilities towards others.

The notion of 'status' refers to one's position in society, particularly the position that other people attribute to one, that is, the prestige or importance that one acquires in the eyes of other people. Meanwhile the term 'reputation'

refers to the opinion that other people have of someone as a result of what he/she does and how he/she behaves. The two are obviously closely related, yet, high status is not automatically linked to good reputation and vice versa.

Social roles are also closely related to status. However, one's status may change depending on the social context – in fact sociologists talk about 'sets of statuses' referring to the individual's various statuses in different social contexts (Giddens et al., 2003). Often a distinction is made between ascribed status based on biological factors, for example, age, sex, race; and achieved status, which refers to the individual's efforts and achievements in his/her life course. While aspects such as structural positions and roles can be considered human accomplishments, they have real consequences for the people who occupy them (Scott, 2005).

Social interaction is always situated in time and space and may involve different forms of verbal and non-verbal communication. Everyday interaction depends on subtle relationships between what we convey with our faces and bodies and what we express in words. The ability to interpret and accord meaning to social situations, in order to draw on the role or positional knowledge acquired during socialization, is therefore an important interactional skill, given that improvisation and negotiation are essential features in the construction of social action (Cicourel, in Scott, 2005). The study of how people make sense of what others do and say has been called ethnomethodology (Garfinkel, 1967).

The metaphor of the theatre has also been used as a framework for the analysis of social interaction and everyday life, among others by Goffman (1959), who gives central attention to how social roles are constructed and performed. This notion also refers to the socially defined expectations of an individual in a given status or social position. Following the theatre metaphor, in the various contexts of social life there tend to be clear distinctions between 'on-stage' and 'off-stage' situations, where actors prepare themselves for the performance and relax afterward. A good example of this is Goffman's classic study of self representation in everyday life, where he demonstrates how social actors, playing out their roles, are sensitive about how they are seen by others, and hence try to manage the impressions they give. Impression management can take many forms, the most common probably being the unconscious following of norms, for example, dressing appropriately for a business meeting or for church.

Elsewhere in this book I refer to the notion of 'the good farmer' which refers, admittedly in a rather nebulous or fuzzy way, to an ideal embodying a series of aspects that are highly valued in others by the farmers in this region, and which includes issues such as personal integrity, independence and respect. At the same time the idea of 'the good farmer' includes a series of common, local values regarding farming and being a fellow community member (this is

touched upon again in subsequent chapters in relation to trust, mutual help and reciprocity).

As a member of the community one is expected to take part in various community issues and *tequios* and contribute one's due share in relation to both actual financial contributions as well as in terms of public service or the responsibilities that one may be appointed to. After several years abroad as a migrant worker, Don Jesus returned to his community, when he was appointed for a public responsibility. Jesus explained that while he saw it both as an honour and an obligation, he also realized that refusing the charge would eventually have made it very difficult for him to return to the community at a later stage and still be respected as a full community member. Other community member obligations are easier to negotiate. For example, failure to participate in *tequios* and other community works is often sanctioned, for example by a 'fine' or, eventually, by loss of certain rights, which can then only be regained through compensation. People who know beforehand that they cannot participate, sometimes make arrangements to send someone else in their place, or, as is sometimes done in the case of migrants, monetary compensation is agreed upon with the authorities and sent from abroad or paid by family members in the community.

As with other farming practices, certain aspects of seed management seem to influence one's standing and reputation as a 'good farmer'. For example, knowing how to select and manage maize seed appears to be regarded as a valuable and central skill. People who do not produce their own seed are frowned upon; sometimes even regarded as lazy or not very good farmers. A discussion regarding this issue developed spontaneously during the men's focus group discussion in San Lorenzo Albarradas, during which the majority of the group quickly established that this applied to 'farmers, who don't know how to do their job properly, or who are lazy, do not select and save seed from the previous harvest' (see also examples in the section in this chapter on Sources of seed, Using own seed). Or note Liliana's comment, with a clearly reproachful tone to it: "Why do you ask for seed, if you have maize?!"

Likewise, in relation to mutual helpfulness, people, who are known to have plenty of seed, but who are nevertheless not willing to provide seed to others, are thought of as selfish. Living up to the role of the good farmer also implies not taking undue advantage of another farmer in need: one should be honest and not take advantage of a fellow farmer/villager (e.g. farmers Camilo, Pablo L. and Lorenzo). This is especially so if the person is in a difficult situation, such as lacking seed in the middle of the planting season. Rodolfo, for example, still held a grudge against the person who sold him seed, but used the occasion to press the price up, on one occasion where he still had land left to plant, but had already run out of seed (Chapter 9, section on negotiation costs).

This is consistent with data from the in-depth interviews, revealing what appears to be a strong cultural value in the study area associated with being helpful to others, as long as one is able to do so while covering one's own needs. Likewise, in connection to this, an important motivating factor for many seed providers is that the person requesting the seed has a genuine need for it. This was an aspect, which arose during almost all the focus group interviews. Finally, it should be mentioned that this also appears to be part of a common sense of reciprocity; as Don Jose pointed out during one of our conversations: "What goes around, comes around" (this will be treated in more detail in subsequent chapters).

Discussion of the 'good farmer'

As mentioned earlier, the study of local knowledge should also include consideration of moral aspects or values. Similar to the point that Marchand makes, about the kind of moral knowledge required to be a master builder in Yemen (2003), being a 'good farmer' in the study area also contains moral components. For example, there are aspects of 'the good farmer' which have more to do with social and cultural values than strictly with farming, for example, being helpful towards others, doing one's fair share of community work, taking part in reciprocity and exchange, and answering to social obligations in general.

With specific regard to farmers' maize seed practices, this is expressed in the custom of saving seed, as well as in relation to a common sense of social responsibility which includes being willing to supply seed to a fellow farmer in need, as far as one is able to, and one is generally pressed to do this and other favours in a way that does not take undue advantage of the other farmer's need.

Like much other performative knowledge related to seed practices, the issues of how to be a good farmer and community member, and gain others' respect clearly influence people's practices. This is often reflected in the strategic representation of local knowledge and in people's individual self-representation.

The way farmers present their local knowledge is influenced by the situation in which they find themselves and by whom they are communicating with and who else is present, but also by how the farmers would like to present themselves. Hence, farmers often do not only represent what they do, but also what they would like to be doing. For example, when describing particular practices or different aspects of community life, many had a tendency only to describe the 'good' version, that is one which is, if not ideal then at least acceptable according to local codes of practice and interaction. Meanwhile, the 'bad' or less acceptable version is always about other people.

Methodologically these are not aspects that are prone to surface, for example, in the application of formal questionnaires. Rather, these and similar issues are better illuminated through the use of more qualitative approaches.

The degree to which, in this research, farmers 'negotiated' their representation of local knowledge in a strategic way is difficult to estimate. The long term interaction with CIMMYT researchers (1997-2003), at different intensities and intervals and through a wide variety of modalities[30], as well as the transparent approach adopted by the institution with regard to research objectives and resources, no doubt served to establish a certain trust and credibility in the relationship between farmers and researchers. However, there is little doubt that some degree of negotiation did take place, both by farmers and by researchers, seeking to explore the possibilities of furthering one's chances of obtaining favours, information, prestige and so forth. Still, this does not necessarily affect research in a negative way - after all this is the usual way, in which knowledge processes and much communication between social actors take place (Box, 2000; Long, 1992, 2001; Pottier et al., 2003).

[30] The various forms of interaction between researchers and farmers included formal surveys, training sessions and field days, informal and in-depth ethnographic interviews and participant observation.

7. The role of collective action in informal seed exchange[31]

This chapter assesses the role of collective action in relation to farmers' maize seed supply by discussing the relationship between two important components of local farmers' maize seed practices in the Central Valleys of Oaxaca: (1) the social arrangements and (2) the seed transactions that ensure the supply of a diverse array of farmer varieties of maize to small-scale farmers in this region. The hypothesis examined here is that individual farmers participate in some form of collective action to ensure their access to a larger base of maize genetic diversity than they would be able to manage or maintain individually. This hypothesis was based on the findings of previous research (1997–2002) in the study area by the International Maize and Wheat Improvement Center (CIMMYT) and the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP) (Bellon et al., 2003; Smale et al., 1999). The aim of that research was to determine the possibility of improving maize productivity while maintaining genetic diversity.

The discussion presented here of the role of collective action in relation to farmers seed supply practices increases the scope of that study by examining the social arrangements that shape the seed and information flows on which farmers depend. The first part of the chapter is an overview of the literature on collective action and based on this an operational definition of collective action is developed for the purpose of this study. The data presented are related to the types of seed transactions, the social relations among the parties involved compared to the type of transaction, and finally the frequency of seed transactions is estimated. The discussion is then based on the findings compared to the operational definition of collective action, and it is argued that collective action does not have an important role in seed management practices in Oaxaca. It is also argued that social relations and trust are important and this is explored further in Chapter 8.

Collective action and crop genetic resources

The term 'collective action' is used to mean many things. Several authors have stressed the need for a clearer and more consistent conceptualization and operationalization of this concept as well as a more consistent terminology

[31] This chapter is published in a different version as a journal article: Badstue, L. B.; Bellon, M. R.; Berthaud, J.; Juárez, X.; Manuel Rosas, I.; Solano, A. M.; Ramírez, A. (2006). Examining the Role of Collective Action in an Informal Seed System: A Case Study from the Central Valleys of Oaxaca, Mexico. *Journal of Human Ecology*, **34** (2): 249-273.

(Nordvig Rasmussen and Meinzen-Dick, 1995; Meinzen-Dick et al., 2004; Poteete and Ostrom, 2004). Collective action has been variously defined as "voluntary action taken by a group to achieve common interests" (Meinzen-Dick and Di Gregorio, 2004), as "the coordinated behaviour of groups toward a common interest or purpose" (Vermillion, 2001), or as what takes place "when more than one individual is required to contribute to an effort in order to achieve an outcome" (Ostrom, 2004). Common to most of the definitions is the notion that collective action involves several actors and is directed towards a certain interest or purpose shared by them. However, different points of view exist as to what constitutes the collective, and to what extend the action reflects a common purpose. The collective may take several forms, ranging from a formal organization to the mere observation of a set of rights and responsibilities related to the use of a common resource (Meinzen-Dick and Di Gregorio, 2004). Furthermore, some who study collective action regard institutions of collective action as social entities acting as a homogeneous unit, whereas others hold the view that collective action is an aggregate or a coalition of actors. The latter view should not be mistaken for a notion of social actors as detached, atomized individuals, however; the point is to avoid regarding an abstraction as a material thing and not to assume "that organizations or collectivities such as social movements act in unison or with one voice" (Long, 2001).

Though good reasons exist for undertaking collective action, it has been argued that the objectives of the individual may not always coincide with the common good. Based on the notion of economic rationality in relation to collective action, Olson (1971) proposed that voluntary group action is unlikely to achieve or maintain a common good because it was rational for individuals to be 'free riders' (Steins, 1999). This view was further stressed in Hardin's seminal article 'The tragedy of the commons' (1968), where the author projected the over-utilization of open-access natural resources because of individual users' unsustainable exploitation of resources at the expense of others. Kimber (1981) later criticized this view for assuming that only 'free riders' are rational, and argued that a considerable number of individuals would still be willing to make the expected contributions to the common good, as long as the benefits they would receive in return would continue to exceed their costs. Various dimensions of cost-benefit considerations play a role in shaping involvement in collective action, such as the time required for benefits to accrue, where and to whom they accrue, as well as how evident or tangible they are. Nevertheless, individual, material self-interest is not the only motivation for purposive action. In a widely cited article, Granovetter (1985) interprets human action as "embedded in concrete, ongoing systems of social relations," which means that individuals are not 'islands' but share values and visions—such as reciprocity or a sense of fairness—that are rooted in their social context and hence help frame their individual decisions. Granovetter's position

has been supported by researchers throughout the social sciences (see Bourdieu, 2001; Long, 2001; Polanyi, 2001 [1957]; Portes and Sensenbrenner, 1993; Swedberg and Granovetter, 2001).

The concept of collective action has been used to describe and analyze the provision of public goods through the collaboration of multiple actors; the development of social movements; and issues of development and natural resources, in particular the management of forests, fisheries, rangelands, irrigation systems, and even pest control (Knox et al., 1998; Ostrom, 1990; Ravnborg et al., 2002Steins, 1999; Vermillion, 2001). To our knowledge, the concept has not been used to understand how crop genetic resources are managed locally and particularly how local seed exchange is organized.

Seed is a unique commodity because it has both private and public good characteristics (Morris et al., 1998). A particular bag of seed cannot be consumed by two farmers at the same time (rivalry), and in that sense the specific benefits derived from planting it accrues to the farmer who plants it and not to anybody else. Furthermore, it is relatively easy for the owner of the seed to supply it only to authorized users (excludability); hence seed can be seen as a private good. Seed can also be considered a public good, however, because in many circumstances neither rivalry nor excludability occurs. Seed is a crop genetic resource that contains the genetic code for certain traits of actual or potential value and contributes to the stock of genetic diversity. Anybody who has access to seed with the same genetic information cannot be excluded from benefiting from the coded traits. The use of this seed by one person does not diminish its availability to another person who has the same type of seed.

As a public good, crop genetic resources differ markedly from other natural resources that are public goods, such as water or land. The main problem for the maintenance of these sorts of resources is over-use. Crop genetic resources, however, are renewable, and the more they are used the better (Friis-Hansen, 1999). In fact, the continued conservation of many landraces and wild relatives is often entirely dependent on their use. This makes the issue of free riders very different in crop genetic resources compared to other natural resources, where over-use is a problem. However it does not eliminate the problem that society may under-invest in maintaining crop genetic resources. There still may be a considerable gap between the public and private benefits derived from genetic resources, and hence there is a need for some form of public or collective action. This characteristic of genetic resources has been well recognized, and public investments have been made in conserving genetic resources over the years, mainly in genebanks but lately also on the farm. What has not been explored is the potential role of collective action in genetic resource conservation at the local level, even though some interventions to support on-farm conservation are based, at least partly, on the idea of collective action (for example, the establishment of community seed banks or

of farmers' seed networks; see Fayissa, 2000; Jarvis et al., 2000; Lewis and Mulvany, 1997; Mazhar, 2000).

The limited literature available on informal seed systems agrees that they are mostly based on traditional social alliances and family relations, are cast in the context of mutual interdependence and trust, and often constitute dynamic and highly complex networks (Almekinders et al., 1994; Seboka and Deressa, 2000). These characteristics suggest that collective action could play a role in local seed supply. In the next section, I discuss why it is hypothesized that collective action may play a role in seed supply among small-scale maize farmers in the Central Valleys of Oaxaca, Mexico.

Previous findings and the argument for the hypothesis

As mentioned, previous research on genetic diversity was conducted in six communities in the Central Valleys of Oaxaca (Bellon, 2004; Bellon et al., 2003; Smale et al., 1999, 2003). It concluded that maize agriculture continues to play a significant role in farmers' livelihoods, food security, and the conservation of genetic diversity. A formal seed sector has yet to develop in this region, where almost all of the maize planted consists of landraces. The use of modern varieties is negligible, because farmers regard their long production cycle as incompatible with local rainfall patterns or their culinary qualities as unsuitable for traditional food preparations. Most farmers either save seed from their own harvest or get it from other farmers. For example, for 87.5% of the maize types planted, farmers saved seed frequently. However, for 47.3% of the maize types, farmers sometimes acquired seed from outside sources. This was particularly the case for specific types of maize. For example, for maize that did not have white grain, 64.9% of farmers resorted to outside seed sources, and for the red-grained *belatove* type, which is among the least common, 80% of farmers resorted to outside seed sources.

Research in the Central Valleys also showed that farmers were interested in diverse maize landraces. On average, farmers planted 1.60 varieties per household; the greatest diversity reached 2.13 varieties per household in one of the communities. Farmers valued different characteristics in maize cultivars; for example, out of 25 characteristics elicited (e.g., yield by weight, tolerance to drought, consumption characteristics), 7 were rated as very important by more than 50% of the male farmers interviewed, and 15 by more than 50% of the female farmers interviewed. Farmers were invited to assess a set of 170 varieties collected in the region by 'voting' for as many as they liked. On average, male and female farmers voted for 10.8 and 13.7 varieties, respectively. Farmers showed interest in many different varieties, not just a few, and even the most popular types accounted for only 36% and 54% of the votes of male and female farmers, respectively. During subsequent field days, where farmers could purchase seed of a representative subset of these maize varieties, they bought 2,726 kg of seed, evidence of their willingness to pay for seed

of a diverse set of the landraces present in the region (Bellon, 2004). Furthermore, by continuing to value and plant these landraces, farmers contributed to the conservation of maize biodiversity. Additional evidence suggests that through their seed selection and management practices farmers play an important role in generating the biological diversity observed in the study area (Pressoir and Berthaud, 2004).

Research in the Central Valleys also indicated that farmers who needed to acquire seed from other farmers experienced some difficulty in finding seed that met their requirements. First, a farmer has to learn who grows which maize variety and investigate the characteristics and performance of the maize of interest. Then he or she must make sure that the information offered is trustworthy and the seed is reliable. Finally, the conditions of acquiring the seed must be negotiated. It therefore appears that acquiring seed of diverse maize varieties under these conditions can entail risks and high transaction costs to individual farmers. If one assumes that there is a high probability of seed loss due to climatic conditions and poor storage,[32] then it is reasonable to hypothesize that a group of farmers could maintain more diversity than any individual, at a lower cost and with reduced probability of loss. There should be clear incentives for individual farmers to cooperate in providing seed and information for a diverse set of maize varieties—in other words, for engaging in collective action to support their seed supply. The basic ingredients for collective action are present: a group of farmers with a common interest and a benefit that accrues from a voluntary group action. Furthermore, in this region several traditional collective action institutions exist, such as the *tequio*[33] and the *guelaguetza*.[34]

To test this hypothesis, the following operational definition of collective action was developed, based on the notions of collective action reviewed earlier: *the actions of a well-defined group of farmers linked by a set of rights and responsibilities regarding the mutual supply of seed of a diverse set of farmer varieties.* Building on this definition, the following predictions were developed in order to examine the hypothesis:

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[32] This is reasonable because rainfed agriculture predominates in the area, with common occurrence of severe drought. For example, during the period of the study 1997-2002 there were two years with major droughts (1997 and 2001). Furthermore, drought and storage losses were identified as very important concerns by these farmers (Smale et al., 1999).

[33] *Téquio* refers to a form of comunal work in which one has to provide a service to the community. It can refer to comunal work in the interest of a certain group (for example, the local school), or it can be in the interest of the community in general (for example, construction and maintenance of roads, drinking water, infrastructure, or sewerage).

[34] *Guelaguetza* is a Zapotec institution of mutual aid between households. It can take place in many different situations and between different people and includes agricultural tasks, the roofing of houses, weddings, funerals, and religious festivals (Montes Vasquez, 1985).

- The existence of a number of people that identify themselves as part of a group that recurrently shares seed in some form (e.g., sale, exchange, or barter).
- Apart from the existence of a group, collective action could be inferred from adherence to a certain set of rights and responsibilities regarding the mutual supply of seed. This behaviour should be reflected in how seed transactions are conducted (e.g., specific practices or patterns associated with seed flows).
- The existence of collective action should depend on providing certain advantages or benefits to farmers compared to working individually. These could include lower transaction costs for acquiring seed or reduced risk of seed shortages.

Results

Saving seed from one's own harvest is the predominant practice in the study area. Previous research showed that 89.7% of all seed lots were saved by farmers from their own previous harvest, and the rest were acquired from other farmers (Smale et al., 1999). Only 24.2% and 20.9% of the farmers in the tracer study acquired or distributed seed, respectively, in 2001. Farmers in the tracer study said that their main reasons for acquiring seed were for experimentation and, to a much lesser extent, to overcome the lack of seed of their own. The main reason for giving seed to others was a sense of social responsibility. Farmers felt that they were morally obliged to give seed to the farmer who asked for it. Most transactions involved the exchange of money or seed, and some farmers said explicitly that they engaged in seed transactions to obtain seed or money, but often the reason to engage in the transaction was not the payment *per se*. Many types of seed transactions were identified.

Types of seed transactions

Informants described different types of seed transactions in detail during the ethnographic interviews and focus group discussions. Quantitative data on seed transactions were later gathered in the seed flow tracer study. Transactions were classified into seven categories, including 'other', which referred to infrequent, *ad hoc* transactions (Table 7.1).

The quantitative data clearly show the heterogeneity of transactions, although purchases account for half of all transactions. Focus group discussions and informant interviews provided detail on the many types of transactions and their individual variations. The hypothesis predicted a relatively uniform and clearly defined mode of transaction, reflecting adherence to a set of rights and responsibilities and a system of collective action. This was not what was found. In addition, although most informants remembered from whom they had obtained seed in the recent past, many had

difficulty recalling to whom they had given seed, which may explain the noticeable discrepancy between the number of acquisitions and distributions.

Table 7.1 Types and number of seed transactions.

Type of transaction	Description	Transactions		Acquisition		Distribution	
		#	%	#	%	#	%
Purchase	Seed that has been bought and paid for in cash	280	52.7	143	42.7	137	69.9
Inheritance	When parents or foster parents pass on maize seed to their children or foster children. This can be when the parents die, or when the children become independent of their parents and start to farm on their own	89	16.8	84	25.1	5	2.5
Exchange	Seed of one kind of maize is exchanged for the same quantity of seed of another kind of maize. Sometimes seed is acquired in exchange for grain, but then quantities normally vary, as seed has higher value than grain	52	9.8	37	11.0	15	7.7
Gift	In this transaction seed is provided without payment, whether monetary or in kind	49	9.2	32	9.6	17	8.7
Barter	This is an exchange in kind, i.e., maize seed is given for some other good of use to the seed provider (e.g., beans or coffee)	7	1.3	4	1.2	3	1.5
Borrowed	The seed provider hands over the seed to the person requesting it, while the latter in turn promises to give back the same quantity of seed of the same kind of maize once it has been harvested	3	0.6	-	-	3	1.5
Other	This category contains various other ways of obtaining seed: sharecropping[1], pepena (gleaning)[2], seed won in a lottery, maize-for-maize exchange, and seed acquired without the knowledge of the seed provider	51	9.6	35	10.4	16	8.2
Total		531	100%	335	100%	196	100%

[1] In this arrangement the owner of the land contributes the plot of land and the seed while the other contributes the labour. When the harvest is over, they split the harvest (in most cases equally) between the two of them.

[2] The practice of collecting one by one grains that are left over on the ground in the field after the harvest.

Most seed transactions carry no obligation beyond the immediate transaction, except for borrowed seed or seed given as a gift. The borrower must repay the seed, and gifts usually carry an implicit obligation to return the favour. Transactions involved different types of social relations between the seed provider and the recipient.

Types of transactions

Purchase is the form of transaction least dependent on the social relation between the two parties. In fact farmers in general say that this type of transaction can be done with any person. This is confirmed by the findings from previous CIMMYT studies in the region (Badstue et al., 2003). The exception

would be the farmers who will only distribute seed to other farmers if they are confident that this other person will observe the general norm of taking good care of the seed and be very careful not to lose it again (Badstue et al., 2003). Of all the farmers interviewed for this study in particular, none had any reservations with regards to selling seed to others, provided they could spare the seed and were appropriately compensated. In Frida's household for example, they cannot spare much maize, whether grain or seed, and in general they do not sell. Only if another family member or a very close friend asks, "but then just 2 – 3 kilos, no more" says Frida.

According to Pablo H. the person who needs to acquire seed will approach a possible seed provider. "Then he asks: 'Will you sell me a bit of maize seed?' One then says yes or no. If there is seed, then 'yes, only, you will have to pay so and so'. And if there is not, then one says 'I haven't got any [seed], but I have maize grain, but it is good, it is big, almost the same as the seed.' Then it's up to the other person".

It should be pointed out that in this region the price of local maize seed is about twice the price of grain (Smale et al., 1999), while the price of a commercial hybrid will be in the order of 8 -10 times the price of grain[35]. The issue of price negotiation is treated below.

Lending seed. Some types of seed transactions are normally only done with people the seed provider knows and trusts. The least common is lending, meaning that the seed provider hands over the seed and is promised by the receiver, that he/she will give back the same quantity and quality of seed, once the harvest is ready; or as Camilo put it: "You give it to me now, and when I harvest I will replace it for you!". This type of transaction is not very common and is usually restricted to very close friends, compadres[36] or kinship relations. Catarina, for example, was very clear on this: "Only with my mom."

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[35] Hybrid seed costs several times the price of local seed and can normally not be acquired in the communities. However, the price of the seed, - whether land race, hybrid or other, is still minimal compared to other production costs. That is, though probably the most important input, the seed is also one of the cheapest. Nevertheless, farmers often state the price of hybrid seed as a reason for not using it. Furthermore, farmers normally emphasize that hybrid varieties need more water than local maize landraces and longer time to mature. Finally, but maybe most importantly, for their own consumption these farmers prefer local landraces. When hybrids are sown, it is mostly for animal fodder or, in smaller quantities, for *elotes*, i.e. corn-on-the-cob, a popular snack.

[36] From the word c*ompadrazgo,* referring to a ritual kinship somewhat similar to the relation known elsewhere as godparents, through which close relations of loyalty, mutual help, reciprocity, and confidence are established and formalized. Often there is a certain degree of prestige associated with being asked to become someone's *compadre* or *comadre*, and in some ways *compadrazgo* can signify social capital (Cordero Avendaño de Durand, 1997).

Informants stress the issue of trust as very important in this case. "That's where people's friendships come in – not just anybody is going to lend you something like that. It will be because they trust you are going to give it back" says Pablo L. The reason is obvious: this type of transaction implies a risk for the seed provider that the receiver of the seed will forget, or not be able to fulfil his/her part of the deal, which is, to give back same quantity and quality of seed after the first harvest.

"Lending is done with family, people one knows well", says Pablo H., while offering an example of a typical dialogue: "'The problem is, I don't have the money! Will you lend it to me? Then, next year, I will pay you back.' 'Oh, well, you take it, then!'" Pablo H. adds: "It is not much used, very little. In my case, with people I know, who are good, who do pay, fine. But if it is somebody I do not know, I'd rather say that I don't have any (seed), so that they don't take my seed without ever paying me." Liliana and Teodoro's comments were similar: lending of seed is only done with family or *compadres*. Liliana recalls that in the past she would lend maize seed once in a while, but that some people never pay. Now she does not want to lend seed. She mentions a person who borrowed seed from her 4 or 5 years ago, and who still has not paid it back. "People don't remember that someone did them a favour", she says, "They don't say 'now when I harvest I will give it back to them'. No! Nothing, nothing!"

In San Pablo Huitzo lending seems to be even less common than in Zegache. This was emphasized with Frida's comment: "We are losing that custom of 'lend me the seed and I will pay you back when the crop is ready'. No. Here, he who doesn't have seed buys it."

Exchanging seed. Another type of transaction is exchange of seed. Josefina explains this transaction in the following way: "If you bring one almud of white maize[seed], we will exchange it for one almud of black maize[seed] – '*a cambio*' (in exchange). If one wants black, if one wants yellow, *belatove*…the colour one wants, you go and bring your maize(seed)."

Exchange appears to be less problematic than lending. The 'handover' and 'payment' takes place at the same time, and the seed provider avoids the risk of not being paid. Nevertheless, judging from these and other interviews many seed providers still have some reservations about exchange. The issue seems to be the uncertainty about whether the provider receives seed of a satisfactory quality in return for his/her seed. The majority of the farmers interviewed insisted, that exchange must be equal quantity and equal quality, for example, Camilo: "Seed I receive – seed I must give! The same. That's why it is called exchange!", or Liliana, when asked if it is possible to obtain seed in exchange for a comparatively larger quantity of grain: "No, no, no! The same! The same quantity!" In order to avoid this problem informants therefore explain, that this type of transaction is best done with close friends and kin

(*gente de confianza*) in which case one can rest assured, they will give a good product in return for what they receive. Furthermore, as mentioned elsewhere above, people often know each others' maize, ways of working etc. Therefore, by agreeing to do an exchange with someone one knows, the seed provider has at least some sort of idea of what to expect in return.

Catarina says, she will exchange seed if the maize the other person brings is of good quality (i.e. seed quality). However, if it is somebody she doesn't know very well, she prefers to sell the seed, especially after she had a bad experience as the seed provider in this type of transaction. Another woman asked her for a seed exchange. Catarina agreed and gave the señora the requested amount of seed, receiving an equal quantity of another kind of maize in return. When Catarina later took a closer look at the maize she had received, she realized she had been given ordinary maize for consumption and not the fine, selected quality characteristic of seed. "That's when you lose confidence" she says with a sceptical smile.

"Some people, although they have maize [seed], they don't want to do an exchange" says Doña Liliana. However, that is understandable, she adds, "Because they may give good maize [seed], while the other person will just give them '*maíz guioxito*' [Zapotec: small maize, i.e. for consumption]. Then it is better to sell" continues Doña Liliana, "so that they will pay [what the good one is worth]." Lorenzo's view is similar and directly to the point: "With people one trusts. Because then you know it is safe".

*Variations in the types of transaction***.** Of course, there are various exceptions and deviations from the general understanding of the different types of seed transactions. On other occasions during fieldwork in the Central Valleys for example, people mentioned exchange of grain for seed, but in different proportions so as to accommodate the extra value of seed as specially selected. During the interviews for the present study, most, but not all, of the informants rejected this concept. Pablo H. commented that sometimes, if the other person does not have seed to give, depending on who the other person is, he gives seed anyway in a 1:1 proportion, knowing that he would receive grain instead. "Here we know each other, we know who to give to and who not", he says.

Lorenzo sometimes practices another version of the exchange, giving seed in exchange for work. As an example, Lorenzo mentions his niece who came to him for maize seed this year. Her household is poor and when they came to the issue of payment, Lorenzo told her to forget about it, and that he was going to give her the two *almudes* (8 kilos). Instead he suggested that her husband come to work with him some day "When he has time, he can come and give a hand."

While selling/purchase does not seem to present a problem for most seed providers, obtaining the money to pay for the seed can be a problem for some

farmers seeking seed. They may have an advantage in exchange or lending instead of purchasing. However, unless the person asking for the seed is trusted, seed providers tend to prefer selling/purchase as the type of transaction, as this helps them avoid the risks of lack of payment or of receiving low quality kernels in return for their own specially selected seed. As Miriam said, "If it is somebody one doesn't know, it is better to sell it."

Regardless of the type of transaction, it seems that both seed receivers and local seed providers favour *gente de confianza* as their partners in seed transactions. The fact that people are *gente de confianza* does not exclude purchase as the type of transaction, in fact even among kin, purchase is a very frequent transaction. The relationship between the type of transaction and the type of social relation has been explored further in Badstue et al., 2003.

As reflected in informants' comments, for the person seeking seed there are furthermore important advantages in acquiring seed from someone known and trusted. Besides trustworthy information - a lot of which may already be known to the seed seeker - this enhances easy access and the possibility of preferential treatment.

Social relations

The in-depth interviews and focus group discussions revealed the categories of social relations frequently involved in seed transactions. These were later quantified in the tracer study (Table 7.2). The seed provider categories mentioned here do not constitute an exhaustive list, and each category could be divided into subcategories with overlaps and variations among them. For example, neighbours can sometimes also be relatives or *compadres*. This grouping reflects the informants' own classifications; that is, if an informant referred to a seed provider as an uncle, the provider was classified as a family member, though the person might also be a neighbour.

Family members and acquaintances are the most common sources or recipients of seed. Most seed transactions took place between people who already knew each other and shared a feeling of mutual obligation. Informants in focus group discussions and ethnographic interviews were not able to identify specific persons as particular seed-relations (except for researchers involved in the CIMMYT/INIFAP project, which included a seed distribution activity). The data regarding social relations do not provide evidence of farmers' involvement in specialized institutions or groups for the mutual supply of seed.

Table 7.2 Transactions by type of seed provider.

Social relation of seed provider	Description	Transactions		Acquisition		Distribution	
		#	%	#	%	#	%
Family members	This group includes blood relatives as well as affiliated relatives	247	46.5	177	52.8	70	35.7
Compadres	Very close relations, considered almost like family. When asked for help they cannot easily refuse (Beals, 1970)	25	4.7	13	3.9	12	6.1
Neighbours	It should be noted that neighbours often also are relatives or compadres	7	1.3	5	1.5	2	1.0
Friends	Includes workmates and people who belong to the same social organizations, church group, or comunal work group. Their role is significant both as a source of information and in terms of exchange or mutual help	38	7.2	22	6.6	16	8.2
Acquaintances	This group includes sharecropper relations and owners of neighbouring fields, plus other persons people know, but with whom they do not have close social ties	157	29.6	70	20.9	87	44.4
Strangers	Persons of whom nothing or very little is known. With strangers seed is usually sold for cash, as no relation of trust or familiarity exists	19	3.6	18	5.4	1	0.5
Others	Includes commercial seed vendors, shopkeepers, and government or NGO programs	38	7.2	30	8.9	8	4.1
Total		531	100%	335	100%	196	100%

Relationship between social relations and seed transactions

Trust is important for these farmers. Trust in the seed may often derive from a relationship of trust between the recipient and the provider. The data suggest a systematic relationship between transaction type and supplier-recipient relationship (Table 7.3). Inheritance and gifts are the most common transactions among kin. While purchase is common among all social relationships, it is clearly the most common among strangers and acquaintances. It seems that as social distance between supplier and recipient increases, the frequency of purchases increases and the frequency of gifts and inheritance decreases. In barter and exchange among acquaintances and strangers, informants also said that quantities were calculated based on market prices, but rates in transactions with kin or a close relationship might be more favourable. Clearly no particular type of transaction is restricted to a single category of seed supplier. Closeness of social relationship improves chances of preferential treatment—a finding that is consistent with Sahlin's (1972) findings on primitive exchange—but it does not determine the type of transaction. Most transactions

involve a feeling of trust between provider and recipient, either through consanguineous or affiliate kinship, *compadrazgo*, or friendship.

Table 7.3 Type of transaction by type of seed provider.

Seed provider's social relation to seed receiver	Purchase	Exchange	Other (incl. barter, borrowed, sharecropping)	Gift/ inheritance	Total no. of transactions
Kin[1]	90 (33 %)	27 (10 %)	25 (9 %)	130 (48 %)	272
Friends / Neighbours	34 (61 %)	12 (21 %)	7 (13 %)	3 (5 %)	56
People the seed receiver knows	126 (75 %)	10 (6 %)	26 (16 %)	5 (3 %)	167
Strangers	30 (86 %)	3 (9 %)	3 (6 %)	0 (-)	36
Total	280	52	61	138	531

1. This includes both consanguineous and affiliate kinship as well as *compadrazgo*.

In interviews as well as focus group discussions, informants emphasized that seed must be of good quality and appropriate for target production conditions and preferences. Some seed seekers also take into consideration the way the seed has been cultivated and what they know about the general quality of a supplier's work. These complex requirements make it difficult for those seeking seed to obtain appropriate information. The problem is exacerbated by the lack of a generally accepted and clearly defined nomenclature for local maize varieties, beyond broad categories such as grain colour, grain size, and growing cycle, as described in previous research in the area (Smale et al., 1999) and confirmed by both Zapotec- and Spanish-speaking farmers in the present study.

The easiest source of knowledge and trustworthy information, not surprisingly, is the people with whom the farmer already has close social relations. Farmers may already know the characteristics of varieties used by kin or close friends, and they can easily obtain more information. Conversations with family members, compadres, and neighbours, as well as observations of what other farmers were growing, were among the most frequently reported ways of obtaining information about seed used elsewhere in the community. Acquiring seed from trusted sources reduces the risk of obtaining inappropriate seed. Similarly, seed transactions can occur through many types of social relationships, so farmers are not dependent on a single supplier.

Frequencies of seed transactions

It is difficult to assess the frequency of seed transactions. Farmers do not keep records of such transactions, and estimates must rely on the memories of those interviewed. In the tracer study, seed transactions involving current cultivars were carefully registered, noting the year they took place and al-

lowing farmers to go as far back in time as desired. Recent transactions are more likely to be remembered than those from a long time ago. Notwithstanding these limitations, an estimate of the frequency of seed transactions was calculated. Table 7.4 shows the average number of transactions (acquisitions and distributions) per farmer for the three most recent years. The distribution between acquisitions and instances of providing seed is approximately the same, meaning that on average acquisitions occur 0.31 times every year and provisions 0.39 times a year (in both cases, approximately once every three years). In 2001 only 24.2% and 20.9% of farmers in the tracer study engaged in seed acquisitions and distributions, respectively. Seed transactions are apparently infrequent and do not involve a large number of farmers every year.

Table 7.4 Frequencies of acquisitions and distributions per year per farmer across most recent years.

Year	Average number of acquisitions/farmer/year	Average number of distributions/farmer/year
2001	0.31	0.39
2000	0.25	0.30
1999	0.23	0.24

Discussion

Three parameters were identified to analyze the presence of collective action among farmers to access seed of a diverse set of maize landraces: (1) a group of farmers, (2) rules or practices, and (3) derived benefits. Within these three parameters, the expected collective action was not found. First, if a farmer is a member of a group related to seed supply, one would have expected informants to be able to name particular people whom they rely upon to obtain seed time after time. This was not so. In many cases, farmers had trouble remembering the people with whom they had had transactions. While many seed transactions take place within prior existing social relations, most seed transactions do not involve any direct long-term obligations between suppliers and recipients, as would have been expected in a specialized organization or group. In other words, while individual farmers participate in groups, networks, or other organizations, none of these networks appear to revolve specifically around issues related to seed supply. In fact, it is when farmers experience problems related to seed that they draw on existing networks and social relations to identify possible solutions.

Second, there were many types of seed transactions. The diversity of transactions, even under similar circumstances, as well as their bilateral nature, suggests that there is no fixed procedure or otherwise clearly defined frame-

work for seed transactions, whereas a collective action scenario would involve a set of relatively well-defined practices. Seed needs, and hence transactions, do not seem to have a special status. They appear to be just another resource that farmers occasionally share with each other as part of the arrangements that make life possible in rural areas. The transactions are not governed by specific seed-related rules but are negotiated in the wider context of the social relation between the involved parties, so the particular details of the transaction may depend on many issues that may not be related specifically to seed. For example, the seed provider may give favourable treatment to those he considers very close relations, regardless of whether the issue is seed, a request for labour, or the loan of farm implements.

Third, no clear benefit seems to be associated with collective action. Part of the rationale for the original hypothesis was that seed loss was the principal driving force behind seed transactions and that collective action would reduce the problem of seed loss. The results showed that this is not the case—seed loss does not seem to be a major problem for these farmers—and a more important driver for acquiring seed is farmers' experimentation (Badstue et al., 2003). Clearly experimentation is a form of managing risk to acquire information, but it is related to curiosity and the search for new maize types that fit farmers' needs.

When farmers occasionally do obtain seed from other farmers, it is mainly from close social relations. There are good reasons for this. The cost of obtaining information on different varieties and availability of seed should be relatively low, given that it can be obtained as part of normal, frequent social interactions. The social ties give rise to trust and confidence that the seed has the desired characteristics and quality. At the same time, farmers often have first-hand knowledge of the varieties grown by relatives or friends. If the variety is grown in the same community under conditions similar to those in the farmer's own fields, uncertainty related to environmental adaptation is reduced. Finally, obtaining seed from a close social relation can often secure preferential treatment in the transaction. Close social relations are an important but not exclusive source of seed for farmers, however. Farmers do get seed from people outside their family circle, particularly through purchase. This variation in seed sources emphasizes the flexible and sometimes *ad hoc* nature of seed transactions among farmers.

Given the low frequency of seed loss, the current seed dynamics, in which each farmer maintains and reproduces one or more landraces and only infrequently engages in a seed exchange, appear relatively resilient in terms of maintaining local crop genetic resource diversity. Nevertheless, these dynamics depend on sufficient opportunities for obtaining seed from others when the need arises. At the moment this does not appear to be a major limitation, but future changes to the production system may alter this. For example, a sharp drop in the number of maize farmers, due to migration or

shifting to other crops, could limit the efficacy of the current practices for maize seed acquisition, particularly if individual farmers assume that others are maintaining certain seed types but nobody actually does so.

Farmers generally save seed from one crop cycle to the next. The need to acquire new seed is therefore occasional rather than constant or recurrent. The incentives for collective action may be low because the fixed costs may exceed the benefits, given the relatively low frequency of acquiring seed off of the farm. Rather than maintaining collective action for seed supply, farmers mobilize social resources on an *ad hoc* basis to solve a problem of seed shortage or to take advantage of an interesting opportunity for accessing new seed. Farmers' seed management in the study communities entails very low transactions costs, and the seed available through existing social relations is sufficiently reliable to prevent seed loss from being a major problem. Collective action would have to bring very considerable benefits to improve on this.

Within the three parameters identified for examining collective action, this was not found to be an important element in farmers' local seed practices. However, the mobilization of social relations plays a crucial part in relation to farmers' seed transactions, and the types of seed transactions are not random, but should rather be seen as the outcome of a negotiation which in turn may reflect certain rules within a social group.

The way collective action was operationalized here could be considered quite restrictive: it is confined to formal organizations with very strict group membership with the sole purpose of supporting seed flows. Its advantage, however, is that it provides very specific predictions to test. Even if these are rejected, it provides a rigorous opportunity to learn and reassess the hypothesis and associated assumptions. One could alternatively consider the existence of more informal institutions with rules that are not predetermined and that adjust to contingencies. These 'fuzzy' rules are more difficult to identify, but they are also more flexible and better suited to deal with risk and uncertainty (for example, crop failure or storage problems). Add to this the desire to experiment. Under these circumstances, it would be reasonable to conclude that elements of collective action in other spheres play an indirect role in seed exchange. One has to be careful, however, not to interpret any outcome of a negotiation in a social group as evidence of collective action, since this could dilute the concept to a degree where almost any activity that is not undertaken in a social vacuum would become a form of collective action.

From a methodological perspective, the findings presented here provide suggestions for other studies regarding collective action. It is important to identify certain minimum criteria to use as indicators for the presence of collective action in a particular context. Furthermore, the specific issue or problem in relation to which collective action is being considered, and the affected population, should be clarified at an early point in the research.

In the initial discussion of the concept of collective action, two approaches were identified: one which is based on the view of collectivities as social entities and another which starts from the perspective of the individual social actor. This study suggests that the point of departure of further studies of informal seed exchange should be the ways and processes through which individual farmers deal with issues and concerns related to seed and the incentives they face to act individually or collectively. One can hypothesize that collective action in seed supply may be quite important in circumstances where seed loss is frequent and widespread and where farmers acting as a group may increase their individual chance of accessing seed when needed (e.g., areas that suffer frequent, but patchy droughts so that not everybody is affected at the same time), or where there is an interest or need for seed of diverse crop types but information about this diversity may be very difficult to gather, as in environmentally heterogeneous areas with very low population density.

Several other issues also merit further study. For example, if collective action does not play a primary role in the organization of maize seed dynamics in these communities, then what does? How does informal seed supply actually work? What are the organizing principles that underlie local seed supply and help shape farmers' practices? Likewise, it would be interesting to understand the extent to which issues regarding the availability of and access to seed of a diverse set of maize varieties are perceived as a limiting factor and whether or not they influence farmers' transaction costs in relation to seed acquisition. This will addresses in the following chapters.

An important implication of the findings presented here is the challenge that certain issues would present to the development of a commercial seed sector in this area of Mexico. The demand for seed from external sources, whether seed of improved or farmer varieties, is small. Furthermore, these farmers have different needs and preferences and therefore require different maize types. One size does not fit all (or at least 'a few sizes do not fit all'). Interventions such as those practiced in the CIMMYT/INIFAP research project demonstrated farmers' interest in acquiring seed of other maize varieties. As part of that project, farmers purchased seed of many diverse maize varieties, but only in small quantities and for experimentation. As mentioned earlier, 2,726 kg of seed were sold to 371 farmers, but the average amount purchased was around 4.3 kg. To sell one ton of seed, almost 250 transactions are required. This may not be such a problem if the demand is only for one or two varieties, but if the demand is for many different varieties, the costs of selling seed may be too high for a commercial provider. Supplying seed under such circumstances may not be a self-sustaining enterprise, since commercial seed enterprises most likely have to supply larger quantities of fewer varieties to be financially viable.

Finally, interventions based on collective action to support farmers' efforts to maintain maize diversity in this region, such as establishing community seed banks, may not be successful. Interventions directed more towards individual farmers, such as the CIMMYT/INIFAP research project, or which build on local institutions that serve other purposes, may be more effective. This remains an area for further research.

8. Social organization of seed exchange

In the previous chapter the role of collective action in relation to farmers' access to seed of diverse maize varieties was examined. Though several indigenous institutions of collective action exist in the study area, for example, for communal works, patron saint celebrations, and household reciprocity, no evidence of institutions collective action with a special focus on seed was found. Nevertheless, social relations and trust were identified as playing an important role in farmers' seed transactions. In this chapter I will take a closer look at this. The point of departure is the notion of 'embeddedness', which is central to the analysis of social capital, trust, social networks, and the role of money in seed exchange. An examination of these issues furthers the understanding of the dynamics of seed supply practices in the study area.

The notion of embeddedness

A seed transaction is a type of economic practice where a good is exchanged between two parties. Discussion on how to analyse such economic practices can be traced back more than a hundred years to what was known as the 'Methodenstreit', which started out in the 1880's in Germany and Austria. Initially there was no clear division between economic and socio-economic analysis, and in some ways the works of Max Weber are an example of this (Swedberg and Granovetter, 2001). However, in the first half of the 20th century, economic analysis based on a view of man as an inherently utility maximizing being, often referred to as *homo economicus*, became the predominant framework of analysis for economic practices (Swedberg and Granovetter, 2001: 4pp). In both classical and neoclassical economic theory[37] the parties in an exchange are seen as *homo economicus*, a fictitious actor, who rationally promotes his self-interest and is only affected minimally by social relationships (Granovetter, 1985: 481). This approach has yielded useful insights when looking at the economy in general.

However, when studying economic practices among specific parties the limitations of this model become apparent (see Fafchamps, 1992, 2002; Fafchamps and Gubert, 2005; Granovetter, 1985, 2005; Gudeman, 2001; Kapferer, 1976; Keen, 2002; Keesing, 1981; Polyani, 2001(1957); Portes and Sensenbrenner, 1993). A main point of critique of economic theory has been the perception of the actors as 'atomised', in the sense that their participation and reliance on networks is ignored (Fafchamps and Gubert, 2005; Granovetter, 1985).

[37] Economic theory is not a unified body of theory. However, it is dominated by neo-classical views and unless otherwise stated, economic theory in the following refers to neo-classical economics.

Granovetter (1985) has termed this view as 'under-socialized'. Other points of critique include the lack of attention to cultural and historical contexts (Gudeman, 1978; Godelier, 1974; Keesing, 1981) and the lack of consideration of human emotions such as trust, anger, and spite (Fafchamps, 2002b).

Seed transactions may also be seen as taking place within a market. In economic theory a competitive market is often assumed to be made up of a large number of consumers and suppliers that, individually, do not influence supply and demand, nor the prices or the terms of the trade. In this idealized market model it is assumed that the actors have perfect information, and that there is no noticeable impact of social relations on the transactions undertaken. Here, it is important to stress that these idealized conditions are often not found in detailed studies of real markets. For instance, Granovetter (1973) shows the importance of personal networks in labour markets, and Geertz has documented the importance of imperfect knowledge and personal relations in a bazaar economy (1978). Moreover, Keen (2002) has criticized the neo-classical notion of market supply and demand models and shown that these are only valid when making assumptions which rarely apply in real world situations.

Another related body of thinking based on the notion of a universal rationality, is rational choice theory which builds on individualism and optimality, that is, the assumption that it is individuals who ultimately take actions, and that their actions are optimally chosen given the preferences, opportunities and constraints of the individual. Within sociology, a well-known exponent of this approach is James Coleman (e.g. Coleman, 1990). Despite their substantial influence on economic and social theory, these theories have also been heavily criticized, among others, for not being able to explain issues relating to collective action and social norms such as altruism, reciprocity, and trust (Scott, 2000a) as well as for ignoring culture and for a tendency towards incoherence and tautology (Ritzer and Goodman, 2003). Noticeable critical anthropological contributions have been made, for example, by Barth (1966) and Kapferer (1976), who were, themselves, influenced by the view of social actors as utility-oriented. Along with several others, they rejected the individualistic perspective and made an important point arguing that economic, and other, actions always take place in a social and cultural context[38].

In 1957, the seminal article "The Economy as Instituted Process" by Polanyi (2001(1957)) reinitiates the discussion of how to approach the analysis and understanding of economic phenomena as part of social life in a broad sense. In this article Polanyi criticizes what he sees as a predominance of economic values over other human values in capitalist societies. He addresses the difference between the formal meaning of the economic, that is, the need to make

[38] Thus, a view of man as reasonable and utility-oriented, but also influenced by the social and cultural context. This is sometimes referred to as 'bounded rationality'.

choices on the use of limited resources; and the substantive meaning of economics as man's dependence for his living upon nature and his fellows. The formal meaning is regarded by Polanyi as a reduced, predefined logical model built on a set of assumptions about scarcity and choice. Once the optic is broadened and economic phenomena are looked at as part of a broader social context, it becomes clear that the economy is "embedded and enmeshed" (p.36) in a variety of aspects and institutions which do not fit the formal model based on a specific set of market elements. Instead, in order to understand economic phenomena as part of social life, Polanyi calls for a substantivist approach which adds significance to history, values and motives, and which starts from "the way in which the economy acquires unity and stability" (p.36), that is, from real life situations rather than a predefined model.

Granovetter's interpretation of the notion of embeddedness as set in or enmeshed with a context of interpersonal relations and social networks later pushed the debate in another direction (Granovetter and Swedberg, 2001: 74). Granovetter (1985) demonstrates the limitations of both the utilitarian tradition on classical and neoclassical economics on one hand, and the argument of embeddedness on the other, which had lead to the impression that economic behaviour was heavily embedded in premarket societies but gradually became more autonomous with modernization. Granovetter's standpoint can be seen as a reaction to a tendency among authors to go too far in either direction: either too 'under socialized', that is, adhering to the utilitarian, 'atomized' notion of man as a rational being only minimally affected by social relations, or too 'over socialized', viewing human behaviour as widely determined by social relations, norms and values[39].

Granovetter's view is based on the idea of a social actor who processes information and experience and acts upon it, but whose actions should not be interpreted independent of the context he/she forms part of. He argues: "actors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for them by the particular intersection of social categories that they happen to occupy" (Granovetter, 1985). Instead, actors' purposive behaviour is *embedded* in concrete contexts, including systems of social relations, and must be analysed as such. This notion of embeddedness has played an important role in the social sciences over the last decades, not least in economic sociology and social networks studies, and the question of the influence of social structure on economic action and outcomes has received much attention (Granovetter, 2005; Granovetter and Swedberg, 2001; Gudeman, 2001; Long, 2001).

According to Granovetter, social structure affects economic outcomes first of all because social networks affect the flow and the quality of information.

[39] The issue of 'over-socialized', has also been discussed by Gudeman (2001), Swedberg (2004), and Wrong (1961).

"Much information is subtle, nuanced and difficult to verify, so actors do not believe in impersonal sources and instead rely on people they know" (Granovetter, 2005). Secondly, social networks are an important source of reward and punishment, which often have bigger impact when coming from others personally known to us and whose acceptance we seek; and finally, where trust emerges, it does so in the context of a social network (Granovetter, 2005).

DiMaggio and Louch (1998) have studied the kinds of purchases for which people most often use networks. Their study demonstrates the importance of social relations in consumer good transactions, particularly when risk or uncertainty about product quality is present. According to their findings, transacting with network contacts is effective because it embeds commercial exchanges in a web of obligations and holds the seller's network hostage to appropriate role performance[40]. DiMaggio and Louch (1998) find this is especially used in not-so-frequent acquisitions or transactions, where there is a perceived risk or uncertainty about product or performance quality. The authors therefore interpret the social embeddedness of consumer transactions as a response to risk, but point out that the decision to transact with a friend or fellow group member may be influenced either by the socio-cultural context or by tacit strategic understandings and personal interest (1998: 623).

While the influence of social relations on economic action is increasingly recognized, certain problems have also been pointed out in the embeddedness debate. Swedberg (2004) calls for a combination of social relations and interests[41] in one and the same analysis. He sees the concept of embeddedness as central to what has become known as 'the new economic sociology'. However, he notes that it does not theorize the role of interests and that it therefore runs the risk of over-emphasizing the role of social relations in economic life. In a somewhat sharper critique, Krippner (2001) argues that the notion of embeddedness has not contributed to the theorization of the market in economic sociology. Instead of promoting the integration of the analytical spheres of economy and society, Krippner believes that the embeddedness approach has contributed to the maintenance of the two as separate natures.

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[40] Uzzi who has looked at how social relations and networks benefit firms in their dealings comments in a similar fashion that the embedding of commercial transactions is beneficial because it invokes expectations of trust and reciprocity as the correct way of carrying out exchanges with others one knows well (Uzzi, 1999; see also Portes and Sensenbrenner, 1993; Uzzi, 1996; and Akerlof's classic "lemons study", 1970).

[41] Swedberg defines 'interests' as "the forces that drive human behaviour" (Swedberg, 2004: 2). He stresses that different kinds of interests "cannot be analyzed using the same metric" (2004: 10), but must be approached empirically, determining their nature through research, rather than assuming it before the analysis. According to Swedberg (2004), social relations are the means through which interests are acknowledged, realized and negotiated in society.

Beckert (2003) stresses the need for an alternative theory of action for the understanding of economic processes. He defines embeddedness as the "social, cultural, political and cognitive structuration of decisions in economic contexts" and sees it as pointing "to the indissoluble connection of the actor with his or her social surrounding". Nevertheless, Beckert points out that the notion of embeddedness does not provide a theory of intentionality and strategic agency of its own. What is needed, he claims, is a ".. theoretical alternative which informs us about what actors actually do to reach decision in complex economic situations" (Beckert, 2003: 773).

Beckert (2003) notes that when information is complex and imperfect, uncertainty influences the situation and actors have little means of knowing which of all courses of action will be the optimal. He therefore highlights the process aspects of action and wishes to focus on the interpretative acts by which actors construct perceptions of rationality intersubjectively in a continuous interaction between means and ends and the expectations of the 'generalized other'[42]. Purposive action is then analyzed as constitutively anchored in the actor's interpretation of the situation which he or she confronts.

The point of view taken here, is that the parties involved in seed transactions behave strategically. However, decisions on seed can be complex due to the lack of transparency of seed, which means information is far from perfect. Furthermore, they are not socially isolated and their strategic actions also include social elements such as reciprocity, trust, and obligations. In order to investigate this further I will draw on the literature on social capital, social relations and trust.

Different understandings of the concept of social capital

Over the last decades, the concept of social capital has become increasingly popular as a way of dealing with the social aspects of economic practice. Both in academic and in policy circles it has become the centre of much attention and debate. From a general perspective social capital has been described as "a metaphor in which social structure is a kind of capital that can create for certain individuals or groups a competitive advantage in pursuing their ends" (Burt, 2000). However, as pointed out by Foley and Edwards in a review article from 1999, there are considerable differences in the ways this concept is defined and operationalized. One major line of thinking on social capital builds on Coleman's early work (Harriss, 2002).

An exponent of rational choice theory, Coleman defines social capital as a variety of entities which consist of some aspect of social structures, and which

[42] Generalized other: the social group which constitutes the social context of the situation in question. According to Beckert (2003: 782) the generalized other, i.e. the expectational background, is always socially constituted.

facilitate certain actions of the individuals who form part of those structures. Coleman likens social capital to material and human capitals as resources available to humans to attain their ends. The main difference is that social capital is more intangible than the other forms of capital, since it is inherent in the structure of relations within which purposive action takes place.

Among those inspired by Coleman is Robert D. Putnam, whose work has played an important part in recent times popularising the concept of social capital (Harriss, 2002; Smit, 2001). Putnam defines social capital as features of social organization such as networks, norms, and social trust that facilitate co-ordination and cooperation for mutual benefit (Putnam, 1996). Putnam's work has focused particularly on issues of civic community and involvement and the role of social capital in these respects. One of his central ideas is that social capital, in the form of interaction and membership in networks, groups and associations enables people to build communities and to commit to each other, and thereby to establish the grounds for development and democracy (Fukuyama, 1995; Putnam, 1993). It is particularly his discussions on issues like these that have spurred interest and debate regarding social capital, both in academic as well as policy circles (e.g. Fafchamps, 2002a, b; Foley and Edwards, 1999; Fukuyama, 2001, 2002; Harriss, 2002; Portes and Landolt, 1996; and The World Bank's social capital web-site: http://www1.worldbank.org /prem/poverty/scapital/index.htm).

Various authors have criticized Putnam's work and those studies inspired by it (see Fine, 2003; Foley and Edwards, 1999; Harris, 2001; Portes and Landolt, 1996; Tarrow, 1996). Most notably, in his book "Depoliticizing development. The World Bank and social capital" (2002), John Harriss launches an extensive critique of Putnam's work and the use of it by the World Bank. According to Harriss, the idea of social capital, as used by Putnam and popularized through his work, is confusing and misleading to the point of obscuring the role of power. The notion that the scarcity or abundance of what Putnam calls 'horizontal, voluntary associations', which is understood to include all kinds of clubs and associations from choirs and football clubs to bird-watching societies, reflects the amount of social capital in the society and determines the level of economic development and democracy in a given society, is opposed by Harriss (2002) as are many other elements of Putnam's work on social capital.

Pierre Bourdieu, a cultural theorist and social constructionist, is another major contributor to the discussions on social capital. In the words of Granovetter and Swedberg (2001) "the work of Pierre Bourdieu …constitutes the earliest systematic social science treatment of 'social capital'". Bourdieu's point of departure is a view of capital in general as a broad term equivalent to resources or power. It comes in a number of different forms (cultural capital, symbolic capital and social capital to mention a few), which can be trans-

formed into one another under certain circumstances (Bourdieu, 1977, 2001; Harker et al., 1990).

Bourdieu (2001: 102) refers to social capital as "the aggregate of the actual or potential resources that are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group …". The volume of the social capital possessed by a given agent depends on the size of the network of connections he or she can mobilize, as well as on the volume of the capital possessed by each of those to whom the agent is connected.

In Bourdieu's understanding, social capital is a product of a continuous effort to establish (and re-establish) practices, and of individual or collective investment strategies, aimed at the establishment or reproduction of social relationships that are directly usable in the short or long term. Social capital must be reproduced continuously, for example, through the repeated exchange of goods, favours, information or acknowledgements. In this process the things exchanged become signs of recognition and through this process of mutual recognition and affirmation, the group and membership in it is reproduced.

In their work on social capital, economists Marcel Fafchamps and Bart Minten (2002) distinguish between two meanings of this term; 1) social capital as "a 'stock' of trust and an emotional attachment to a group or society at large that facilitate the provision of public goods"; and 2) social capital as "an individual asset that benefits a single individual or firm". Fafchamps (2002b) identifies the difference between the two meanings of social capital to lie in the origin of trust, which may arise from repeated interpersonal interaction - personalized trust; or from "general knowledge about the population of agents, the incentives they face and the upbringing they have received" - generalized trust. As Fafchamps explains (2002b), although it has been argued that trust and interpersonal relationships are conceptually and empirically different (Knack and Keefer, 1997 in Fafchamps and Minten, 2002), the two meanings of social capital can be seen as closely interlinked. For example, agents may form relationships with other agents to economize on transaction costs – the second meaning of social capital (i.e. personalized trust). However, this may lead to a situation in which agents expect others to behave in a trustworthy manner – the first meaning of social capital or generalized trust (Fafchamps, 2002b; Fafchamps and Minten, 2002).

Mobilisation of social capital

A common critique of the concept of social capital is the vagueness of the term and the way it is used in many studies simply indicates recognition of the fact that certain social resources influence certain economic or political processes. Some studies, however, do aim to go beyond this and attempt to elucidate the actual workings of social capital in practice. For example, Portes understands social capital as the capacity of individuals to use networks in order to mobi-

lize resources. 'The resources themselves are not social capital, the concept refers instead to the individual's [and group's] ability to mobilize them on demand' (Portes, 1995 in Long, 2001). In other words; for Portes, social capital is not something that 'is just there', rather, it refers to the process of mobilizing resources and must be activated in order to acquire particular significance. Two examples will be mentioned here to illustrate this approach: Portes' study of immigration (1997; Portes and Sensenbrenner, 1993), and Long's study (2001) of a Peruvian family over several decades.

Portes has used studies on immigration as an empirical basis for a more detailed analysis of social capital. Together with Julia Sensenbrenner (1993) Portes identifies 4 different sources of social capital: *Value introjection,* which refers to transactions that are guided by value imperatives learnt through the process of socialization; social capital stemming from individual *reciprocity exchanges*; and *bounded solidarity,* which differs from the previous two in that it arises out of the situational reaction of a class of people faced with common adversities; and finally, *enforceable trust,* by which is understood the circumstances under which individuals subordinate their present desires to collective expectations in anticipation of long term advantages by virtue of group membership.

Drawing on the literature on migration, the authors give various examples of *bounded solidarity*, for example, the case of the early Chinese immigrants in New York and San Francisco (Portes and Sensenbrenner, 1993). The severe discrimination and the generally difficult situation of this group gave rise to a shared feeling of 'otherness' and a strong sense of community among its' members, bringing people closer and creating among them a solidarity born out of the shared experience as 'outcasts' or being marginalised. In a similar way, the authors use other examples from migration studies to explain the nature of the fourth source of social capital, *enforceable trust,* which is based on the internal capacity of the community to sanction deviant behaviour (Portes, 1997; Portes and Sensenbrenner, 1993), According to the authors, favourable loans among Cuban immigrants in Miami would be granted, based only on the reputation and integrity of the loan-seeker as an honest and respectable individual. The risk of loans not being repaid is perceived to be very little in these transactions due to the fact that the trust involved is enforceable, that is, sanctioned in case it is not respected. Both in the short and the long term the loan takers depend so much on the goodwill of the community that they can not afford their reputation to be ruined and their trustworthiness to be questioned.

The other example to be mentioned here, of grounding the notion of social capital in empirical knowledge, is offered by Long in "Development Sociology. Actor Perspectives" (2001: 132). Here, Long examines issues related to social capital through the use of an extended case study of a Peruvian family over a period of more than 30 years. In particular, the author demonstrates

how social capital is used in specific situations and how its use may change over time. He does this by examining the situations that lead to the setting up or dismantling of different types of economic activities.

On the methodological side Long (2001) stresses the importance of detailed case studies to adequately analyse the ways in which social capital is applied in everyday situations. Likewise, he questions attempts to devise general principles for the generation of social capital. With regards to the concept of social capital, he ends with concluding, firstly, that membership in a social network gives no guarantee that a social actor will be able to leverage support and cooperation in a given situation, and secondly (and in line with Portes and Landolt, 1996; and Portes and Sensenbrenner, 1993), that the inclusion of some in a group or a network is also the exclusion or marginalization of others.

Social capital as an asset – and as a nuisance

Like the latter point, made by Long (2001), Portes and Sensenbrenner (1993) have also drawn attention to the fact that under certain conditions social capital can have a negative and constraining effect on individual action. Similarly, in the process of 'fleshing' out more clearly the concepts of embeddedness and social capital Portes and Landolt (1996) have discussed what they have called 'the down-side' of social capital. With this they refer to an aspect of social capital, which can have a negative and constraining effect on individual action under certain conditions (Long, 2001; Portes, 1997; Portes and Landolt, 1996; Portes and Sensenbrenner, 1993). For the economically successful individual this may show itself, for example, as a problem of free-riding or of social obligations accompanying economic success. Alternatively, community norms, which sometimes give access to resources, may under other circumstances restrict individual expression. Similarly, individual members of marginalized groups, who strive for upwards mobility, occasionally face the negative effects of social capital as an attempt from the group to exert levelling pressure in order to keep them in the same situation as their peers (Portes and Sensenbrenner, 1993: 127pp).

In this book I follow the approach to social capital, represented by Portes and Long. Thus I will look at social capital as something which must be activated or mobilized in order to become significant and be useful, for example for obtaining access to resources - or restricting others' access to the same, whether the resources in question are material or economic; or of a less tangible kind, such as knowledge or skills, representation or trust. In other words, the inclusion of some in a group or a network may also be the exclusion or marginalization of others. Furthermore, network or group membership in itself does not guarantee ability to leverage support and cooperation in a particular situation. Rather, social capital depends on the social actor's ability to mobilize social relations and networks for particular purposes. In

order to understand and demonstrate the ways social capital is brought to work in concrete, everyday social situations, including seed transactions, the analytical concept must be grounded in empirical evidence.

Social relationships in seed exchange

In Chapter 7, Table 7.2 shows that seed transactions in the study area predominantly involve family members, friends, neighbours, or acquaintances. Only a small fraction of the seed transactions are undertaken with complete strangers (3.5% or 11.1% if we join the categories 'strangers' and 'others'). The vast majority of the seed transactions reported are with people with whom prior social relationships exist. According to the data presented in Table 7.2, in 245 (or 47.5 %) of the 516 seed transactions registered in the tracer study, the seed provider was a relative of the seed receiver. If we add to this the transactions carried out with *compadres* (24) and 'friends' (33), the number increases to 302 or 59%. In another 157 of the transactions the seed provider was either an acquaintance or a neighbour of the seed receiver. In other words, a total of 459 or 89% of the seed transactions registered in the tracer study took place within the context of a social relationship which already existed at the time of the seed transaction.

According to Table 7.2 the seed acquisitions are carried out with family relations much more often than the distributions. This is largely due to the transaction 'inheritance', or the fact that among the respondents most people had inherited or received seed from their parents as is customary, for example, when a new couple starts farming independently. However, only some of them had, in turn, inherited or given seed to their children yet. It is also noticeable that the number of acquisitions is larger than the number of distributions. This is linked to some of the problems mentioned in relation to the methodology of the tracer study, in particular the problems of focusing on events in the past (see Chapter 2) and to a general tendency in the farmers to be better at recalling from whom they acquired the seed they are currently using, than to whom they may have distributed seed in the past. Finally these numbers are likely also to be influenced by a skewed possibility for detecting inheritance.

The trend towards using already existing social relationships in seed acquisitions is clear. However, in general this does not mean that farmers acquire seed from the same people over and over again. On the contrary, if they like the seed and decide to incorporate this particular maize into their 'maize repertoire', most farmers in the study area will strive to produce their own seed from then on. Though some people are known to produce and store more maize than others, and are sought out as seed providers by more farmers than others, informants in focus group discussions and ethnographic interviews were not able to identify specific persons as particular seed-relations (except

for researchers involved in the CIMMYT/INIFAP project, which included a seed distribution activity).

In Table 7.3 the data suggest a correlation between transaction type and supplier-recipient relationship. Inheritance and gifts are the most common transactions among kin, however, for all other groups monetary transactions are the most common form of seed transaction. Purchase is common among all social relations and it is predominant with strangers and acquaintances. As was argued in Chapter 7, it appears that closer social relations lead to an increased chance of a more favourable form of transaction from the recipient's point of view. Obtaining an advantage through the use of social relationships illustrates social capital at work in the seed transactions.

Mobilizing social capital in relation to maize seed acquisitions

Examining more closely the data pertaining to the group of seed providers with kinship relations to the seed receiver, the considerable difference between providers with kinship ties to the female household head and providers with kinship ties to the male household head attracts attention (see Table 8.1). The seed provider is a blood relative of the male in 178 cases and of the female in only 40 cases. This difference coincides with the traditional virilocal pattern in the region, and the norm that from the moment he marries and becomes independent from his parents it is the responsibility of the male to provide for the necessities of the couple and the members of their household. The traditional pattern of gender relations furthermore makes it more difficult for the male to accept help from his in-laws than from his own family. In terms of seed flow, it could be said that this favours the flow of maize seed of the maize varieties cultivated by the man's family.

Table 8.1 Seed provider's kinship relation to female or male household head.

	Parents	Siblings	Parents' siblings	Cousins	Siblings' children	Total
Female household head	28	5	3	0	4	40
Male household head	96	13	27	31	11	178

In general farmers would say that engaging in seed transactions, whether as provider or receiver, is a task that both men and women can do, just like in general both men and women take part in household seed production. Nevertheless, there seems to be a tendency for the person who goes to request seed, or any other favour for that matter, to approach people of their own sex. In San Agustín Amatengo, for example, the participants in the women's focus group agreed that they prefer to ask other women for seed. They approach them in their homes during a social visit. After chatting a little while about other things they openly ask the favour, explaining the motive for the visit. Still, they added, when there is much trust and they know each other very

well, like for example between close relatives, some people ask for the seed with even less preamble.

The bias towards people of one's own sex is hardly surprising in a setting where gender relations remain an important, and sometimes delicate, issue in social life.

Providing seed to other farmers

The flip side of acquiring seed is distributing it. As with seed acquisitions, for each distribution the informant was asked what had been the motive for providing the seed. Since the study's focus was on seed flow, only 'affirmative' cases in which a distribution actually took place were recorded, and no attention was paid on this occasion to the motives of *not* providing seed to other people, and it is possible that this implies a certain bias in the data. Nevertheless, of the 190 recorded events of seed distribution there was one case in which no answer was given as to what was the motive for providing seed. In the remaining 189 seed distributions the answers were distributed in the following way:

Table 8.2 presents the reasons given by informants in the tracer study for providing seed to others, and their percentage relative to the total number of recorded seed distributions in the seed flow tracer study, of which this question formed part. The reasons provided by farmers for distributing seed to other farmers can be divided into two main elements: (a) to help the recipient and (b) to obtain something in return, such as money, seed or other.

As shown in Table 8.2, in most seed distributions farmers' reasons for providing maize seed to others had to do with helping the recipient of the seed. Various informants stated they provided the seed because they had it, or had enough [seed], or did not have a reason to deny it to the seed receiver. In fact, this makes up the largest group of the responses, accounting for the seed providers' motive in more than half of all the distributions recorded (57.1%). This points towards the existence of a generally shared idea among farmers that one cannot refuse to help a fellow farmer asking for seed, if one has sufficient seed to share (compare to the notion of the 'good farmer', Chapter 6). For example, Don Lorenzo explains that he has told his wife not to deny seed to anyone who comes to ask for it, whether they want to buy it or ask for an interchange. "I can see that we have enough. 'Don't worry', I tell her 'God gave us'." [43]

The other theme involves obtaining something in return for the seed, mostly cash but also seed. It is important to note that most distributions with the purpose of obtaining money were associated with only two persons who are

[43] Bearing in mind Novellino's (2003) comments regarding informants' strategic representation of local knowledge, it is possible this response was chosen because it makes one look like a good farmer.

known to sell seed every year as a way of supplementing their income generating strategies. As pointed out elsewhere (Table 7.1 here, and Badstue et al., 2005), most acquisitions were purchases. Nevertheless, relatively few seed providers appear to be motivated exclusively by the aim of obtaining money in return. This, in turn, suggests that the motive for farmer-to-farmer seed distribution is rarely to generate a profit. Furthermore, seed is primarily produced for farmers' own use and not destined for sale. In addition, when farmers agree to sell a certain part of their seed to another farmer, the price he/she gets for it generally does not reflect the value they put on it.

Table 8.2 Reasons for distributing seed.

Theme	Reasons for distributing seed	(% of distributions)
Help the recipient	The farmer was asked for seed and had no reason to deny	57.1
	A seed interchange was asked for	3.2
	A barter was solicited	1.1
	For reasons of compassion	1.1
	Obligation	4.2
	For being kin	2.6
	Subtotal	69.3
Obtain something in return	Needed to obtain money	5.8
	Sell seed and/or grain	12.2
	To obtain seed	1.1
	Provide seed to sharecropper	7.4
	Subtotal	26.5
	Others	4.2
Total number of distributions		189

Overall there was a lot of similarity in the results from the different focus groups. For example, all the groups explained that seed is generally not just given away. For most farmers, giving seed as a gift appears to be restricted to close relatives and friends, "only to a brother" as the participants in the men's focus group in Santo Tomas Mazaltepec put it. However, in several of the focus groups the participants mentioned that sometimes seed would be given freely, if the person asking is very poor and has a real need for it. However, in that case the gift would normally only be of a small quantity, for example, a few kilos and only once. The women participating in the focus group in Huitzo agreed that it is difficult not to provide seed to a person who really needs it. However, at the same time they also confirmed that unless it is to a relative or close personal relation, it is not common to *give* seed away. Instead,

in order to help, one can for example grant the person asking for seed a barter and then be generous when measuring out the seed, for example, by giving the person a little extra.

In one of the groups (Men, Albarradas) it was furthermore mentioned that, one doesn't give seed to somebody who drinks, because it can be exchanged for *mezcal*. Also, in all but one community (Zegache) the participants confirmed the use of preferential treatment for close relatives and friends. For example, according to the men's group in Santo Tomas Mazaltepec, seed is mostly sold. However, they underlined that when sold to relatives it is often transacted at a lower price than normal.

The focus group participants in Valdeflores explained that people who need maize seed for planting generally first turn towards their relatives. If for some reason they do not have seed, then they will turn towards a friend, a *compadre* or a neighbour or eventually to an acquaintance from the community, because their seed is acclimatised, that is, adapted to the specific environmental conditions. As the farmers in one of the men's focus groups commented: As long as it is someone from the same community they will know each other and one's request is unlikely to be rejected. In so far as this holds true, this could also be an example of farmers' efforts to mobilize or activate social capital.

The women in Valdeflores pointed out that even though no payment is expected when seed is given as a gift, it is expected that the favour will be returned, whenever the seed provider needs it. Although this is not openly expressed it is implicit in the transaction. Also this aspect was present in the discussions of most of the focus groups. Indeed, it appears to be a general trait in most of the seed transaction types, that there is an implicit moral obligation on the seed receiver's behalf to return the favour if the opportunity arises (compare to the notion of the 'good farmer', Chapter 6). However, that said, the return favour does not necessarily have to be paid back in the same kind or quantity. It is simply just a question of mutual help and reciprocity. In relation to this issue, farmers on various occasions made reference to the saying '*favor con favor se paga*' [what goes around comes around]; and the female farmers in Valdeflores explained it clearly: "When people receive a favour, it should be kept in mind and returned when the opportunity presents itself. Otherwise one looks very bad and is categorized as an ungrateful person who takes advantage of other people, and one cannot expect help from the same person on another occasion." Farmers expressed similar views in the other communities, for example in Zegache, talking about borrowing seed and not fulfilling one's obligation to 'pay it back': "If people hear, just once, that you don't pay, they will no longer help you, because the trust [in you] disappeared."

Farmers described the exchange of little things and gifts as very common. This reciprocity appears to confirm the established relations of friendship, trust and mutual help. When the first cycle of reciprocity ends, the friendship

is confirmed. Once trust is established between the two parties, they explained, one can ask each other favours without being embarrassed. According to the participants in these discussions the exchanges can be about seed, food, loans in kind or in cash. It appears for example to be very common that the seed receiver gives *elotes* [corn-on-the-cob] to the seed provider, as recognition, when the maize reaches maturity. However, the 'compensation' [*recompensa*] as farmers sometimes call it when they have received a gift of something and want to give something back to the provider, can also be beans, *atole* or another dish; or, as in the case of Lorenzo and Juvencio, who are introduced later in this chapter, it can be to give a hand in some other work.

In relation to the custom of extending mutual help and favours, during the women's focus group discussion in Valdeflores, a particular person in the community was mentioned. Known for his beautiful and abundant maize, several people have acquired seed from him; however, the participants in the focus group discussion also described him as 'proud and egoistic', difficult to deal with and not inclined to do favours. As some of them said: "He doesn't need to do anybody a favour". The farmer in question is relatively successful in his endeavours and does not try to hide the fact that he knows this. He does not depend on the help of others, and therefore does not need to 'invest' in doing favours to others. Though the women who participated in this group clearly recognized the quality of his maize, it was obvious that none of them would feel comfortable approaching this person for seed. However, this comment also demonstrates the awareness, that in order to be able to count on others, should the need arise; one must also be willing to help others in need.

The issue of having confidence to approach another person for seed and that one's request will be granted, is related to the discomfort or awkwardness or, in some cases even shame, that farmers express directly or indirectly in relation to the prospect of having to request seed from another person. When discussing the implications of losing one's maize seed, the participants in one of the focus groups put as one of five points "the sadness of losing seed which one considers good and has kept for several years; and the discomfort of having to ask others for seed".

This aspect first came up in the initial qualitative survey and was since confirmed and explored further in the subsequent phases of the research. Farmers would refer to this element in very different ways, often using the third person: that is, their examples would be about someone else or about an imaginary person, as if preferring not to talk or think about oneself in that situation. Occasionally someone would describe the issue in quite direct terms, like for example in the women's focus group in Huitzo, where the participants explained that sometimes, when farmers cannot afford to pay for the seed at the time of planting they ask permission to pay the seed provider later. "However", the women pointed out, "they only do this with relatives, because they

are too embarrassed to ask this favour of someone else". In other words, as one of them added by way of elaboration: "Their pride is bigger than their need".

The data also shows a clear trend of farmers being more likely to ask favours, including the provision of maize seed, from people they know and have some degree of familiarity with. As was pointed out by informants on several occasions, if one has the means, it can be difficult to decline to help, in particular if the person in need is a family member. In other words: if one's brother, son or daughter asks for maize seed to plant, and one has the requested amount either in seed or in grain, one cannot refuse. Although this does not necessarily mean that one will not receive anything in return, it does indicate the strength of the norm of mutual responsibility – for good and for bad. On several occasions, both in individual and group interviews, farmers expressed annoyance with others whom they saw as taking advantage of their or other people's sense of responsibility. Many claimed this is a principal reason why the seed transaction types 'interchange' and 'borrowing' are no longer quite as common as farmers claim they were in the past. It seems seed providers reserve these types of seed transactions for 'trusted people' [*gente de confianza*], preferring a money payment transaction whenever the seed receiver is not a well-known or trusted person.

Table 8.3 Social relations and reason to provide seed.

Theme	Reason for distributing seed	Family	Com-padres	Neigh-bours	Friends	Acquain-tances	Strangers	Others	Total
Help the recipient	They asked	33	8	2	8	51	1	5	108
	A seed interchange was asked for	3				2		1	6
	A barter was solicited	1				1			2
	For reasons of compassion	1			1				2
	Obligation	8							8
	For being kin	5							5
Obtain something in return	Needed to obtain money	1	1		1	8			11
	Sell seed and/or grain	11	2			9		1	23
	To obtain seed	1			1				2
	Provide seed to sharecropper	2				12			14
Others	Others	3	1		2	1		1	8
Total		69	12	2	13	84	1	8	189

Table 8.3 illustrates the way in which the social relation is correlated with the motivation for providing seed. In 108 out of the 189 cases of seed distribution

the motivation was simply that they were asked. This suggests that people feel a certain inclination to provide seed when asked. However, in 89 of the 108 cases the type of transaction was sale, and the willingness to provide seed is also followed by an expectation to be paid for the seed. Obligation to provide seed is only felt towards family members, and if the driving motivation is the need to obtain money, then acquaintances are the preferred partners rather than closer relations.

Trust as a form of social capital

In daily life, trust is often used to refer to one's confidence in someone and the belief that they are honest and sincere and will not deliberately do anything that will hurt one in any way. In analytical terms, however, trust is a difficult concept to pin down. As pointed out by Rose-Ackerman (2001) the notion of trust implies confidence, but not certainty, that a person or an organizational actor will act in a particular way. It is a culturally determined and relational concept (Adler Lomnitz and Sheinbaum, 2004). It is culturally determined because its meaning varies across cultures and according to the context; and relational because trust always plays out in the relation between social actors and in many cases is what permits them to take risks in dealing with each other (Adler Lomnitz and Sheinbaum, 2004).

Though they are closely connected it is important to distinguish between honesty and trustworthiness: A person may be honest but incompetent at the same time and therefore not trustworthy. To deal with the issue of competence and the problems it can create with regard to the analysis of trust relations, Cook (2005) notes the usefulness, under certain circumstances, of viewing trust related decisions as a two-part decision: First, there is the question of whether I am confident that the other person can perform the task I am entrusting her with. Second is the question of whether I believe that the other person will honour the trust I place in her.

An overview of trust as an analytical concept has been offered by Rose-Ackerman (2001), in which she distinguishes between three overall categories of trust: *Generalized trust*, *One-sided reliability*, and *Reciprocal trust*. Generalized trust expresses a general psychological attitude and refers to a general trust in others as opposed to trust in specific, identifiable others to do particular things. In contrast to generalized trust, one-sided reliability refers to specific human or organizational interactions in which the question of trust is one-way. Rose-Ackerman mentions three subtypes. The first is 'encapsulated interest' (Hardin, 2002), which arises from one's belief that the other party is trustworthy because it is in his interest to be trusted, for example, a shopkeeper or business person who strives to be known as being trustworthy[44].

[44] Hardin (2002) exemplifies encapsulated interest as the situation in which two parties value the relationship they have with each other and which each has an interest in maintaining.

The second subtype is trust in a professional or an expert with specialized knowledge, for example, a scientist, doctor or lawyer. Finally, the third subtype is rule-based trustworthiness related to organizational functioning, that is, trust that formal rules or procedures will be followed in a neutral way, for example, in the provision of services or benefits. Meanwhile, reciprocal trust, as presented by Rose-Ackerman refers to specific human or organizational interactions in which trust is mutual or two-way and may be based on interest (e.g. 'two-way encapsulated interest'), feelings of affection, responsibility or shared values (2001: 535).

Though at first instance trust appears to be a good thing, it can in fact be viewed as both positive and negative depending on one's interpretation of the context. Drawing on both experimental work on cooperation and trust, and empirical work on social exchange under uncertainty and risk, Cook (2005) has argued that trust networks tending towards closure may, under certain circumstances, have negative effects on the degree of social cooperation in society, which, in turn, may lead to negative implications for processes of change and economic development - a point which strongly contrasts with Putnam's claims regarding the effects of social capital (see above).

Personal trust relations among friends and families can undermine trust in institutions, for example, when public officials favour personal relationships instead of following normative rules of impartial and equal treatment of all[45]. Furthermore, it has been pointed out that corrupt regimes normally require some type of trust in order to maintain faith that each party will perform certain acts, and not turn the other in to the authorities (Cook et al., 2002). In a similar way criminal gangs and organizations, for example, the mafia and smugglers, generally depend on a high level of interpersonal trust. On the other hand, in the face of illegitimate governmental powers, organizations

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Each party therefore acts in a trustworthy manner towards the other in order to inspire or maintain trust as a means of ensuring the continuation of the relationship. Each party's interest 'encapsulates' or includes the other. While this definition of trust in this form is simple and precise, it has been criticized for implying a risk of reducing the concept of trust to a question of mere individual profit maximizing, e.g. as soon as people's incentive structures change, they will betray hitherto trusted partners if their utility increases by doing so. Rothstein (2000) for one, claims, that the results from experimental research show that such a calculative notion of trust does not conform to empirical findings. Furthermore he points out that Hardin's notion of trust lacks the ability to account for the variation in the meaning of trust across different societies. I tend to agree with Rothstein in so far as Hardin's 'encapsulated interest' is used as a definition of trust in a general sense. However, I consider Hardin's concept of 'encapsulated interest' useful when applied, like Rose-Ackerman does, in a narrow sense as a sub-category of a certain type of trust.

[45] According to several authors, this type of conflict is a particular challenge in rapidly changing societies where people commonly relied on personal relationships rather than an indifferent or weak state (Adler Lomnitz and Sheinbaum, 2004; Cook, 2005; Portes and Sensenbrenner, 1993; Rose-Ackerman, 2001).

based on trust and interpersonal solidarity can generate resistance and change (Rose-Ackerman, 2001).

Trust in relation to uncertainty and risk

Several studies on the role of trust link the emergence of trust and trust networks to conditions of risk and uncertainty (Adler Lomnitz and Sheinbaum, 2004; Cook, 2005; Cook et al., 2002; Rose-Ackerman, 2001). The presence of trust can provide a more secure environment for transactions and social exchange. This is, for example, the case when a reliable contract law is lacking and no enforcement mechanisms exist, as demonstrated by Cook et al. (2002) in a study of trust and exchange networks in a context of national instability and transition. The authors show that when uncertainty and risk are high, transactions are likely to occur primarily among people who know each other well, as a way of limiting risks.

Others have reached similar conclusions under different circumstances. The above mentioned study of consumer transactions by DiMaggio and Louch (1998) showed that uncertainty about product characteristics or performance quality leads people to prefer sellers with whom they have non-commercial ties. According to DiMaggio and Louch the exchange thereby becomes embedded in a web of obligations, which in turn functions as leverage for appropriate role performance in the course of the transaction. In addition, they note that exchange frequency appears to reduce the extent of within-network exchanges – that is, people's use of networks is more common in not-so-frequent acquisitions/transactions.

Seed exchange and trust

Seed is non-transparent and for the person looking for new maize seed it is difficult to assess how the seed will perform in the environment where it will be planted, what the production characteristics are, for example in terms of quantity and quality of grain and fodder. In addition the germination rate and health of the seed is difficult to assess by merely looking at it. Hence, for the farmers in this study, trust is a central issue in seed transactions.

In general a strong concept of *gente de confianza* [trustworthy persons] exists among the farmers in this study. The term 'confianza' can imply both trust and confidence. It can refer to different categories of people, such as kin, friends or acquaintances, whom the speaker considers as trustworthy and/or feels confident with. For seed providers the issue of the seed receiver being a trustworthy person appears to be relevant in relation to certain types of transactions, in particular those that involve other forms of 'payment' than money. In this case the seed provider must trust the seed receiver that he/she will uphold his/her part of the deal.

For the seed receiver the issue of the seed provider being *de confianza* is relevant in relation to several issues. On one hand, there is the issue of informa-

tion regarding the traits and quality of the seed acquired. On the other hand, as informants pointed out several times, it is preferable that the seed provider is someone who the seed receiver believes will grant the request and that he/she feels confident to approach, especially in circumstances where the person seeking seed cannot pay for it with money and therefore depends on negotiating another type of transaction. This consideration is most likely linked to what I have called the idea of the good farmer (see Chapter 6), which refers to an ideal embodying a series of aspects that are highly valued in others by the farmers in this region, and which includes issues such as personal integrity, independence and respect. With the high value on independence and the ability to look after one's own and one's dependents' needs, comes, for many, a feeling of awkwardness and embarrassment when they find themselves in a situation where they must ask others for help. Furthermore, this is especially the case when the item one needs is as crucial to one's livelihood as seed is to a farmer.

When asked who to interchange or borrow seed from, Camilo said: "Ah well, with someone who… somebody one trusts. Someone you feel confident with, because not everybody is willing to do that kind of favour, only people you know. Because one isn't friends with everybody, right? One knows more or less who will do that kind of favour."

Though reciprocity can sometimes lead to the establishment of trust relations, it is unlikely that seed exchange alone, as it takes place in the Central Valleys of Oaxaca, constitutes an efficient basis for building trust. With an average frequency of once every three years (see Table 7.4), - and not necessarily with the same seed provider/recipient every time, maize seed transactions among the farmers in this study simply do not occur often enough, to be an important source of trust in itself. As argued by DiMaggio and Louch (1998) transactions characterized by uncertainty and low frequency are often undertaken with partners with whom one also has broader ties. This is in accordance with the findings of this study: seed transactions in the study area are relatively infrequent and the quality of the product in question is difficult to assess. As in DiMaggio and Louch's study (1998), the majority of the transactions recorded in this study are between people with prior social relationships.

If we consider the three general types of trust proposed by Rose-Ackerman (2001), (Generalized trust, One-sided reliability, and Reciprocal trust) we find these co-existing and present to different degrees in relation to farmers' seed transactions.

Generalized trust

Generalized trust is exhibited towards other farmers in the community in general. For example on several occasions informants clearly saw it as inconceivable that other farmers from the same community would, knowingly, provide

them with seed of low quality. However, as is clear from the interviews, this does not mean that farmers trust all other community members equally. Although on a broad scale farmers express general trust in their fellow villagers, each individual may have stronger feelings of trust, including reciprocal trust, with certain people in particular [*gente de confianza*], or, for that matter, feelings of actual distrust towards particular persons in the community.

> Over the years Camilo has planted various different types of local maize landraces. Like most other farmers in San Pablo Huitzo, he saves seed every year of the maize varieties he wants to keep. Whenever he has tried out a new maize variety, he has acquired seed from other farmers. He has never bought seed at the market or from an agro-stockist. Discussing seed acquisition and the question of seed quality Camilo says: "Say, if you come to buy seed from me, and I know that you want this maize to use it for planting, in that case I cannot sell you bad seed! Now, if I don't have any fresh [buena] seed, I will be honest: 'You know, look… I am sorry, but I don't have any fresh seed. This is what the seed I have is like, like this. If you can use it, take it and if not, then don't.' So, like that…Here we know the people who can be trusted, … – How can I sell you something that doesn't work? Next moment, you'll be coming back to complain. To ask why I sold you bad seed?"
>
> Asked about transactions in the marketplace, Camilo continues: "Ah!", he exclaims "In the market place – Oh yes! There, there is nowhere to complain, there is no way one can complain..! And even if you remembered who sold it to you – how are you going to find him?! And there, they show you what they are selling to you – so, the guy who sold it to you can say, that he is not to blame. Whereas here, no, because if they come here, and I sell them something that doesn't work – Ah! They will complain! But, like I tell you, it has never happened to me, because here, we are people who… Yes well, we don't like to cheat! One must sell things that are good."

Like farmers in the other study communities, Camilo obviously regards it as much more risky to buy seed in a shop or at the market in Etla or Oaxaca, than to acquire it locally in the community where people by and large know each other, and will have to live with the consequences. Most of the farmers in this study share his view. For example, independently, Pablo, said very much the same as Camilo regarding acquisition of seed from other farmers in the community: "Well, in general there is trust among people, among fellow farmers, right. And one will say: 'Well, look, this seed was harvested two years ago', right - as a precaution. 'If you want it, take it, but I am not sure, how it will develop'".

Pablo continues, making reference to a couple of other farmers in the community, who are known to plant and harvest a lot of maize and therefore sometimes have maize left over from previous years: "Or sometimes people themselves will tell you beforehand: 'I no longer have maize from two years ago. If you want – I only have fresh [maize] now. And truth is, they really do have good maize. But sometimes it's the distrust. One doesn't have maize [seed], but 'what if they sell me the one from two years ago…'".

One-sided reliability

When it comes to acquiring seed at the marketplace or from an agro-stockist, the question of trust appears to fall more or less under the category of one-sided reliability, as a mixture of encapsulated interest on one hand, that is, the assumption that the vendor will act in a trustworthy way because he is interested in being known as trustworthy; and trust in someone with a specialized knowledge on the other hand. In this situation where no previous relations exist between the seed provider and the buyer, a strong asymmetry of information exists due to the difficulty of assessing the traits and the quality of the seed by mere visual inspection. As a result, the farmer has to rely on the information provided by the vendor of the seed. Some farmers recognize the significance for the vendor of acquiring a reputation as untrustworthy, and assume that he will have an interest in behaving in a trustworthy manner in order to avoid this. Nevertheless, in general, the farmers in this study have very low trust in market vendors and shopkeepers in the nearby market towns and the city of Oaxaca, and they tend to be suspicious about the motives of the vendors. They have little confidence both in the information about the seed provided by the vendors, and in the quality of the seed. A few examples of their comments serve to illustrate this:

> "Oh yes! He wants to sell – he will say anything!", says Fiona about the typical market vendor. "If the seed doesn't germinate? Then it wasn't good seed! And then now, afterwards, they will say: ' Ah, well – it's because you didn't fertilize!' – And with that, the one who sold you the seed escapes. That's it!"
>
> "In the city it is much more commercial" says Pablo. On weekly market days, a considerable number of vendors are in fact farmers who travel to the market to sell their produce. "They are there to sell. And as soon as they finish, they are off. But here it is different."
>
> Francisco's comment on the issue of acquiring seed at the market was similar: "It is difficult…sometimes people can cheat. They will say 'This seed will produce! It will give!' but when the time comes… if one plants and then when you want to harvest – nothing! It didn't produce'……"

> Catarina's experience from one time when she bought maize seed at the market illustrates farmers' doubts with regard to acquiring seed from unknown sources: "I felt like trying out the type of [maize] seed from San Martin. It wasn't that I had lost my own seed; it wasn't that I didn't have seed, mind you. I felt like trying this round, fat maize that they have. But I got so mad! I bought the palomilla! It was in the market in Ocotlán, where the people from San Martin come to sell their goods. That's where I got it. I took it home and I left it there in its bag. When I was ready to plant I opened the bag, and a cloud of *palomilla* came out! And by then it had contaminated the whole house! It was full of *palomilla*! I still planted the seed, but only a few germinated! But it looked good!" [when she bought it].

Despite his formal training, Lucio has not lost touch with the issues of ordinary small-scale farming. "'Thing is, you didn't plant it properly..!'" he says in a know-it-all-voice, mimicking a shopkeeper. "With that they go free, even though I know that you planted it correctly, that you irrigated on time etc….".

Data does not allow any judgments as to whether or not farmers' doubts and suspicions are justified. The point here is that farmers perceive the formal seed sector and other non-local seed sources as less trustworthy and as such also more risky.

Reciprocal trust

The most important form of trust at work in the farmer-to-farmer seed exchanges in the Central Valleys of Oaxaca is without doubt what Rose-Ackerman calls reciprocal trust. Oaxacan popular culture has a strong tradition of reciprocity and mutual help, aspects which are most clearly expressed in the concept of *guelaguetza* as described in Chapter 4. As mentioned there, though no longer common in its traditional *guelaguetza* form in many communities, principles of reciprocity and mutual help generally remain a strong characteristic of social life. This is evident most of all among kin and in the significance of *compadrazgo* relationships, but also in the various village life institutions, in which everyone is expected to contribute his or her share, such as *tequios* and *mayordomías*, and where, often, the rotational aspect exposes the individual and his/her performance to that of previous and future post-holders.

More often than not, the seed transaction is just one of several kinds of exchanges taking place between the two parties, thereby forming part of a diverse flow of favours, services and mutual considerations. Social networks and personal relations with different people can help make life easier and provide relief, for example, when problems or emergencies arise, when re-

sources have to be amassed or work piles up. The following is an example of this kind of mutual help relation between two households.

Don Lorenzo is an industrious farmer. He obviously enjoys his work and is known for his meticulous tending to his crops and for his beautiful black maize. Except for his youngest daughter Dinia, all his children have left home, and three of them, including his only son, are in the US. Although both Dinia and her mother help with the farm work Lorenzo sometimes has to hire extra hands. While we are degraining black maize in his storage room he makes a point of explaining the value of being able to count on other people and of cultivating one's relationships. "You know the young woman who came by a little earlier", he says, "When she comes for something, sometimes I don't have it. She comes: "Can you lend me 50 pesos?" If it is there, she gets it, if not… well. The other day she came to buy maize [grain]. And she said, 'I will pay you, I will find a way to'. 'No niece', I said, 'forget it, look at it as a gift,' I say. We'll see, maybe your husband can work with me. See when he has time, maybe he can give a hand with whatever I am doing.'" Lorenzo kicks the pile of ears, so I can reach better, and we continue. "They are so grateful. And this Juvencio, well he works with me. I don't say anything, if I need help, I just send the girl over to say, if by any chance he has time some day. Then he lets me know what day he will come, then he says 'I'll be there that day', and that day --!!" [Lorenzo makes a gesture in the air to signal that Juvencio will be there exactly as promised]. "That is why, as I tell you, for my part – if only all were like that or would help each other! Those who don't have – one has to help the poor people! But, just like we are talking and as I just said, there are some who just take what is there and leave. They don't even remember. Well, with those people, it's just the once. Next time: no! That's where you lose confidence."

The majority of the local maize seed exchanges in the study communities take place within a broader framework of social relations. That is, the exchange of seed is just one out of many possible ties between the people involved. As noted above, 89 % of the seed transactions registered in the tracer study took place within an already existing broader social relationship with a certain degree of familiarity, and therefore - it seems reasonable to assume - of some degree of mutual trust.

In general there was strong coherence between the results of the various data gathering activities. The importance of trust and relations of trust in connection with seed transactions was indicated in the initial qualitative survey and was confirmed and clearly highlighted in the focus groups, which, in turn, strongly coincided with the pattern indicated by the tracer study. Both male and female focus groups in all the six study communities emphasized the role of trust both with regards to seed acquisition as well as seed distribution, which, in turn, largely coincided with data from the other interview activities. The key issues concerned were: the quality of the information about

the seed and its varietal traits and qualities; the issue of the trustworthiness of the other party, that is, whether or not he/she can be trusted to uphold his/her part of the deal; and finally, the issue of confidence to approach the seed provider and the chances that he/she will be responsive to one's request.

According to the informants, no contract or formal deal is made in seed transactions. Rather, the problem is discussed and an agreement reached. As indicated above, it appears that within a trust relationship one can solicit seed in a relatively relaxed and open manner. For example, farmers explained that when in need of seed, their first choice is to go to people they feel very confident with. This is also reflected in the way most of them did the socio-drama (see Chapter 2, under focus groups). In the men's focus group in San Lorenzo Albarradas the participants identified *gente de confianza* as including parents, siblings, brothers and parents-in-law, friends and cousins.

Liliana likes to exchange maize and has done so many times in the past, both grain for grain and seed for seed. However, nowadays, except with family and people she knows very well and trusts, she prefers money payment when people ask her for seed. "Yes, because there are some people, you give them good maize and they give old maize. And that is why people don't interchange, because sometimes it is like one day at Catarina's place, a woman came and [Catarina] exchanged [seed with her]. [The other woman] gave her grain and Catarina gave her seed. That's why, that's where you lose confidence. Then one doesn't want to interchange."

Lorenzo coincides: "Not all select maize the way I do. I take these good ears, only the good ones. And people bring this….like this that I am degraining here, mixed like this. This won't do, no, it is not… -Why would I tell you this is seed? We only select from the good ears, look, only like this one. But the maize people bring! That's why many don't want to interchange. They prefer your money, that's it. …If only it would be as you say, seed maize for seed maize."

The role of relations of trust and mutual reciprocity in relation to seed acquisition

The significance of relations of reciprocity and trust is also put in perspective in relation to the question of who has trouble acquiring maize seed. This formed part of the topics covered in the focus group discussions. In all the groups except one the answer was: those who have no money and who have no relatives or other close relations that are able to help them out. In the last focus group, the participants, who all claimed not to have lost seed for many years, insisted that every body has family and/or friends and therefore it is not difficult for anybody. In any case it confirms the impression that for the farmers in the study communities, reciprocal trust relations are very important in relation to seed acquisition in general, and in particular if the seed receiver does not have money to give in return for the seed.

It should be mentioned that, though in general family ties are very important in this region and usually are amongst the social relations with whom farmers in the study area manifest most trust, responsibility and mutual reciprocity, informants did point out that sometimes people do not get along with their relatives and may even have conflicts with them. This was for example mentioned by the male focus group participants in Zegache, when someone commented that the important thing is not always kinship ties, but rather a friendship tie that one has with certain person, kin or not. Still, as the data from the tracer study show, relatives is the only group in which buy/sale was not the most frequent seed transaction, and for some of the farmers, kinship relations are so important that they are appalled even at the idea of selling seed to one's own family. For example, one of the female farmers from San Agustín Amatengo exclaimed: "How am I going to sell it [seed] to my sister?! When one has, one gives her, and when she has, she gives us!".

At the same time, it appears that part of the seed transactions take place at the market, in other words not with other farmers from the same community, in order for the seed receiver to avoid the various implications of acquiring seed from other farmers in the community, such as the norm of reciprocity and the feeling of 'indebtedness', or the 'stigma' of seed loss. For example, when discussing different ways of obtaining seed with women in Amatengo, Doña Ester mentioned that, in order to avoid the awkwardness of asking others for seed in the village, one can go to the market ["*Si uno no quiere mortificar aquí, va uno al mercado*" (If one doesn't want to become indebted here, one can go to the market)].

A social network perspective

A social network can be defined as a set of people connected by a set of social relationships, for example, friendship, co-working or information exchange (Garton et al., 1997). In the late 1950s and the 1960s, social network analysis started to take form, among others, through the work of a group of Manchester anthropologists including John Barnes, Elizabeth Bott and Clyde Mitchell. Inspired by Radcliffe-Brown's ideas concerning social structures and networks of relations as the basis of societies, they analysed the networks of social relations surrounding individuals[46].

Interest in social network analysis has seen a remarkable growth over the last decades, and a considerable body of literature now exists (Cook, 2005; DiMaggio and Louch, 1998; Freeman, 2004; Granovetter, 1983; Pescosolido and Rubin, 2000; Scott, 2000b; Smith-Doerr and Powell, 2005; Wellman and Wortley, 1990). The approach focuses on the patterns of relations among peo-

[46] See, for example, Barnes (1954) on the networks of Norwegian fishermen, Bott (1957) on families and social networks in London, and Mitchell (1969) on the networks of migrants in urban Zambia.

ple and organizations. It facilitates the analysis of the ways people acquire information and other resources through direct and indirect network ties, and seeks to explain the effects of these relations.

The role of networks in social and economic life has received particular attention. Social relationships and networks can facilitate access to information or resources and furthermore often provide opportunities to bypass formal channels. Networks can therefore have considerable influence on economic outcomes (Smith-Doerr and Powell, 2005).

According to Smith-Doerr and Powell (2005), the economic sociological literature on networks falls into three categories: Networks as informal relationships influencing economic or work-related outcomes; Networks as formal exchanges and; Networks as a relational form of governance in which authority is broadly dispersed. The first and the third of these are relevant in relation to the analysis of Oaxacan farmers' local acquisitions of maize seed. The majority of seed transactions are bilateral and take place in informal and dyadic relationships, often blending purposive activity with friendship and trust. Meanwhile, from a crop genetic conservationist perspective, at community level, one could compare the local seed system in the study communities with the third network category mentioned by Smith-Doerr and Powell (2005). However, while 'a relational form of governance in which authority is broadly dispersed' may or may not involve collective action depending on the circumstances, it should be kept in mind that, no evidence of a network based on collective action for the specific purpose of securing seed supply was found in this research, as described in Chapter 7 and elsewhere (Badstue et al., 2003, 2005, 2006).

A variety of analytical concepts have been developed for the detailed description and analysis of social networks. These include aspects referring to the density and the span of networks; the strength of network ties, network structure and the opportunities or constraints this may imply. In the following I will briefly introduce some of the concepts from network analysis based on Smith-Doerr and Powell (2005), and afterwards apply these to the seed exchanges.

Network density refers to the structural properties of the network as a whole, and *network range* refers to its size and heterogeneity. Smith-Doerr and Powell (2005) define a dense network as one that is maximally connected. The small village is a classic case of a relatively homogeneous and densely-knit network with considerable direct communication between all members. According to Garton et al. (1997) networks of this sort are good for conserving existing resources, while larger, heterogeneous networks are good for obtaining new resources. However, it has been suggested that stable communities with dense social networks can be highly vulnerable to attack or perturbation, and for example, the removal of several highly connected hubs can destabilize the entire network (Smith-Doerr and Powel 2005: 11).

The type of one's connections with the rest of the network as well as one's position in a network, influences one's access to the resources of the network. The importance of weak ties or, as Granovetter has called it, 'the strength of weak ties' has become a core element of social network research (Granovetter, 1973, 1995). Strong ties are associated with intimacy, frequent contact and reciprocal services as between close friends, kin or colleagues. In contrast weak ties refer to relations of infrequent contacts that are not intimate (Garton et al., 1997). In terms of resource exchange strong and weak ties play different roles. While strong ties are important for mutual support and the sharing of readily available resources, the so-called weak ties reach further than the day-to-day network and therefore often play an important role when it comes to providing new or 'exotic' resources.

However, as Smith-Doerr and Powell (2005: 27) point out, a prevalence of strong ties may result in information gathering being limited to local sources. Under certain conditions this may constrain action and innovation. Over-investing in a network of strong ties can, for example, lead to redundancy. That is, when groups become too tightly knit and information passes only in the same select channels, networks can stall and 'backfire' (Smith-Doerr and Powell, 2005: 30). As Portes and Sensenbrenner have pointed out (1993) in their studies of closely knit immigrant communities, breaking out of strong affiliations or norms of behaviour can sometimes carry high costs.

Smith-Doerr and Powell (2005) believe that'position' in the network structure remains key to determining access to information that may lead to adoption of a new technology. They argue that early adopters of new practices are likely to be situated at the intersection of multiple networks, and to have links to diverse informational sources that expose them more quickly to new ideas as well as to critical evaluations of their merits. These types of positions are sometimes also referred to as 'gatekeepers' or 'brokers'.

Within network studies terminology, the notion of 'structural' holes refers to gaps between groups in social space (Smith-Doerr and Powell, 2005), for example, a lack of connections between clusters or groups in the network. From a crop genetic resource conservationist point of view, structural holes can constitute barriers to gene flow in the sense that too many structural holes may lead to the breakdown of the network (i.e. seed system).

Networks are sometimes described as 'multistranded' or 'multiplex'. This refers to a combination of a number of meaningfully distinct relations in the same network, for example, friendship relations overlapping with kinship relations or neighbourship. According to Scott (2000b), "multistranded relationships can involve a complex balance of compensating reciprocated and unreciprocated relations, in which, for example financial aid flows in one direction and political support in the other". Furthermore, he comments that, multistranded or multiplex relationships tend to be relatively intense, that is, involve strong obligations, because of their more diffuse character.

As much as social networks function as channels of information and new ideas, they also are important sources of trust, norms and social control, or as Granovetter puts it (2005: 1) of "reward and punishment". Social network analysis can help map out the flows of various resources between social actors, for example, information, technologies, and disease.

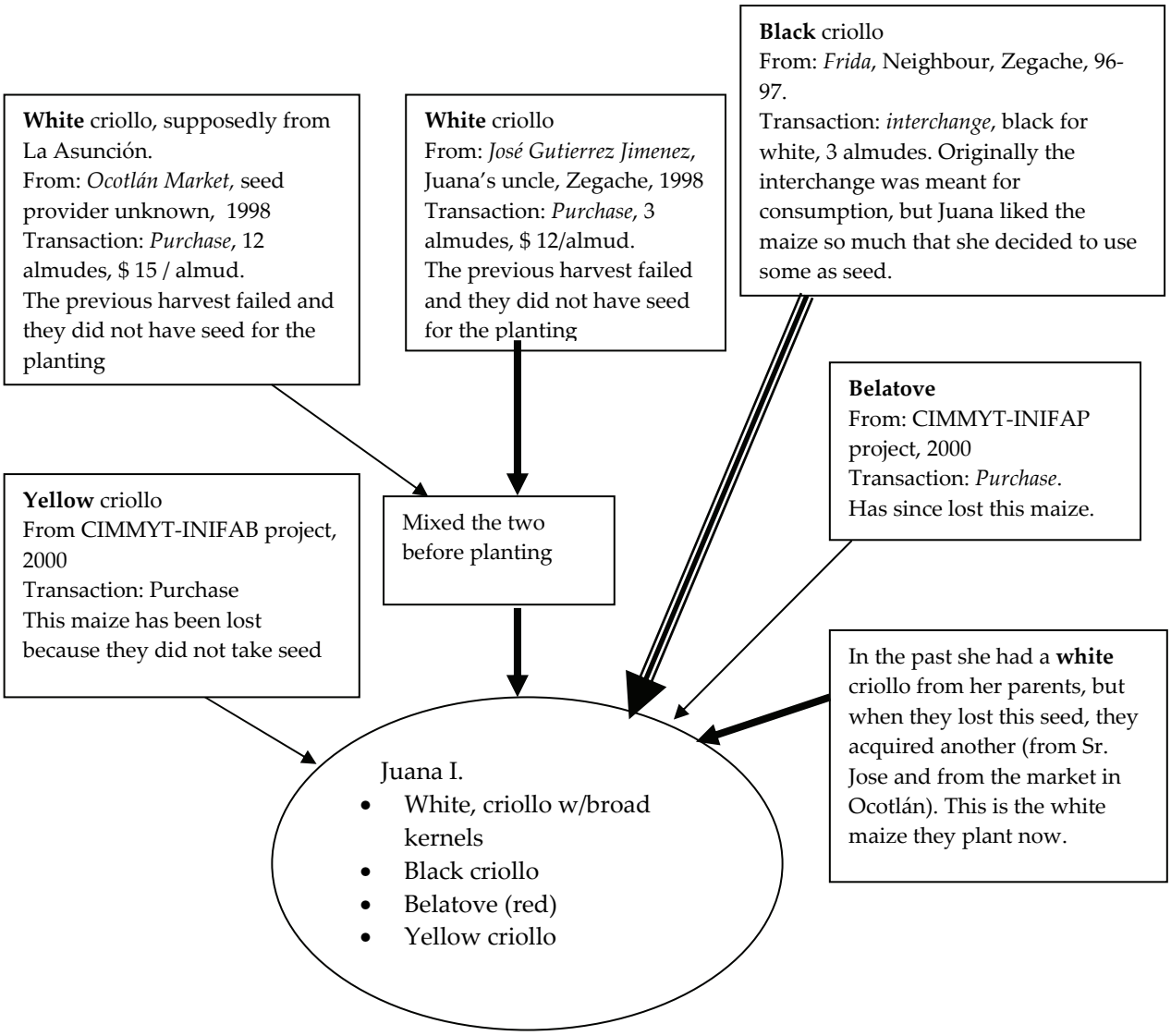
While the study of social networks has taken many different forms, a considerable part of the literature focuses on the structural aspects of social networks. As would be expected, this of course plays a central role in relation to the mapping out of flows / spread of resources and other elements, and in addition it is likely to also have great merit in terms of the development of conceptual frameworks and tools. However, if social network analysis focuses entirely on the structural aspects of social networks, the tendency will be towards the analysis of 'form' only, leaving behind the 'content' of the network and the processes taking place within it, as well as its context. In addition, it should be noted that similar to the concept of social capital, membership in a social network does not guarantee resources or support; it is the ability to mobilize or use one's network that counts. Moreover, like social capital, social networks can be interpreted as positive or negative[47] - the inclusion of some in a network, may well mean the exclusion of others.

Seed exchange in the study area from a social network analysis perspective

In general, the aspects of social network analysis briefly introduced here fit well with several characteristics of the organization of local maize seed supply among small-scale farmers in the Central Valleys of Oaxaca. Maize seed transaction in the study communities has a distinct local emphasis and the vast majority of seed transactions take place using 'strong' ties (i.e. kin, friends, neighbours, *compadres* and Table 7.2). This has several advantages; among others it implies a high probability that the germplasm will be locally adapted and live up to local criteria regarding both consumption and production characteristics. Furthermore it ensures timely supply and the transaction is associated with a high degree of trust and therefore low perceived risk on behalf of the seed receiver. In other words, strong ties are good for providing more of the same (that is, local materials), while weak ties are good for providing new or exotic resources at more infrequent intervals. A possible downside may be linked to this; the focus on strong ties may have the consequence of restricting wider searches and may therefore limit access to new technologies, such as exotic germplasm.

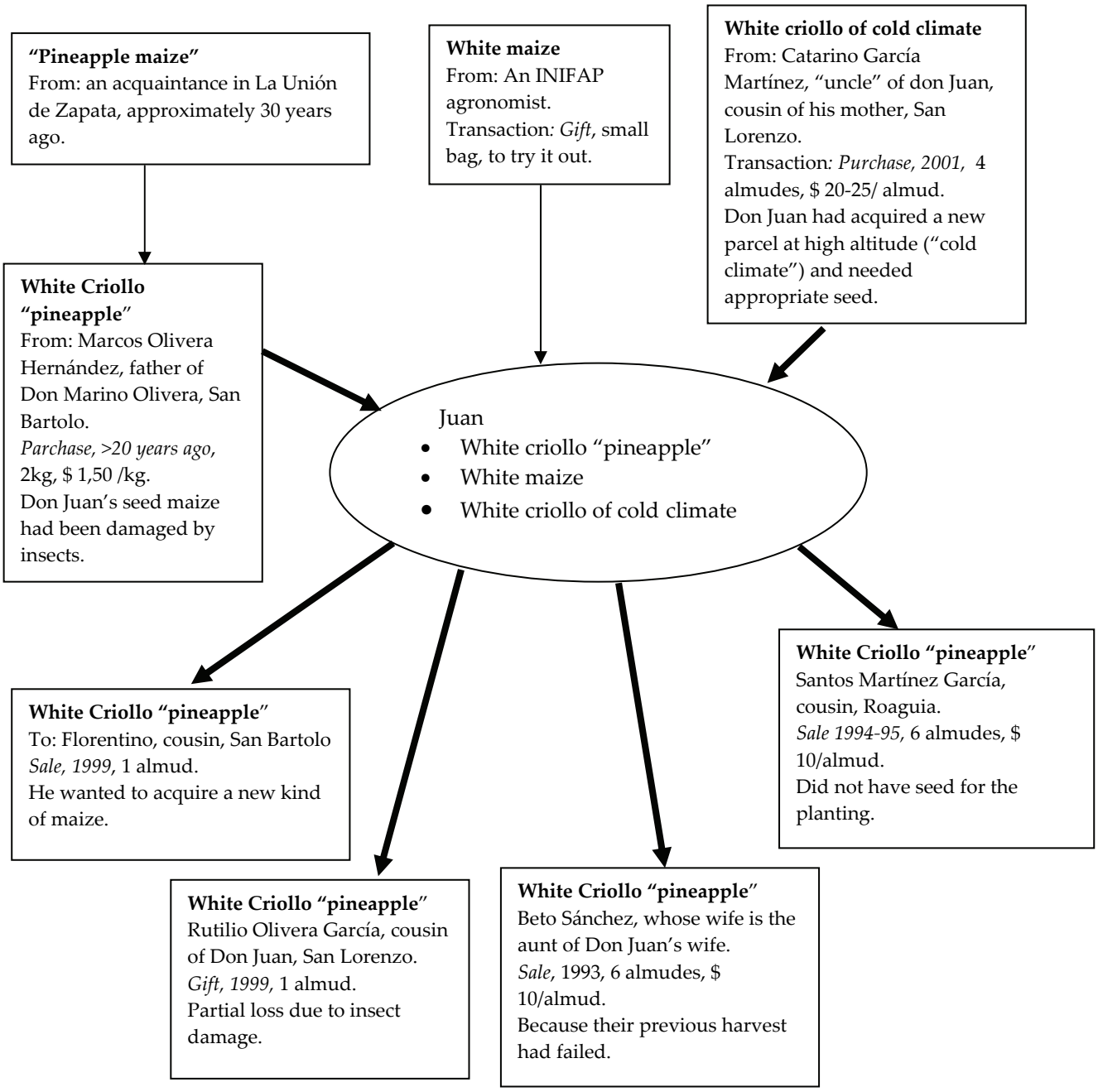
[47]As mentioned above in the section on 'Trust as a form of social capital' some forms of trust-networks are not necessarily regarded as positive (e.g. corruption, mafia, terrorist networks etc). As Rose-Ackerman points out (2001), certain social networks may sometimes be deemed negative and illegal by some, while others regard them as positive, e.g. resistance movements, political parties, etc..

In the following I will apply a social network analysis to a limited number of examples of household maize seed flows from the seed flow tracer study, namely the cases of Juana, Juan, Catarino and Miriam. Though several of the concepts drawn from social network analysis were useful for mapping out the seed flows in and out of households and thus contributed interesting aspects to the analysis, in other respects, the social network approach had limited explanatory value. Here it is important to stress that the seed flow diagrams shown do not represent seed networks, but merely seed exchanges superimposed on a multitude of other social relationships and networks.



Note: The thickness of the arrows reflects the closeness of the ties.

Figure 8.1 Seed flow diagram, Juana Ino G.



Note: The arrows show the incoming and outgoing seed flows involving Juan Olivera Garcia's household. As in the previous diagram, the bold arrows symbolize 'strong ties' and the thin arrows symbolize 'weak ties'.

Figure 8.2 Seed flow diagram, Juan Olivera G.

In the majority of local maize seed transactions in the study communities, seed supplier and seed receiver are separated only by one degree, that is, the seed transaction is directly between two actors. Only in a minority of the cases is the linkage between the two mediated by a third party, as in the case of Josefina and Eduardo, who acquired black maize for planting from the sister-

in-law of the lady they approached originally (Chapter 9, under Referral by others).

In many cases, the relations between seed provider and seed receiver are multistranded: that is, in addition to exchanging seed together their relationship often doubles as neighbours, sharecroppers, kin, friends or *compadres*. In fact, it is not unusual that several of these categories coincide in the same relationship, for example, Juana obtained black maize seed from Frida who is her friend, neighbour and cousin (Figure 8.1). Juana gave white maize to Frida and received black maize in return. Juana explained that originally the interchange was for consumption purposes, but when she received the black maize she found it so beautiful and liked it so much that she decided to select seed from it, which she subsequently planted and has kept ever since. Similarly Felipe from San Lorenzo Albarradas obtained seed of pinto maize from Julian who is both his sharecropper and also his brother's father-in-law.

As discussed in relation to Table 8.2, in most of the maize seed transactions the seed provider's motives were linked to a wish to help the seed receiver. Only in a minority of the registered distributions was the seed provider motivated by a view to receive something in return, and, in less than half of these cases (23), did the seed receiver belong to the small group of farmers who use the sale of seed as part of the household's income generating strategies.

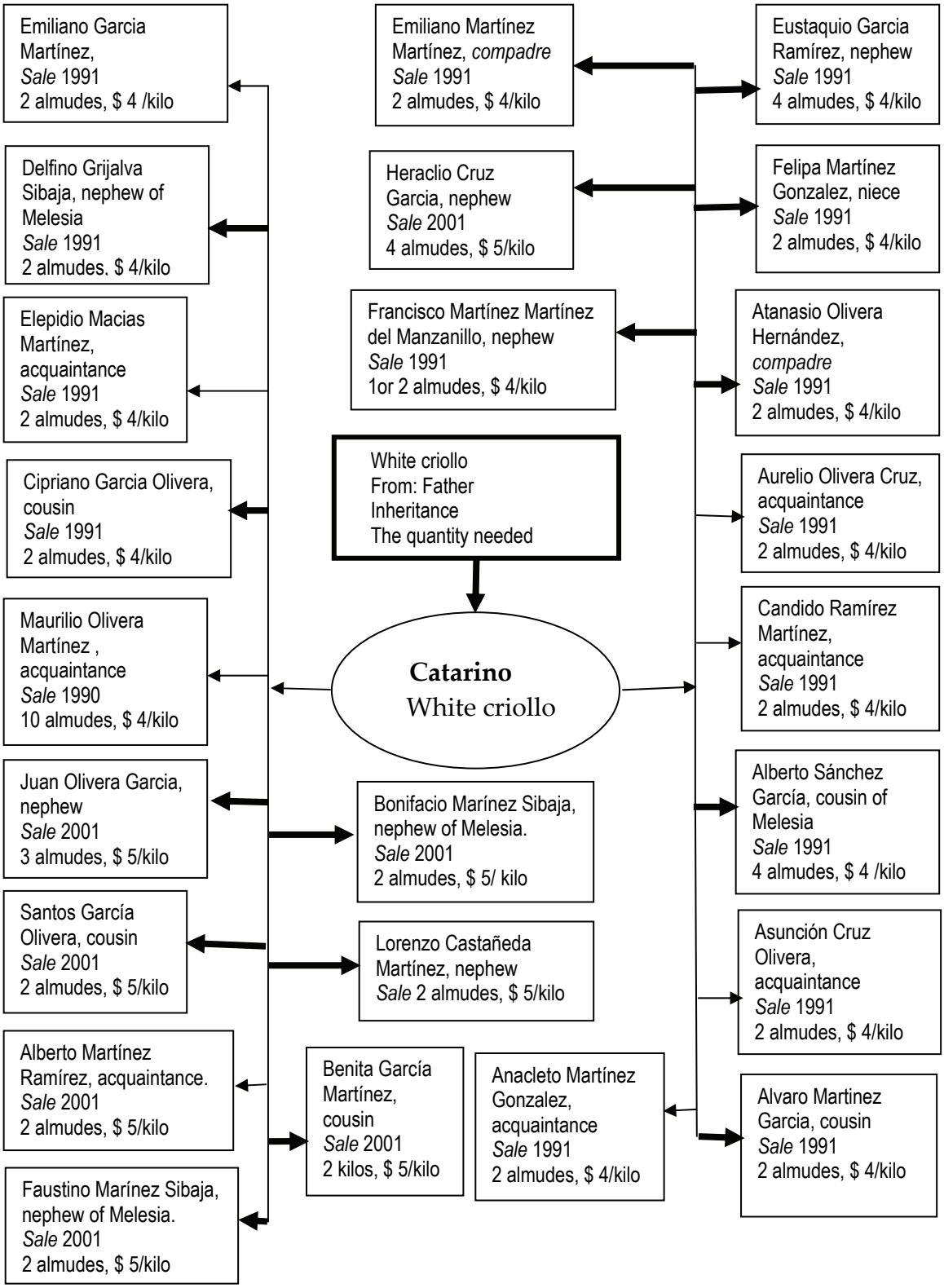
In general, maize seed is not produced for a market; farmers produce the seed they expect to need for the next planting plus a certain extra amount as a security measure against risk, for example, in case of seed loss in storage, or, if there is a need to replant, whether due to low germination, pests or climatological factors. The seed that is not used for planting can be used for other purposes or distributed to others in the event of someone coming to ask for it. Indeed, most seed providers are ordinary farmers who will provide maize seed if someone asks for it, and they feel they can spare the amount asked for. The seed providers who sell seed as part of an income strategy, can thus be said to constitute special cases. Farmer Catarino from Albarradas is an example of this.

Catarino belongs to one of the large families in Albarradas. He is lives on the main street in the administrative centre of the municipality of San Lorenzo Albarradas, together with his wife, Doña Melesia, their two youngest daughters and a couple of grandchildren, one of whom is grown up. Three other children are in the US and one daughter is in Mexico City. Every once in a while, Catarino and Melesia receive remittances from their children in the US. Some of this money was used to set up a small store in connection with the family home. Catarino grows white maize, a variety he inherited from his father as a boy, and which he has maintained ever since. He is known to be a relatively successful maize farmer and for always having maize, both grain and seed. People come to buy maize for consumption, but every year Catarino and Melesia are also contacted either in the shop or in their house by people

who are in need of seed. Each year after the harvest, they therefore select and store considerable quantities of maize seed, for which they generally charge a higher price than for grain. Figure 8.3 shows the incoming and outgoing seed flows that were registered from Catarino's household in the tracer study. Like other farmers in this study, Catarino and Melesia do not keep records of the seed transactions they engage in. An old list of participants in a communal work event that Catarino was involved in organizing, helped them remember some of the people they have sold seed to. This may, in part, explain why most of the seed distributions in the diagram were recorded as having occurred in the same year. In any case, according to both of them they have sold maize seed to many more people over the years, only they do not recall to whom or the details of the transactions. However, according to Catarino most of the people who acquire maize seed from his household are from the same part of San Lorenzo Albarradas and know where and under what conditions his maize is grown. As a seed provider who uses the sale of seed as part of the household's income generating strategies, Don Catarino constitutes a special case in several ways. First, he produces surplus seed with the specific purpose of selling it at a premium (i.e. he is motivated by economic interest). Second, with regard to farmer-to-farmer seed flow, and looked at from a social network analysis perspective he has more ties and is more centrally located in the (seed flow-) network than other seed providers. Finally, as long as the seed receiver pays for the seed, Catarino will provide seed to anyone without conditions and without implicit obligations of any kind for the seed receiver.

Social relationships play a central role for most farmers and are an important channel for mutual help, influence and the sharing of resources and information. However, access to information is heavily influenced by the nature of one's networks of social relations or 'connectedness', as well as the farmer's own social and political standing. Those who enjoy social or political standing and/or have many skills and connections are, in general, particularly fortunate, whereas the opposite could be said about those who have neither.

Still, much also depends on the personality and skills of the individual farmer. For example: As an extremely poor, illiterate, Zapotec, single woman, Miriam is marginalized in a series of respects, and her participation in ordinary social life, local social institutions and other common fora for information is limited. Miriam lives alone and does not receive help, for example, remittances, from anyone. Not owning any land of her own, Miriam works a quarter of a hectare of the common lands on the slopes of the small María Sánchez mountain. To make a living she also works as a sharecropper with two other farmers on some of their maize fields and complements this by working as a day labourer for other farmers and by making tortillas which she sells locally or at the market in Oaxaca or Ocotlán.



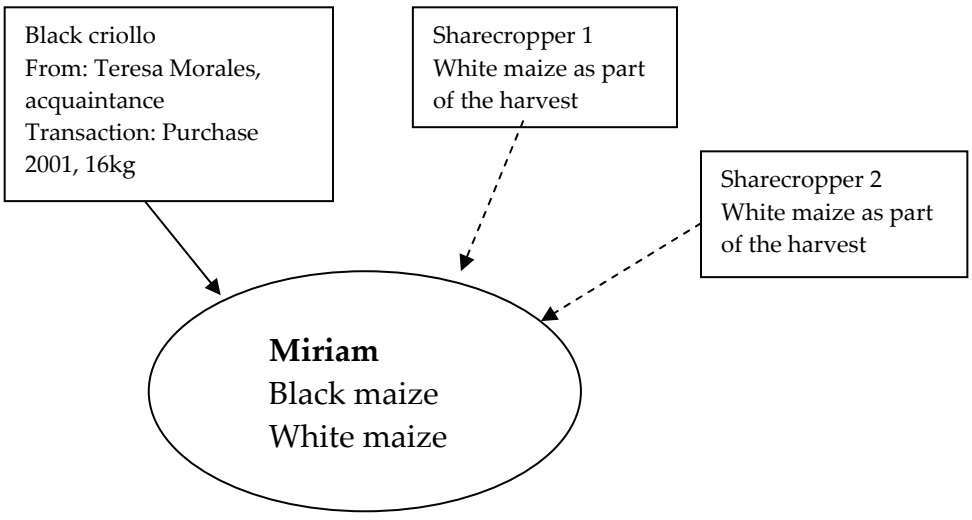
Note: As in the previous diagram, the bold arrows symbolize 'strong ties' and the thin arrows symbolize 'weak ties'.

Figure 8.3 Seed flow diagram, Catarino.

Maize is the most important thing for Miriam. It is her main staple, the crop she works with in the fields and the raw material for the tortillas that give her a small cash income. She likes to try different types of maize. Wherever she goes, when she comes across spilt maize kernels that someone else has dropped, she picks them up and takes them home where she plants them in her little patio.

Despite her precarious situation and marginal social position, Miriam seeks to manage as best she can, using her other social skills and resources in order to get by. For example, she chats and makes friends in the maize mill, cultivates her relationships with the farmers she works for as a day labourer, does other people little favours when she can and so forth.

On one occasion, one of her sharecroppers did not have seed for the planting. Instead he gave her money with which to buy seed and let her decide which kind of maize to acquire. Miriam chose black maize because it is fast [*tempranero*], that is, it has a short growing cycle and matures relatively quickly. She bought the seed from Teresa, whom she knew from the maize mill and whose black maize she had seen there while waiting for her own *nixtamal* to be milled. It is this maize she now grows on her little plot of communal land.



Note: The dotted lines between Miriam and the two sharecroppers are meant to reflect the fact that as she receives part of the harvest as compensation for her work, she has access to the seed lot, even though she does not use it for seed.

Figure 8.4 Seed flow diagram, Miriam.

As expected, Miriam's position in relation to farmer-to-farmer seed flows is very different from Catarino's. In a sense they are both extremes. While Ca-

tarino is a nodal point with regard to seed transactions, Miriam's position is distinctly marginal. She uses little seed and is not a seed provider herself.

To a certain extent, a social network approach can contribute to documenting the ways seed flows take place, and thus to the understanding of the local evolution of maize genetic diversity. Under the current circumstances, farmers' seed practices in the study area seem to constitute a relatively resilient network for local level exchange and conservation of maize genetic resources. However, the notion of 'structural holes' may eventually become relevant, for example, in the event of long-term erosion of social networks in the study communities. Structural holes may develop, which, in turn, could challenge the resilience of local seed dynamics, and hence, the on-farm conservation of local maize genetic resources.

The role of money in seed exchange

In his classic work, "The philosophy of money" Georg Simmel (1907) offers a wide-ranging discussion of the social, psychological and philosophical aspects of the money economy. According to Simmel "to the extent that money expresses the value relationship between goods, measures them and facilitates their exchange, it enters the world of useful goods as a power of entirely different origin; either as an abstract system of measurement or as a means of exchange which moves between tangible objects as does ether between objects possessing weight" (Simmel (1907) 2004: 122). In other words, money is merely an expression of value; what is measured as value is not money, but goods (or objects or services). In the same fashion changes in price are simply reflections of a change in the relations between goods (Simmel (1907) 2004: 122).

Some objects have a distinctly individual value, which means they are considered irreplaceable, while others have different degrees of replaceability. According to Simmel, money is characterized by an "absolute lack of individuality" or, in other words, by an almost unlimited convertibility (p. 124). As he subsequently points out, this makes exchanges involving money as payment quite different from exchanges in kind, or barter economy. "[Money] is nothing but the pure form of exchangeability. It embodies that element or function of things, by virtue of which they are economic" (Simmel (1907) 2004: 130). One of Simmel's main points, of particular relevance to the question of the role of money in seed transactions, is his statement that the use of money as payment often increases the freedom of both the receiver of the money and the one making the payment.

Turning again to the case of farmers' maize seed transactions in the Central Valleys of Oaxaca, more than half of the seed transactions (52%) in the tracer study were registered as purchases/sales involving money payments in exchange for maize seed.

According to the farmers in this study, buying maize seed is generally the easiest way of obtaining seed. "This can be done with anyone who is willing to sell seed" as many of them put it. On several occasions farmers elaborated on this, explaining that when the person who is looking for maize seed has money with which to buy the seed, the social relation with the seed provider is of less importance. It seems that with the prospect of receiving compensation immediately and in the form of money, most seed providers' concerns about what they will receive as compensation are reduced. This was confirmed by both men and women from all the study communities, both individually and in groups.

According to Lorenzo, for example, many people are not satisfied with the quality of what they receive in return for the seed they provide, or are afraid that the seed receiver will 'forget' about their compensation. "Many do not want to interchange - they prefer your money", as he said. On the other hand, he commented that if the person asking for seed is willing to pay for it, most people would probably agree to provide seed if they can spare it.

Liliana, who commented on the issue of trust in the section on reciprocal trust above, explained the use of money in a similar way: "Sometimes, they want money, they want a price. They don't want to interchange. Because, like they say, you interchange with someone, you give good maize and they give old maize in return or something that won't do. That's why people don't want to interchange. It is better to sell, so one wants a price! That is what it costs. That is how one will sell it, but interchange – no."

For the seed supplier receiving money as payment is often a distinct advantage as compared to receiving seed, grain, labour or other, which, in some cases, could be of questionable quality, in addition to normally having a relatively restricted use value. In contrast, money can be exchanged freely for a wide range of products or services at the convenience of its owner. In addition, money payments have the advantage that they can be done at the moment the exchange takes place, whereas payment in kind, for example, with labour or seed after harvest often has a time delay, and implies increased risk of non-payment or enforcement costs.

Table 8.4 illustrates the importance of money payment for the supplier. The number of sales is 131 whereas exchange or barter only make up a total of 17 cases. It is thus important to keep in mind that 'seed exchange' in Oaxaca only rarely means an actual exchange of seed for seed, but much more likely is a purchase of seed or a gift or inheritance from a family member.

Overall, the data also reflect aspects in which the use of money as payment makes seed transactions easier for the person in need of seed. For example, following Simmel's thinking in the case of the seed receiver, acquiring a compromise of 'paying' in kind or with labour at a later stage can be said to reduce one's freedom of operations, as compared to simply paying for the seed with money. While money can be obtained from different sources for the seed

receiver to choose between, 'paying' with seed or labour commits the seed receiver to a very specific form of payment, that is, reduces his/her freedom of action.

Table 8.4 Reasons for distributing seed in relation to type of transaction.

Theme	Reason for distributing seed	Sale	Exchange	Barter	Gift	Inheritance	Loan	Other	Total
Help the recipient	They asked	89	4		11		3	1	108
	A seed interchange was asked for		6						6
	A barter was solicited			1	1				2
	For reasons of compassion	2							2
	Obligation				3	5			8
	For being kin	1	1	1	1			1	5
Obtain something in return	Needed to obtain money	11							11
	Sell seed and/or grain	23							23
	To obtain seed		2						2
	Provide seed to sharecropper	2						12	14
Other	Others	3	1	1	1			2	8
Total		131	14	3	17	5	3	16	189

In addition, if one has money with which to buy seed, one is less dependent on trust relations for accessing seed – as informants pointed out, one can buy seed from just about any one who can spare the extra seed. If, on the contrary, one does not have the necessary economic resources, one can be forced to use other types of transaction, which may not always be easy to negotiate, and which often depend on the state of one's social relations with possible seed providers. It follows that people who have neither economic nor social resources to draw on (e.g. relatives, friends or neighbours who have seed), face the most problems when in need of seed.

As farmers pointed out, people will generally agree to provide seed, if one is willing to pay with money. In this case it is not necessary for the seed receiver

to know the seed provider beforehand - rather like in a commercial setting, such as buying seed or other implements from a shop in Oaxaca, Etla or Ocotlán. One could say that the prospect of money payment, as opposed to other transactions forms, makes more people willing to act as seed providers. In other words, the number of possible seed providers increase when one is willing to pay for the seed with money. Also, as mentioned by the participants in the women's focus group in Amatengo, in the situation where the parties do not know each other, some farmers seem to feel less need for preambles or explanations regarding why one wants to acquire seed, that is, less embarrassment, less humiliation ('*Si es entre personas que no se conocen, o una situación commercial como con un comerciante, no se necesita de ningun preambulo ni explicación de por que quire uno comprar semilla*': "If it is between people who do not know each other, or a commercial situation, like with a shopkeeper, one does not need a preamble, or to explain why one wants to acquire seed".)

Finally, many of the farmers expressed the view that, once the maize seed and the money have changed hands, the deal is done: It is out of the way and one does not owe the other anything, ["*Es una compra-venta – dando el maíz, dando el dinero, y allí se quedó. Ya fue el trato, ya no se debe nada*"], Fiona (Huitzo). Nevertheless, while they would often claim that neither the seed provider nor the seed receiver acquires any obligations when buying/selling seed, in many cases the informants would still maintain that of course they would expect the other to provide similar help, in case one day the roles are reversed. That is, should it become relevant, the seed receiver would be expected to 'return the favour', and supply seed to the seed provider, though not necessarily for nothing.

In other words, while with other types of seed transactions there is a delay between the delivery of the seed and the 'payment', during which the seed receiver owes the seed provider (e.g. when borrowing seed, or acquiring seed in return for labour at a later stage), this is not the case when seed is bought/sold and the exchange of the seed for money takes place at the same time. Still, whatever the type of transaction, responding positively to someone's request for seed (or other items or services for that matter), appears to be expected to trigger a feeling of obligation (gratitude?) in the seed receiver to behave likewise towards the seed provider if the situation should arise (see, for example, the section on reciprocal trust).

In summary, then, money appears to be able, to some extent, to alleviate the problem of access to seed. For seed providers, seed distribution seems to be easiest and to imply the least risks and inconvenience, when the seed is paid for with money. When this is the case, farmers appear to be more inclined to provide seed to others. On the other hand, though the use of money may increase the number of possible seed providers, contribute to the fast completion of the transaction and reduce the seed receiver's discomfort (thereby easing seed receiver's access to seed), it does not, in itself, influence the seed

receiver's problem regarding the quality of the information received about the seed (i.e. the issue of the lack of transparency of seed). This remains a question of the seed receiver's trust in the seed provider and the information provided by him/her.

Simmel (2004 (1907)) makes a point concerning what he calls money's ability to "de-personalize" a transaction (p. 286). Roughly put, he argues that the more important the use of money becomes, the less important are the personalities involved and the personal relations between them (p. 296). The fact that ability to pay for seed with money decreases one's dependency on social connections and trust relations with possible seed providers is a direct example of this. If payment is in the form of labour or seed, the seed provider will consider whether it is likely that the receiver will deliver as promised and whether the labour or seed will be of good quality. On the other hand, if the payment is made with money, the personality of the seed receiver is much less of an issue. For the individuals seeking new seed this is also a distinct advantage. If they cannot pay for the seed with money they will be restricted to a very limited number of suppliers with whom they have close social relations. However, if they are willing to pay with money, the number of willing suppliers increases significantly, and also opportunistic acquisitions based on accidental encounters become much more feasible. In a certain way, one might say that the use of money as payment can help extend one's network of potential seed suppliers. Elpidio's acquisition of a small quantity of *belatove* maize for planting at the market in Tlacolula, mentioned in Chapter 5, is an example of an opportunistic purchase of germplasm. The same is true for Benito and Hipolita, who had lost the seed of their white maize. When they came across a white maize, which they found particularly appealing, at the market in Oaxaca, they quickly decided to use this maize for the forthcoming planting and bought the necessary amount right away.

The 'de-personalizing' effect of money can also be observed in other spheres of social life. In all the six communities, failure to show up and participate in *tequio* (see Chapter 4), a traditional form of comunal work and part of what is generally considered one's civic duty as a community member, used to lead eventually to a reduction of one's right to certain community services. However, nowadays in all of the six communities, one's participation can be substituted for a money payment (i.e. a fine), without causing any limitation of one's rights to the services in question.

As Simmel comments: "On the one hand, money makes possible the plurality of economic dependencies through its infinite flexibility and divisibility, while on the other, it is conducive to the removal of the personal element from human relationships through its indifferent and objective nature." (p. 297). As he subsequently argues, this eventually leads to the individual's increased independence from the group (p. 342). "The extremely significant power of money to lend to the individual a new independence from group interests is

manifested not only in the basic differences between a barter and a money economy but also within the money economy itself" (p. 342). Examples of this include the effects of money payments mentioned above, the potential increase in the number of suppliers, and in the number of opportunistic transactions.

Even though the transaction is completed and each party has lived up to his/her part of the deal, the fact of engaging in exchange with others - of which seed exchange is but one example - appears to contribute to the establishment and maintenance of social relationships, as has been amply described in the literature (e.g. Adler Lomnitz and Sheinbaum, 2004; Cook et al., 2002; Gudeman, 2001; Kapferer, 1976; Mauss, 1954; Sahlins, 1972).

Why not use a standard economic model?

If money is the predominant form of payment, it seems relevant to ask, whether we should not simply look at this, using standard economic tools for analysing supply and demand and their relation to price? The findings presented here, however, demonstrate that several aspects of farmers' seed transactions do not readily fit into models of conventional market-based economic theory.

Conventional economics builds on a theory of rational choice and profit maximization. Yet, although purchase/sale is the most common type of transaction in farmer-to-farmer maize seed transactions in the study area, economic gain does not seem to be the motivating factor for most seed providers in this study (see Table 8.4). Another limitation of much economic theory is the assumption of perfect information. As we have seen previously (Chapter 3) seed is characterized by a lack of transparency, which makes the seed receiver highly dependent on the quality of the information offered by the seed provider. Hence, the situation is one of information asymmetry, in which trust plays a key role. As discussed in Chapter 9, this questions the validity of the common assumption in conventional economic theory that commercial market mechanisms lead to lower transaction costs than informal exchange in farmers' seed acquisitions in the Central Valleys of Oaxaca. In addition to this, there are other problems. A farmer without seed needs seed no matter what it costs, but on the other hand, he or she cannot plant more seed than she has land for, no matter how cheap it is. In all but a few cases, farmers' individual maize seed production is motivated by a wish to secure one's own supply of seed, plus a margin of safety, which serves as a buffer that can be used, for example, in the case of seed loss during storage, or, as we have seen in this study, as a source for supplying seed to others. The quantity of seed produced by the household is therefore generally a function of the quantity of seed needed to plant a specific area of maize plus some extra for contingencies. In consequence, the amount of seed available to cover other farmers' requests for seed, depends on how much seed is left over after one's own planting. Thus,

in other words, seed production in informal markets is not related as such to production costs.

Regarding farmers' seed acquisitions from other sources, the amount of seed that farmers in the study communities need is a function of the area of land to be planted. When the objective is to produce maize for feed (e.g. for silage), planting density is higher and more seed is therefore needed per unit of land. However, farmers do not buy more seed than they need, because prices go down; nor does an increase in price mean that farmers acquire less seed than they need. While more opportunistic seed acquisitions and the level of farmers' experimentation may be influenced by fluctuations in prices and supply, a certain basic quantity of maize seed per unit of land remains stable. Occasionally, farmers opt for another, cheaper, quality of planting material (e.g. the use of grain as seed); however this does not generally influence the amount of planting material used per unit of land. In summary, the supply and demand model can therefore be said to apply only partly to farmers' seed transactions. To a certain degree this is also the case for grain transactions: Instead of selling grain in large quantities, many of the farmers in this study sell grain little by little, according to their own expenses. That is, little by little, maize is converted into money, with which other necessities are purchased.

Furthermore, in relation to the supply and demand model, it must be kept in mind that, according to data from the tracer study, the frequency of farmers' seed acquisitions is so low for the majority (averaging once every three years), that it is doubtful whether they would respond at all to a change in seed price. Of course, they may respond by converting grain to seed, as they do in some cases of shortage, but, since the main demand for seed is at the time of planting, where the demand for labour is also at its peak, it appears likely that farmers would try to avoid having to divert resources to this purpose at that time.

Finally, rather than demonstrating a relation between supply and demand and price formation in farmer-to-farmer seed transactions, this study shows that in many cases these transactions depend crucially on social relationships, and/or reflect the alternative use-value of 'excess seed' from one's own planting, that is 'excess seed' is likely to be treated as grain.

9. Farmers' transaction costs in relation to seed acquisition[48]

Introduction

In this chapter the relevance of the concept of transaction costs for analysing and understanding farmers' local maize seed acquisition practices, is examined. Farmers' perceived transaction costs in relation to maize seed acquisition in the Central Valleys of Oaxaca are explored using an ethnographic approach. Issues of information about maize seed, seed transaction negotiation and enforcement are examined from a small-scale farmers' perspective through the use of qualitative data. Findings indicate that farmers' perceived transaction costs are low to negligible in most cases where seed transactions take place locally, and trust is identified as a factor which serves to reduce transaction costs to a minimum. Though not a transaction cost in the conventional economic sense of the term, it is argued that the risk of crop failure, due to inadequate seed, is a major concern for farmers in relation to seed acquisition.

As should be clear by now, most farmers in the study area continue to produce their own maize seed year after year. However, maize farmers do occasionally acquire seed from other sources, mostly other farmers, either because of seed loss due to climatic or storage problems, or because they want to try out or work with other kinds of maize. Previous research in the region showed that 89.7% of maize seed lots were saved by farmers from their own previous harvest, and the rest were acquired from other farmers (Smale et al., 1999).

These farmers have different needs and require seed of diverse landraces with multiple traits in particular combinations. Finding seed that meets the individual farmer's particular requirements is not always easy (CIMMYT, 2002). First, the farmer has to find out who grows what maize variety and investigate the characteristics and performance of the maize of interest. Then he/she must make sure that the information offered is trustworthy and the seed is reliable. Finally, he/she has to negotiate the conditions of the transaction with the seed provider. Under such conditions it therefore seemed reasonable to expect that acquisition of seed of diverse maize varieties entails high transaction costs to individual farmers.

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[48] This chapter has been published in a different version, as: Badstue, L. B. (2004) Identifying the factors that influence small-scale farmers' transaction costs in relation to seed acquisition. An ethnographic case study of maize growing smallholders in the Central Valleys of Oaxaca, Mexico. *ESA Working Paper No. 04-16*. Food and Agriculture Organization of the United Nations (FAO). Rome.

The chapter starts out with some general considerations regarding the scope and focus of the study. Subsequently, the presentation of the findings is structured according to the key issues raised in the economic literature on transaction costs. This is followed by a discussion, and finally, a conclusion. For further information on the methodology used and the study area, the reader is kindly referred to Chapters 2 (Methodology) and 4 (Study area).

Scope and focus of the study

The original aim of this study was to use transaction cost analysis in order to explain farmers' local maize seed acquisition strategies, and the immediate, empirical objective was to identify and describe the various factors that influence farmers' transaction costs in relation to seed acquisitions, using an open, ethnographic approach. This requires that the researcher is willing to step out of his/her own personal or professional ways of thinking in order to seek to understand what constitutes the important issues from the informants' point of view, in this case, the small-scale maize farmers in the Central Valleys of Oaxaca.

The small-scale farmers' perspective may not necessarily appear to be rational and coherent, and it may not fit nicely into a preconceived model of how farmers should consider their reality. We should therefore not be surprised that the findings do not coincide fully with the model we took as a point of departure, that is, the concept of transaction costs as presented in the economic literature.

The concept of transaction costs

The term 'transaction costs' has been defined as the costs incurred by participants in an exchange in order to initiate and complete the transactions (Dudek and Wienar, 1996, in Cacho, Marshall and Milne, 2003). Transaction costs are often subdivided into search or information costs (costs of obtaining information about the product and its price as well as about trading partners), negotiation costs (costs of negotiating and carrying out the transaction), and monitoring or enforcement costs (costs of ensuring the terms of transaction) (Dahlman, 1979 in Cacho, Marshall and Milne, 2003; Gabre-Madhin, 2001; Hobbs, 1997).

Transaction costs are specific to each market participant. As pointed out by Sadoulet and De Janvry (in Gabre-Madhin, 2001) this means that there is no single effective market price at which exchanges take place. Furthermore, as argued by Buckley and Chapman (1997), transaction cost issues cannot be understood apart from issues of perception, that is, the perception and definition of reality of the social actors. Therefore, transaction costs are difficult to measure in any objective way.

Here the notion of transaction costs are understood in a broad sense and may include other costs or 'sacrifices' that farmers may have to incur to carry

out a seed transaction—even if unsuccessful. These include opportunity costs in terms of time, loss of prestige, risk assumed or others.

The concept of transaction costs is essentially a child of economic theory, although it has also been used by non-economists studying different aspects of economic life (e.g. Godoy, 1993; Mayer and Glave, 1999; Plattner, 1989;). However, the concept of transaction costs does not exist as such in the terminology of ordinary Oaxacan small-scale farmers. As stated above, the ethnographical approach is open and does not define the issues before the study is undertaken. Instead, this approach seeks to understand the issue from the informant's perspective. As such, the point of departure for this study was to try to identify the costs, sacrifices or concerns, which farmers experience in relation to seed transactions.

Admittedly, this rather nebulous definition may not be sufficient for the purpose of an analysis based on economic theory. However, in as far as our goal is to understand what factors farmers consider a sacrifice in relation to seed acquisition, it is necessary to examine this from a farmer's perspective. In any case, the idea is to look at this from a small-scale farmer's point of view and consider what they consider a cost. This applies both in the cases where the question is, for instance, about time spent in a particular way, which could have been spent differently, thereby in theory representing a (lost) opportunity; as well as where the question is one of shadow value, for example, by using my own seed, I loose the opportunity of selling it instead. In other words, this is seen as the real cost of using own seed. Most of the farmers interviewed see it as a cost, if they have to acquire seed from someone else, whereas the common perception of using one's own seed is, that it is 'free'. Therefore, notwithstanding that economic theory would look differently at this; from a farmer's perspective, this does not constitute a transaction cost. Economists may well disagree with this perspective; however, within an ethnographical framework there is no other way to address this.

Observed– unobserved costs

Transactions with the formal seed sector in the study region are few and far between, which means that it has not been possible to study this in any great detail, as the study was carried out with a limited number of informants. The unobserved costs, that is, of formal seed sector transactions or non-local transactions, could potentially be relatively high; however, at this point in time data is not available to document this. In a quantitative survey with many informants this may be approached more easily.

What is the desired good in the transactions?

The transaction costs are related to the costs of obtaining the 'desired good'. It could be argued that the desired good is a 'bagful of maize seed'. However, the farmer is not looking for seed *per se*, but rather for an input in the crop

production cycle. In that sense the desired product is a successful harvest which yields grain and fodder of the desired quality. In relation to seed acquisitions, therefore, the farmer wants seed that will perform successfully under the production conditions present in a particular field, and which produces maize grain with the particular qualities desired by the farmer, for instance in terms of consumption qualities, storageability or marketing.

However, farmers know that simply by looking at the seed, it is not possible to tell under which conditions, it will perform well or if it will germinate at all – in other words, seed is not transparent (Morris, 1998, see also Chapter 5 here). When acquiring seed, if the farmer is uncertain as to whether it will live up to the expectations mentioned above, he/she runs the risk that the acquired good may not actually be the desired good. The problem is that the farmer will not know this until he/she plants the seed. In the following this is referred to as the problem of inadequate seed. It should be noted that this can mean either maize seed that is not adapted to the given environmental or management circumstances, or, seed which produces maize that lacks the particular consumption characteristics the farmer sought at the moment of acquiring the seed.

From an economic point of view, we may want to separate the seed transaction from the rest of the production process, but for the farmer these are inseparable; he or she does not procure seed unless it is with the specific purpose of obtaining a harvest. Furthermore, the farmers correctly draw attention to the fact that the problem of inadequate seed arises in the moment of acquiring the seed, and not at some later stage in the crop production cycle. As such, both from a farmer's point of view as well as from an economic point of view, I would argue that the risk of crop failure due to inadequate seed should be considered a transaction cost - in the same way that the risk of getting the wrong product due to lack of information would be considered a transaction cost. Meanwhile, it should be kept in mind that crop failure may also be caused by a series of other factors, such as drought, pests, disease or other, in which case it would be a production cost.

Search costs

In general, searching for information is a situation in which farmers draw on their various social networks. Access to information is heavily influenced by the nature of the farmer's networks of social relations including his/her social and political standing or connectedness. Physical isolation can also influence the flow of information, in other words, the further away from the village the smaller the flow of information. In several respects this is the case of Francisco and the other farmers in Rio Blanco who live and farm in the hills several hours travel from the village of San Pablo Huitzo. Still, much also depends on the personality and skills of the individual farmer. For example, despite her socially and economically marginal position, Miriam (who was introduced in

Chapter 8 in the section on seed exchange from a social network analysis perspective) seeks to manage as best she can, using her social skills and resources in order to acquire information (e.g. chatting in the maize mill, cultivating the relationships with the farmers she works for as a day labourer, and doing other people little favours when she can.). Of course those who enjoy social or political standing and/or have many skills are particularly fortunate, whereas the opposite could be said about those who have neither.

How do farmers get information on seed traits?

When maize-growing smallholders in the Central Valleys of Oaxaca want to acquire new maize seed, they look for maize varieties with traits that relate to their particular production conditions and consumption preferences. This is similar to findings elsewhere in Mexico and abroad (Almekinders, Louwaars and de Bruijn, 1994; Bellon, 2004; Linnemann and de Bruyn, 1987). The local maize taxonomy in the region is based mainly on grain colour, grain width, and the time for maturing, and in previous CIMMYT studies it has been found not to reflect fully the actual maize diversity present in the region (Smale et al., 1999)[49]. It is therefore relevant to ask in what other ways farmers obtain information on seed traits. Through the interviews, several means used by farmers for gathering information about seed traits were identified:

Observation

A common form of obtaining information is through direct observation of maize in other farmers' fields. According to informants, farmers gather information when moving about in their communities while paying attention to the crops other people grow, their performance, management and growing conditions.

For example, farmer Camilo from San Pablo Huitzo explains that when the maize plants are mature, he will usually 'do a round' - just to see. "One must go and look", he says "one must see, that this maize is good, I like this maize … I am going to see the person who planted this maize….".

In Camilo's experience yellow maize can be difficult to sell so last year he decided to acquire seed of white maize from Don Luis. When asked how he found out about the kind of maize that Luis grows and its characteristics, Camilo answered: "Well, we are on friendly terms. A son of his married one of my sisters, so it's like family. Whenever I dropped by I would notice the type of maize he had and I liked it. … So I saw the maize and the type of ear and everything, and I liked the maize. As it was very good, I decided I was going to get this one".

[49] The lack of a commonly recognized and clearly defined local nomenclature for local maize diversity, which goes beyond grain colour, width, and time for maturing, was confirmed by both Zapotec and Spanish speaking farmers from the study communities during interviews and focus group discussions.

Similar to Camilo, the way farmer Pablo L. gets information is by being observant and asking questions. Pablo often works land which belong to other people, either as a sharecropping arrangement, renting or pawning. If any of this land is under irrigation he sometimes plants hybrid maize H311 on it, which he then sells for silage. He first learnt about this variety some 18 years ago, when one day he noticed a particularly good looking crop. "I saw a maize crop, - so uniform this crop and the ears…! I went and talked with [the owner] and I asked him what kind of maize that was, if it was a criollo. And he said 'No, that is a hybrid maize. Look' he said 'if you want to plant this, ask for the number 311'. And where do I get it? 'In Oaxaca' he says, 'in those shops where they sell pesticides.'"

Conversation

Talking to other farmers, family relations and so forth, is another common way of getting information about seed traits. According to Lorenzo this is an effective way to get information about the characteristics of a certain kind of maize seed: "You get along talking, one asks questions. I ask the other guy, say, 'How come this maize looks so good?' 'Because I have a well', he says, 'I have irrigation'. So, you may want to buy this maize if you have irrigation, but as it comes from seed that was irrigated, I tell you, it will not succeed where there is no irrigation".

Informal gathering and exchange of information, through observation and everyday conversation with other farmers, is in fact so much part of life in Zegache that according to Catarina, the people who come to her for maize seed already know the kind of maize she has. Nevertheless, some will ask if it was fertilized with manure (as opposed to chemical fertilizer), or whether it was rain fed (as opposed to irrigated).

Farmer experimentation as a knowledge generating process

Almost all farmers at some stage engage in some kind of informal experimentation (see also Chapter 6). Some farmers are more persistent and structured in their experimentation than others, and those who are continuously on the look-out for new and interesting things may be more curious and innovative than the majority. This is not determined by age or economic standing. Rather, it seems to depend mostly on people's personalities. However, it should be noted, that poverty is often accompanied by risk aversion, and that very poor farmers therefore may be somewhat more reluctant to engage in experiments that imply risk, or, their experiments may be of a more humble, low cost nature.

Many farmers in the study communities like to carry out their own experiments, trying out seed of different crops and crop varieties. When farmers come across interesting maize material, they will often try it out on a small

piece of land first, either in the field or in the backyard. Depending on the experiment's outcome and the circumstances in general, they will then decide whether or not to plant this material again on a larger piece of land. Experimenting allows farmers to see for themselves how the variety performs and if it is convenient for them, without incurring major risks of failure if the variety does not perform.

In general maize farmers in the Central Valleys believe that if a maize variety performs well under certain agro-ecological conditions, it may not necessarily perform equally well under different conditions - what breeders call a high genotype-by-environment interaction (Badstue et al., 2003b).

Francisco farms on common land in the mountains near Huitzo. On several occasions he has experimented with maize seed from elsewhere, mostly with small amounts of seed acquired in the Valley, but on one occasion he tried out maize seed that came all the way from Tapachula, Chiapas. "Sure, the plants grew, but they didn't give any maize" he says. Having made this kind of experiment various times, Francisco is now convinced that the only maize that will perform well on the land he works, is the kind used by himself and the few other families from the little settlement in the woods.

Rodolfo (Huitzo) has also tried to plant the maize sold by the travelling maize vendors. "It just grows and is hairy. It doesn't give anything" (similar to Liliana's evaluation, Chapter 6 under Production conditions). When Rodolfo tries out a new kind of maize, he first plants it on a little piece of land. "If I plant it on all 12 hectares and it turns out not to perform well, then it is a case of losing, no? Therefore I try it out on a smaller piece of land, and if God is willing that it succeeds, then I will harvest. Next year one can use it, then I have faith in it. Then it is easier to plant it on all the land; then I know that it works on this land."

Farmers' experiments with maize seed in the Central Valleys of Oaxaca most often consist in planting small amounts of seed, of maize unknown to the farmer, to see if it germinates, how it performs and compares to the farmer's own maize[50]. Comparisons may be made in a variety of aspects, including production, consumption, storage and marketing issues.

How do farmers get information on seed quality?

Seed quality

Seed quality is affected by a range of factors (e.g. free from damage by pests and diseases, age, and appropriate storage), which all have a bearing on the viability of the seed. At the end of the day it all comes down to the ability of

[50] Others have reported similar practices with different crops elsewhere, e.g. Biggelaar, 1996, on local knowledge generation in Rwanda; Box, 1999, 2000, on local casava experimentation in the Dominican Republic; Heckler, 2004, on women's experimentations with manioc in Amazonia; and Richards, 1985, on farmers' rice experiments in Sierra Leone.

the seed to germinate. In terms of seed quality, this is what counts at the farmer's level.

As mentioned above, seed is not transparent (Morris, 1998) - one cannot know the traits and performance of the plants that will grow from it merely by looking at the seed before planting. By looking at the seed, farmers can check immediately observable features, including physical damage to the seed, but apart from this, seed quality can be difficult to determine. Age, pathogens, or inappropriate storage may affect germination; however, this is not necessarily visible to the human eye, and though farmers usually inspect the seed before acquisition, in these regards farmers in the Central Valleys must rely on the information given to them by the seed provider.

Farmer seed criteria: clean and undamaged

From a biological point of view any healthy maize kernel could serve as seed or as food. However, farmers in the Central Valleys distinguish between seed and grain, seed being a specially selected category consisting only of 'best quality' maize kernels (large uniform size, clean and undamaged by pests or other agents), whereas grain is a mixed category, albeit with a certain minimum quality control enforced at the time of de-husking.

When Eduardo was asked how to make sure that the seed will germinate, he answered "That is a lottery, I could not be certain". Like him, most farmers recognize that there is almost always some element of risk, however small, that the seed will not germinate. However, to limit this risk farmers apply certain criteria when they select their own seed and if they acquire seed from elsewhere, they usually inspect it before striking a deal.

To a certain extent the criteria behind farmers' definition of seed (specially selected, large uniform seed, clean, undamaged by insects or other) protect against some of the factors that may affect germination (see also Chapter 6). For example, all farmers stressed that the seed must be clean and intact, that is, it should not be stained or show any signs of mould and it should not be damaged by insects. Don Elías put it this way: "That it is clean. The one that has insect damage: No". In the latter case, explains Pablo H., the seed will not germinate. He adds that when inspecting seed, he breaks one to see if the '*puntito*' [pointy end] is intact. In the opposite case, or if the seed disintegrates by itself, it is no good, he explains.

Once in a while Pablo L. acquires small amounts of hybrid maize seed. He is extra careful after a bad experience buying seed from the local agro-veterinary stockist. He noticed that there were signs of insect damage to some of the seeds, but he bought it anyway. After planting, however, the majority did not germinate. "I went to see the guy [at the shop] and I told him. 'So you were right', he said, and he gave me back what I had paid for the seed. But we still lost, because I had to start all over again, ploughing the plot and planting

again. Therefore, now, when I go to Oaxaca to buy seed, I make sure to check that it is not damaged by insects."

The age of seed

Some farmers are aware that the age of the seed can affect germination. Some years ago, Pablo H. acquired a small quantity of hybrid maize seed through SAGARPA (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación). He did not use it all, and when five years later he planted what was left over of the seed, it did not germinate. Don Pablo reflects on this and comments: "In the stores where they sell [seed], it sometimes happens that they have already had it stored there for a long time. That is when this sort of thing can happen. They buy in big quantities, so they sometimes have some left over." He mentions that this happened to him on another occasion, not with maize, but with onion seed. After much arguing with the stockist who had sold him the seed, he was compensated with another tin of onion seed.

Unless the seed comes in a sealed package with proper labelling, it can be difficult to know how old the seed is. However, Pablo L. explains that he checks whether the pointed end of the maize seed looks fresh. "The bellybutton, the pointy bit, must look fresh. If it is getting old, the pointy end of the kernel, where it is fixed to the cob, looks blackish. That is a sign that it is getting old."

This is similar to what Camilo says he has learnt from the older generation: "If the '*patita*' [the pedicel or pointy bit connecting the kernel to the cob] is black or spotted, they say it is no good. Then they say 'this maize no longer works.' The maize kernel must be clean. It cannot be spotted." Camilo adds that if the maize kernels are clean and free of spots it is an indicator that it is maize seed from the previous harvest.

Trust

Although farmers inspect the seed before acquiring it, thereby limiting the chance of bad seed quality, this does not provide a guarantee that the seed will germinate. In various regards, farmers must still rely on the information given by the seed provider and depend on its trustworthiness. This constitutes an important reason for farmers to prefer to acquire seed from somebody they know and trust.

This year in Fiona's household they bought seed from farmer Miguel. Fiona explains that her father knows the type of seed, and that he has planted that same kind of maize on other occasions. He also knows Miguel quite well and furthermore had noticed Miguel's maize crop in the field the previous cycle. He therefore felt confident the seed Miguel would sell him would be of good quality.

Similarly, according to Don Lorenzo it is not wise to buy seed from somebody one does not know; "These days, there is a lot of cheating. It is not safe. Therefore one goes where there is trust". Lorenzo is particularly suspicious about buying seed at the marketplace. He has heard people talk about a liquid that can be used to protect the maize against insect attacks. The liquid makes the maize so hard that grain borers cannot eat it. However, he claims to have heard that if it is used on maize seed, the same hardness will prevent the seed from germinating. "That is why people bite the maize seed: '…this seed is very hard! What have they treated it with? I think it has been treated!'"

Like several of the other farmers who work full time in agriculture (e.g. Pablo H., Jesus, Eduardo) Lorenzo also insists, that in order to produce good seed, the quality of the work of the farmer who provides the seed is important, for example, whether the farmer keeps the *milpa* clean of weeds or not. "*Es que, hay gente que no saben trabajar*!" he exclaims (…some people don't know how to work [well]).

When grain is used as seed

For various reasons, such as lack of resources, chance or emergency, farmers will sometimes acquire maize grain and then use it as seed. However, in that case it is customary to carefully sort the kernels, selecting the 'best' for seed, thereby achieving some minimum quality control similar to normal farmer seed selection. This is not uncommon, and some farmers, when asked for seed, will offer their grain if they do not have enough seed to share with others, for example Pablo H. (see below).

Germination rates

To my knowledge no farmers test for germination[51], which, in theory could diminish the risk of germination failure. During previous research activities CIMMYT researchers determined the germination rates of farmer maize seed samples collected in 15 communities of the Central Valleys of Oaxaca and six communities in the coast of Oaxaca and the Frailesca region in Chiapas respectively (Table 9.1). Clearly the average germination rates and even the maximum are low compared to what one should expect from certified seed (above 90%). This is not considered a serious problem however, since farmers seem to compensate for it by planting several seeds per hole when planting.

[51] It is not uncommon for farmers in these communities to carry out little backyard experiments with seed of different kinds (maize or other) "to see if it germinates" ("para ver si nace"). However, this is very different from checking seed germination rate in a systematic way as a preventive measure towards germination failure, e.g. through a basic germination rate test among scientists commonly referred to as "rag-doll" (D. Jeffers, CIMMYT researcher, personal communication).

Table 9.1 Germination rates for seed samples collected from farmers in selected regions of Mexico.

Region	Coast of Oaxaca	Frailesca, Chiapas	Central Valleys, Oaxaca
Germination data			
Number of samples	51	53	152
Germination rate (%)			
average	60.0	59.5	76.8
standard deviation	3.7	6.7	3.9
maximum	68	68	83.4
minimum	49	35	64.2

Source: CIMMYT, unpublished data.

Where to get seed?

Conversation

Among farmers in the Central Valleys of Oaxaca maize is a frequent topic of everyday conversation for both men and women. Usually, a few people are known always to have and be willing to sell maize grain or seed. However, none of them actively advertises this and while, of course, this may supplement the household income, it hardly constitutes an important part of their income generation.

Informal conversation is one of the best ways of obtaining information. Fiona talks about her father, Don Ildefonso, who is in charge of the distribution of irrigation water from the dam near Huitzo. "He has a lot of dialogue with the farmers, those who use irrigation. When he moves around distributing the water, he asks them, 'Who has maize seed' or 'what do I do, I want to plant this and that!' That's the way he gets to know."

Though not from the same community, Josefina and Eduardo say almost the same: "We talk, and people will tell each other where there is seed, 'You wouldn't know who has [seed] because I am going to plant.'" In 2003 Josefina and Eduardo planted black maize on one plot because the ideal planting time for their usual white maize had passed. One day at the market in Oaxaca selling maize, they met another *señora* from the village. Eduardo says: "My wife asked her, 'Listen' she says 'would you happen to have black maize?' 'Yes', she says, 'I do, but in the village.' 'Ah, then I will ask you to sell me a bit that we need for planting."

Referral by others

When a person is looking for a certain kind of maize seed, if a farmer cannot help, he or she will often try to refer the other to somebody else. This was what finally happened when a few days later in the village Josefina and Eduardo arrived at the woman's house: "When we got there: 'Aye! I ran out of it', she says, 'I have just sold the last, but here, my sister in law has the same'.

And to make sure, she took us there, to the house of the other *señora* who gave us the maize seed."

Eduardo also recalls an occasion several years back when many farmers all over the valley had suffered seed loss due to a particularly bad harvest the previous year. His father still had seed. A friend from Reyes Mantecón (another village some 8 km away) came to see him and when he left, he took maize seed back with him. Later, more people from the same town came to Zegache to buy seed from Eduardo's father.

Not surprisingly the information appears to be passed from one to another when people talk. As Catarina explains: "People come to ask you, or they ask somebody else." This is confirmed during the interview with Fiona: "They come to look for him (Ildefonso). 'You wouldn't happen to know who has maize seed?' they ask, and then we tell them, 'At my uncle's they still have.' We are very communicative people. Here we don't need newspapers, we communicate faster than the newspapers. And those who acquire seed, others will ask them in turn. 'Where did you get it?' Then they tell them, the chain develops quickly, then they arrive. That's the way."

Even Francisco who lives and works in the hills on the common land belonging to San Pablo Huitzo describes the flow of information in a similar fashion. Once in a while people will ask him for seed, people who live in the village or elsewhere, but who farm a piece of land up in the hills near the little settlement. According to Francisco people look for others who grow maize in similar circumstances to themselves. This once again stresses the significance that farmers attribute to the genotype-by-environment interaction.

The maize mill

The maize mill is another forum where farmers learn who has what types of maize. Women gather here every day, each one bringing her *nixtamal* (cooked maize ready for milling). While each one waits for her turn, the time is spent talking and meanwhile the various *nixtamals* of different kinds of maize can be admired and the quality of the dough can be assessed as it is milled and gathered.

For Miriam, the maize mill is the place for finding out who has what kind of maize. "That is where one can see. You ask, you see, 'Aye, what a beautiful *negrito* [black maize] you have! Will you sell me one *almud* [approximately 4 kg]?' 'Yes! Of course, I will'. So you go to make sure, you go to their house, the people will sell, yes. It is the same with the *amarillo* [yellow maize]; you see it at the mill, that is the person you ask. 'If she has more? If she will sell some'."

As a man Don Lorenzo rarely, if ever, sets foot in the maize mill. Nevertheless, it is one of the first sources of information he mentions when asked how people find out who plants what kind of maize. When Frida, his wife, brings *nixtamal* to the maize mill, other women will sometimes notice. "They ask her,

'Do you have…?' That's where they notice, the women. The señora tells me. They are talking, having a good time, saying what (kinds of maize) they have."

Figure 9.1 Milling the *nixtamal.*

Like most women in the traditional villages, Doña Liliana also goes to the maize mill on a regular basis. "There you see. They bring *nixtamal* of *belatove*, *negrito*, *amarillo*, all kinds. There you ask the *señoras*: Will you exchange maize

seed with me? Or will you sell some? Just like that." Doña Liliana adds that the people she meets at the maize mill are all from the village and most of them know each other. Nevertheless, like many others, such as Camilo or Pablo L. mentioned above, Doña Liliana also points out, that one can also find out what kinds of maize people cultivate by paying attention when working or walking through the fields, and then noticing to whom a certain field belongs.

Other

Finally there are other ways or sources of information through which people become aware of who has what kind of maize seed. At some stage in Huitzo, for example, a loudspeaker was used by a local merchant to announce the sale of seed. Another good source of this kind of information are the women who make tortillas or other maize dishes for sale, either because they buy maize from others or because people bring them maize to use for a particular order.

How to acquire knowledge about the other party?

Choosing people you know

In as far as the question is about the reputation of the seed provider most people tackle the issue by acquiring seed from people they know. Don Lorenzo's statement above is an example of this, as is the comment by Ildefonso's old mother, Doña Sofia, who pointed out that when acquiring seed, whether maize or bean seed, it is best to acquire it in one's own neighbourhood so that one knows the seed provider quite well and can count on the seed to be good. ("*para que se conozca y para que sea buen maíz para volverlo a tapar*." – "so that you know and can be sure that it is good maize for planting").

Pablo L. acknowledges that there is always a certain element of suspicion that someone will try to take advantage by selling grain and pretending it is seed, although it really is not, or by selling seed left over from the previous year. "That is where one loses confidence and prefers to go to [a friend]." Pablo mentions a couple of farmers, who plant and harvest considerable amounts of maize. "Right now, they must still have maize from two years back. So…not many people buy seed from them…We, and most other people, finished all the maize and only have maize from this year's harvest." The point is the risk that one may acquire seed, which has already lost some of its germination ability, an issue the owner may well be aware of. "Sometimes they will inform people on their own initiative, saying for example 'Now I no longer have maize from two years ago, now I only have fresh [maize]'. The truth is they have really good maize. But sometimes it's the lack of confidence, like, if one does not have maize [seed], 'what if they sell me the one from two years ago…?'".

According to Doña Liliana, people who are rumoured to be reluctant to help others are not popular: "Some people are like that, they don't want to exchange maize [seed], they don't want to sell their maize [seed]. They have no need. They don't trust others. Therefore other people don't like them. Yes, some people are that way." Doña Liliana adds that some people are difficult and unpleasant to deal with. In theory, this could represent a transaction cost in terms of humiliation and embarrassment, if one approached them in order to acquire maize seed from them. However, as long as farmers prefer to acquire seed from people they know and trust, this does not represent any addition to farmers' transaction costs in relation to seed acquisition.

Farmer versus salesman

Those who are recognized as 'good farmers' with good maize germplasm tend to be sought out by others as seed providers. The notion of the 'good farmer' refers to someone who works well and has good maize, knows how to select and save seed, has a sense of social responsibility and is willing to help others (see also Chapter 6).

In order to know what kind of farmer somebody is, Pablo H. points out that one must pay attention to the way the person lives and works. He adds that this is only possible living in the village, as people in the village know each other and each other's ways.

According to Pablo H. it is best to acquire seed from another farmer who is known to be fully dedicated to agriculture. It should not be from someone who buys and sells grain (i.e. as a business), because then there is always a risk, for example, of getting old or mixed seed.

"In my case, for example, I work in the field, I have my seed, I have my maize, I do not need to buy in order to sell. If I sell anything, I have produced it myself. I know what I am selling. And when there is no more maize seed left, what I say to people here is, 'I do not have actual maize seed [specially selected], but I have maize for consumption which is also good. It is big, it is from last year, it is clean.' 'Ah, if it is good, then let me buy some of that'. But that way I do not cheat people." But a farmer who is also a salesman may be tempted to mix his maize harvest with another poorer kind of maize in order to earn an extra profit. Contrary to this, says Don Pablo, one can count on what is sold by the real farmer who does not have any kind of business on the side.

Discussing the issue of knowledge of the seed provider, Pablo L. compares seed acquisition in the village with buying seed at the market in Oaxaca, "No! In the city it is much more commercialized. They want to sell!" In the village, on the other hand, he continues: "There is confidence among people – among fellow farmers, friends. One will say, 'Look, this maize I harvested two years ago. If you want, take it, but I am not certain it will develop well."

In principle the price is negotiable (more on this below). In this case the price is likely to be that of grain – as the maize kernels referred to are from previous years, it is not likely to be sold as seed (due to the rapid decline in maize seed viability under ordinary storage conditions). This does not exclude the possibility that someone would use it as seed. The point is not so much the price as the trust or confidence that one will not be cheated.

Through a third party

In the case where people do not know each other beforehand, but both are from the village, they usually have a relation with a third party in common. This facilitates the transaction, like in the case of Eduardo and Josefina, where their friend went with them and introduced them to her sister-in-law, from whom they then purchased seed.

Negotiation costs

How is the negotiation for seed done?

Various factors influence the terms of a seed transaction. The type of transaction and the price or exchange must be defined. Both may depend on the type of social relation between the seed provider and the person requesting the seed, or the knowledge one may have about the other - particularly the seed provider about the person asking for seed. Furthermore the time of year and the general demand for seed may influence the price in the case of purchase.

Below, I first present the findings relevant to the negotiation of the type of transaction, ordered by transaction type. Then findings relevant to the negotiation of the price or exchange rate are presented. Finally this section ends with a few remarks regarding the influence of the reputation of each party on the outcome.

Negotiation of price

Generally, it is up to the seed provider to say how much the price will be (Pablo H., Eduardo). However, at any stage there is usually a commonly recognized price which may vary a bit, but not much, in the individual transaction. As Fiona explained, "There is already a price, which people will know. Here the one for eating is at 3 [pesos]/kg and the one for planting is at 5 [pesos]". Similarly Catarina said: "In the village, the price of maize for tortilla is 3 pesos and the one for seed is at 4.50 [pesos]/ kg." Pablo L.: "You negotiate a price or [in most cases] there is already a price."

Price information is a frequent topic of ordinary small talk, and upon returning from the market people are often asked about the prices of produce and goods. When buying/selling maize seed, the price has to be agreed upon before a transaction takes place, and unless they feel very pressed, farmers will only buy if they can accept the price, which is, of course, not necessarily

the same as being happy with it. Sometimes, therefore, if the person buying thinks the price is too high, he or she may prefer to wait and see if a better deal can be made elsewhere.

If the kernels in question were selected as seed, the seed provider will usually try to sell at the price of seed. Likewise, if the kernels were not selected as seed they are likely to go at the price of grain. However, depending on the situation the seller may want to try to pass it off as seed. This is where the negotiation comes in. Alternatively, if it is his brother who requests the seed/grain, the provider may just give it to him for free! Table 9.2 shows producer and consumer prices for maize seed and grain in three communities in the region in May 1998.

Table 9.2 Producer and consumer prices for maize seed and grain, San Pablo Huitzo, San Lorenzo Albarradas, and Santa Ana Zegache, Central Valleys of Oaxaca, Mexico, May 1998.

Maize	San Pablo Huitzo	San Lorenzo Albarradas	Santa Ana Zegache
Seed (MX$/kg)			
Buy	4.66	--	4.09
Sell	4.34	4.97	4.07
Grain (MX$/kg)			
Buy	2.20	1.54	2.61
Sell	2.17	2.06	2.60

Source: Smale et al., 1999.
US$1 = MX$8.89 (May 1998).

Price fluctuation. Both seed and grain prices fluctuate during the course of the year. According to informants, grain prices start climbing between planting and harvest, when many people's grain reserves run out. Meanwhile, seed is at its most expensive during planting season, in other words, from around the 15th of May, until 15th of July. If the previous year was bad and many farmers lost seed, it may affect the price of seed the following year.

As Liliana said: "(It is most expensive) when it is time for planting. When there is no harvest. But when there is a good harvest it doesn't sell." Or, as Rodolfo explained, if one is running late with the planting of some of the land and needs to acquire seed in order to finish planting in time, one may be pressed and therefore willing to pay whatever price the seed provider asks. This happened to him last year. He had already paid for a tractor to plough the piece of land and planting season was almost over. "Let's buy, it is getting too late', I said to my son, 'If it succeeds, that's it. If not, we can always give it to the animals'". When his daughter told him her father-in-law still had seed maize, Rodolfo didn't think twice before asking if they would sell seed.

Rodolfo was pressed for time and eager to finish planting. He did not care much whether this last plot was going to succeed at producing grain or not. If he had wanted to, he could have negotiated another type of transaction, or he

could have bought seed from someone else, or he could have chosen to use his own maize for consumption as seed or any other consumption maize he could get his hands on.

Rodolfo's daughter went to get the seed, but had to shell it herself, and they were still asked to pay 5 pesos/kg (the average price, but for shelled seed). Rodolfo thinks this is too much, considering the seed was not shelled and considering they are affiliated through the conjugal relation of their children (i.e. he would have expected more favourable treatment). "As I say, we don't all have the same heart." Still, Rodolfo says, he would have taken the seed even if the price had been double: "Even so, one will grab it – that's when you really need it!"

Haggling. Although there is normally some generally recognized price level, the person who is acquiring the seed may try to haggle the price. However, according to various informants, in the end the price depends on how interested the buyer is in acquiring the seed, like in the case of Rodolfo (mentioned above) or the case of Bernardo. An acquaintance from the market in Etla had talked very favourably about his maize, and when Bernardo saw it, he liked it very much and decided he would like to try it out on his own land. He was planning to get 10 kilos, but when they came to discussing the price and the other wanted 7 pesos/kg, Bernardo changed his mind. "'Why so expensive, compadre[52]? That is very expensive!' 'No, this also cost me a lot of work!'" Finally they arrived at a compromise: Bernardo would pay 6 pesos per kg, but then he only wanted to acquire 1 *almud* (4 kg). Bernardo had managed to negotiate the price.

So did Eduardo and Josefina when they acquired the black maize seed this year. Josefina explains: "We bought it at 18 [pesos] per *almud*. Yes. Because she wanted 20 [pesos], and I said, 'Yes, it is true, they sell it at more, but that's when they take it to Oaxaca, one has other expenses paying the bus, the bags and so on… This, on the other hand is direct…'". Eduardo adds, that this was partly due to their relation with the other woman (who introduced them to her sister in-law from whom they bought the seed) "and also because the *señora* (Josefina) is a bit of a haggler", he laughs. Josefina defends herself mentioning that with several children, she must be careful with the expenses, lest she might find herself without money to pay at the maize mill. "What is more", she says, "One pays back with the same coin. One remembers." ("*Con la misma moneda se paga*", "What goes around, comes around").

Exchange and lending. In the case of exchange there is less room for negotiation of 'price', at least in theory. The general understanding of the terms of this type of transaction is that the category and quantity must be the same, that is, exchange of equal amounts and quality of seed of different kinds of

[52] Here a way speaking to invoke a notion of social affiliation or closeness.

maize. If the seed seeker does not have seed, but has grain instead, he/she can ask for an exchange of maize grain, from which he/she must then select the best for seed. Josefina explains: "'Look, I am going to give you seed maize, because what I want is seed.' And then they do as agreed: 'Seed I receive, seed I give'. But if they agree, one can say: 'Look, I have no seed maize left, I only have tortilla maize. If you want you can select from that' – and then: you give me tortilla maize and I give you tortilla maize. But if I want seed maize, I have to give seed maize!" If somebody requests *cambio de semilla* (exchange of seed) and gives the seed provider maize which is obviously not seed quality in return for seed quality maize, it is regarded as cheating the seed provider, unless he/she was aware of and had accepted the difference in qualities. This is what happened, when Catarina agreed to exchange seed with another *señora* and received grain for consumption in return for her own specially selected seed (Chapter 8, Section on Reciprocal trust).

If it is a question of lending seed, the general understanding is that after the harvest the seed receiver must give back same category and amount of seed as he/she received from the seed provider. "He gave me seed, so I must give seed. Exactly! The same!" as Camilo explained. Informants made no mention of the use of interests or similar costs in relation to this type of transaction, either during this or previous CIMMYT studies in the Central Valleys.

How much does the reputation of each party influence the outcome?

When people seek seed, their first choice of seed source will be somebody they already know and feel comfortable with (e.g. Lorenzo (this chapter's section on Trust), Camilo (Chapter 8, section on Seed exchange and trust)). If this is not possible they will seek to acquire the desired seed elsewhere. However they will not approach someone with a 'bad reputation' if they can avoid it. In this context reputation refers to his or her approachability and willingness to interact socially. In that sense, if one has a reputation of being bad tempered or not inclined to help others, not many people will ask you for seed. As Liliana said about people who have a reputation for not wanting to provide seed: "Other people don't like them." The opposite will be the case if the seed provider is known for having good maize and quality seed and for being fair and agreeable to deal with.

Not bothering to select seed. From focus group discussions and individual interviews in these and other communities in the Central Valleys of Oaxaca, we know that some farmers have a special attachment to their seed lot and need to be convinced, before distributing any of it, that a receiving farmer will take good care of the seed, that is, appreciate it and select his/her own seed from one year to the other in order not to lose it. In the interviews for the present study, this was not directly expressed; however, it emerged clearly that not bothering to select and save seed, if one had the opportunity to do so, is associated with being lazy, and looked upon with disapproval. As Don

Teodoro said: "No! Then people will say, 'Well, you have maize! Why do you go to buy? Work! Why do you go buying? Why do you go to buy seed? Is it that you don't work? If you work, why don't you select it yourself, then? Or is it because you are lazy that you don't have any [seed]?'"

Losing one's seed. In some ways losing one's seed may be associated with a similar humiliation or stigma. As described elsewhere (Badstue et al., 2003b) the practice of saving one's own maize seed is strongly associated with the notion of being a 'good farmer', that is, someone who takes good care of his/her seed and make every effort not to lose it. As became clear in several ways during fieldwork, for example in the focus group discussions, some farmers therefore find seed loss embarrassing (see Chapter 6).

Requesting a seed transaction may therefore invoke the impression, that the person asking for seed is not a 'good farmer', or at least this may be the seed seeker's own perception. Some farmers will therefore try to avoid mentioning seed loss, or make a point of not having lost their seed. For example, when Catarina described her experience with the moth infested seed (Chapter 8, section on One-sided reliability), she deliberately emphasized that she was not acquiring seed because she had lost her own. When I made a note of this and asked Catarina about other people's attitude to farmers who lose their maize seed, she smiled, knowing exactly what the question was about "They will say to them, why they don't save seed, instead of having to ask for it all the time!"

It should be mentioned, though, that farmers in the Central Valleys generally acknowledge that bad luck can happen to anyone. If a certain farmer normally takes good care of the seed, but somehow happens to lose it, it appears to be fully acceptable and legitimate for him/her to obtain seed from other farmers that year. In this case, the person is regarded as someone who has a justifiable need for the seed. Furthermore, the seed provider can rest assured that the other farmer will 'take good care' of the seed, as in the example above. In other words, this person is someone who 'deserves' the favour and who will appreciate it.

The majority of all farmers in the study communities, however, observe the general practice of selecting and saving their own seed from the previous harvest. Very few farmers, if any at all, do not bother to select and save seed from the previous maize harvest, and seed acquisitions from other farmers are therefore mainly to obtain different kinds of maize seed or to make up for a partial or complete seed loss.

Seed seeker's reliability. Seed providers want a 'safe' transaction. Pablo H. explains, for example, that if people want to buy, he has no reservations. On the other hand, if the person who requests seed wishes to borrow it, he will only agree if it is somebody he knows can be trusted, and is able to pay it back. In the opposite case, he says, "I would rather say that I have don't have any seed, and that's it. To avoid having to explain myself." Similarly, in the case of

exchange, some people (e.g. Pablo H.) may give seed for grain as preferential treatment, if it is somebody they know or feel some kind of responsibility for.

Seed seeker's resources. The seed provider's knowledge about the person requesting the seed may also influence the negotiation in other ways. According to Don Rodolfo, in any kind of transaction people will take advantage and try to make you pay a good price if they know you can afford it. Nevertheless, he still acknowledges that the opposite may also apply; that a poor person will get a comparatively cheaper price. This largely depends on the personality and sense of social responsibility of the provider.

Social responsibility. Some people have a strong sense of social responsibility. Therefore, if the person seeking seed is very poor, some seed providers will take pity and give that person favourable treatment, such as give maize for consumption for free to be used as seed. Like Pablo H. said, if it is someone he knows and who is very poor, he may just do it as a special favour. "*Se trata de ayudar*", he says ("It's about helping others").

Lorenzo also made a point of the importance of being willing to help others. As mentioned above, he will sometimes accept work instead of money or other payment. "One must not be bad. Otherwise, [when you need help], people will [remember] you. The person, who treats you well, should also be treated well. Those who do not have - one must help them."

Enforcement costs

What happens when the seed is of poor quality?

When Fiona was asked what happens if the seed one acquired (from a commercial seed vendor) does not germinate, it was clear that she did not think one should expect any compensation, but rather that the seed vendor would talk his/her way out of it (see Fiona's comment, Chapter 8, Seed exchange and trust, One-sided reliability). "One takes a risk; it is one's own problem. You bought the seed. Whether it went well or not is your problem. You can't go back and complain," she added.

Judging from what other farmers said, this seems not to be an unlikely outcome. Catarina's experience with the maize seed from San Martin is a good example (see Chapter 8, section on One-sided reliability). When I asked her whether she went to complain, Catarina exclaimed: "Aye! Just to find the one who sold it to me!! No! [Furthermore] I was the one who decided to buy it!"

Whether in these situations it is possible to get compensation, seems to depend very much on the circumstances. If the seed was bought at the market, there is very little chance of compensation. As Catarina said, "just to find the person who sold it to you is a problem". If it was bought at an agro-veterinary stockist, there is little chance, but depending on the circumstances one may actually succeed in getting some kind of compensation.

As mentioned earlier, when Pablo L. found that the seed he had bought at the local agro-veterinary shop was damaged by insects and only germinated in parts, he managed to make the shopkeeper compensate him for the cost of the seed. Similarly Pablo H. complained to the stockist, who had sold him a tin of onion seed that was overdue and did not germinate, and in the end he received a new tin of onion seed. Nevertheless, it requires a certain amount of confidence to take up a discussion/argument of this kind with a shopkeeper, who can always claim that it was your own decision to buy. Furthermore, even if the farmer is compensated for the cost of the seed, this may only cover a small part of his/her loss.

If the seed in a recently planted field does not germinate, or if the crop is lost in the very early stage (e.g. due to weather conditions), depending on the circumstances, there may still be time to plant another maize crop in the same field, or, if it is too late for maize, another crop, for example chickpeas. However, whether maize or chickpeas, the land will normally have to be ploughed again. Therefore, if the maize seed does not germinate, it may not mean complete loss of crop production that year, but it will normally mean the loss of the cost of (at a minimum) the first land preparation, as in Pablo L.'s case, where his loss also included the costs of the ploughing of the land and the planting.

If the seed was acquired from another farmer in the same community, most informants did not believe that the seed would not be good, or that compensation would be an issue at all. "In the village you know this won't happen," said Pablo H. "As long as it is not damaged by insects, that will not happen," was the comment of Josefina and Eduardo. And as Camilo said: "How can I sell you something that is not good? No, not here. Like I say, that has never happened to me. I guess because we are not people who…yes, we don't like to cheat others. One must sell good things."

Some commented that failure to perform in the case of maize would most likely be accredited to agro-ecological issues or inappropriate management. It seems clear that in most cases it would be very difficult to prove that the reason for failure was bad seed quality – furthermore having seen the seed before acquiring it, it is difficult to claim that it was not the farmer's own decision to acquire it.

Does crop failure have repercussions on the reputation of the seller?

If seed is acquired which does not germinate, and it is believed that the reason for this was bad seed quality or cheating, the seed receiver will not come back for more seed in future if he/ she has other alternative sources. As Rodolfo said: "You simply don't plant that one again." What is more, the seed receiver is not likely to recommend the provider to others.

Is compensation for crop failure relevant?

Informants clearly do not consider compensation is relevant in relation to seed acquired within the same community. On the other hand most people seem to foster a general lack of confidence when it comes to acquiring seed from strangers and market vendors. In the section on One-sided reliability, Chapter 8, Francisco expressed reservations with regard to buying seed from strangers. Likewise, Camilo had no doubt that there is an element of risk attached to acquiring seed in the market, and that the possibility for complaining or obtaining compensation is minimal, for example, in the case of germination failure (Chapter 8, under Generalized trust).

To a certain extent this also applies to agro-veterinary stockists: see Pablo H.'s comment above that one cannot always be sure about the seed they sell. A formal seed sector has yet to develop in Oaxaca, and seed stockists are few here. Their assortment of maize varieties is limited and few small scale maize farmers are among their clients. The uncertainty around seed quality, which Pablo H. refers to in the above-mentioned example, relates particularly to small quantity purchases. In Mexico maize seed from the formal seed sector is sold in 50 kg bags, meaning that when a small-scale farmer acquires 10 kg it is weighed out and sold without information about its expiry date.

How are contracts finalized?

The finalization of individual seed transactions occurs when payment is completed. "It was a case of buying-selling and that was it. Now it is finished, nobody owes anything" as Fiona explained about purchase. However, as mentioned in Chapter 8 (under The role of money in seed exchange) in many cases the seed transaction occurs in a context of mutual favours and reciprocity. Even though the individual seed transaction has been finalized, the relationship of mutual help and reciprocity may continue.

In the case where the seed transaction is gift or has a strong element of this (e.g. preferential treatment) the finalization may appear more blurred. If it is a gift, does it mean that you do not owe anything? Informants differ in their responses as to whether one party owes anything in the case of gift; however, most informants (if not all) agree that one ought to return the favour if the need arises and one has the opportunity to do so.

Time of payment depends on the type of transaction. If it is a purchase, the payment is made immediately, or in other words the handing over of the seed is dependent on payment. *"Allí mismo!"* as Pablo L., Fiona and Don Teodoro said ("Right there!"). If it is exchange, the interchange is done simultaneously, and if it is a loan, the rule of thumb is that the same quantity of seed, which was borrowed, is given back to the seed provider after the harvest.

Discussion

In the following, an overview of the transaction costs related to small-scale farmers' maize seed acquisitions is pulled together, based on the findings presented in the previous sections. This is followed by an overview of the risk factors, which farmers perceive in relation to maize seed acquisitions. Farmers' strategies for risk reduction in relation to maize seed acquisitions are then discussed, and finally an overview of the cost factors related to the acquisition of different categories of seed is presented.

Transaction costs

The findings presented in the previous sections show that the easiest source of knowledge and trustworthy information about seed, not surprisingly, is the people whom the farmer already knows and trusts. Often he or she may already know the characteristics of varieties used by kin or close friends and can easily obtain more information. Indeed, the most frequent ways of obtaining information about maize seed from outside the household are:

- Farmer experimentation;
- Conversations with family members, *compadres*, and neighbours;
- Paying attention to what other farmers are growing and how it performs (e.g. when working together in a *tequio* or a *guelaguetza*; and moving around in the communities);
- Furthermore, farmers usually inspect the seed before acquisition as a minimum measure of protection against low seed quality.

In general these ways of acquiring information about maize seed are not interpreted by farmers as sacrifices. Rather, to a great extent, they form part of every day social practice and conversation and are normally not separated from ordinary social life. Still, if the information or the seed is sought further away, for instance in Oaxaca, it may entail a cost. However, when farmers go to the market or travel to the city, they always take advantage of the occasion to combine several tasks, thereby economizing on transaction costs.

When looking for seed, farmers will refer each other to seed providers they know and trust. Referral by others may imply costs in terms of increased search time and the social relations with the new person might be less close. This in turn may lead to increased costs in the sense that the one who obtains seed may not get the preferential treatment, which could have occurred with a closer relation. On the other hand the new contact may represent an expansion of one's social network.

Finally, the advertisement of seed for sale via a loudspeaker, as was mentioned by informants in a previous study in this region, represents a cost for

the seed provider, but not to the buyer, though of course, the advertisement cost may be factored into the price of the seed.

Farmers' negotiation costs in relation to maize seed acquisition, as reported in this study, are generally low and mostly consist of the time and effort spent to achieve a satisfactory transaction. The type of social relation between the parties involved may influence the outcome of the negotiation, that is, the type of transaction or the price and form of payment. Similarly, depending on the circumstances, the reputation of either of the parties may influence the negotiation, positively or negatively. Furthermore, farmers sometimes try to haggle the price of seed. This way the financial cost of the seed may be reduced; however, depending on the situation, this could be outweighed by increased negotiation costs, in terms of social responsibility or loss of prestige on behalf of the person acquiring the seed.

In terms of enforcement costs the situation is similar. The possibility of compensation, for example in the case of low germination, is generally very low. The vast majority of seed transactions in the study area are informal and in most cases the farmer has little or no means of actual enforcement. As a result it is essentially presumed that the seed receiver assumes the risk. Nevertheless, a few examples were found of compensation for seed that did not germinate. In these cases, however, the compensation only covered the seed itself, not the investment in land preparation and loss of harvest, that is, only a very partial compensation. Still, if a transaction is not completed satisfactorily, there may be other repercussions. The seed seeker may avoid that particular seed provider in future and not recommend him/ her to others, or; if the fault is on the seed receiver's side, the seed provider may be very reluctant to engage in new seed transactions with this person.

Transactions are normally considered to be finalized when payment is completed. However, regardless of the type of transaction, farmers often look at seed transactions from a perspective of mutual favours and consideration. In this light, most informants, if not all, agree that one ought to return the favour, if the need arises and one has the opportunity to do so. This can be interpreted in the sense that, although the transaction has been finalized, a relationship of mutual help and reciprocity continues or has been initiated. In this context certain obligations may pertain, although they are not clearly spelt out. This, on the other hand, permits flexibility and practical solutions whenever problems arise and social networks of mutual help are called upon.

Risk as a transaction cost

Given the definition of transaction costs as the costs incurred by participants in order to initiate and complete a transaction, it could be argued that the issue of risk connected to crop failure or germination failure is not part of the transaction, but rather represents risks strictly inherent in farming. Thus, it

could be argued, these issues should be regarded as production costs, and not as transaction costs.

However, many farmers have experienced crop failure, either as partial or complete harvest losses for different reasons. When acquiring seed from outside the farm, the risk of crop failure due to inadequate seed is therefore interpreted as a 'real' risk and constitutes a serious concern for farmers. Furthermore, to a large extent, the risk of crop failure due to inadequate seed is directly linked to the lack of transparency of seed. On one hand, there is the issue of seed quality, that is, the question of whether the seed will germinate. On the other hand, if it germinates there is still the question of how the genotype will perform under the particular agro-ecological and management conditions, and whether it will display the traits and characteristics demanded by the farmer.

The question of seed quality mainly implies a transaction cost in terms of risk of germination failure. However, as long as the seed is acquired from another farmer within the same community, the issue of seed quality does not seem to invoke any notion of transaction costs among the informants. In general, as long as the seed was clean and undamaged, farmers in both communities had difficulty imagining that locally acquired seed would not germinate. That is, in this situation the perceived transaction costs in terms of germination failure were very low or zero. This may increase in the cases where grain is used as seed, as grain is often stored with less care than seed and though the selection is careful, deficiencies in storage may have lowered seed quality.

Meanwhile, informants manifested a general distrust in market vendors and maize seed from these or other unknown sources. In that sense, the moment farmers acquire seed from unknown sources, for example, from outside the community, transaction costs increase drastically in terms of perceived insecurity regarding seed quality and/or seed traits, in other words, risk of crop failure due to inadequate seed.

The non-transparency of seed creates problems of incomplete and/or asymmetric information. The seed provider may know that the seed performs well under the usual conditions where he or she has planted it. However, these conditions may be different from the conditions in the seed receiver's field, and the information may therefore not be applicable. Likewise, the seed receiver normally knows the place where the seed will be planted, but this knowledge may not be sufficiently comparable to the knowledge of the seed supplier. In both cases, the asymmetry in information may lead to the acquisition of inadequate seed. Thus it is not necessarily due to ill will on behalf of the seller - it may simply be attributed to incomplete information on the local production conditions or incomplete information on the requirements of the seed receiver in terms of seed traits.

The problem of asymmetry of information is less when seed provider and seed receiver are from the same area. In that case the chances are high, that the seed receiver will know the circumstances the seed was produced under, and likewise, that the seed provider will know the kind of production conditions the seed receiver requires the seed for. However, when distances increase, it may accentuate the problem of asymmetry of information, as the chances are that each one will know less about the conditions in which the other grows his/her maize.

Other types of risk may also constitute transaction costs in relation to seed transactions. For example, in the case of exchange or lending, the seed provider assumes a transaction cost in terms of the risk of not receiving the expected quality of seed in return. For lending there is furthermore a time factor, which can be interpreted as negative or positive: the lender is without his/her seed for a time, but on the other hand he/she receives fresh seed in return. Finally, there is yet another risk factor for the lender; that of the seed not being returned. Depending on the amount of seed in question, this can be a relatively high cost, and according to informants' testimonies this is the main reason for seed providers' reluctance to use this type of transaction.

Ways of dealing with risk

Experimentation

As pointed out in the findings, informal experimentation provides farmers with first hand information about the characteristics and the performance of particular maize types under specific agro-ecological and management circumstances. Upon evaluating the experiment, the farmer has a relatively good basis for deciding whether the maize type in question is appropriate in relation to his or her production objectives. Such experimentation typically implies planting a separate variety at a reduced scale (e.g. 1-2 rows) but according to the farmers who participated in this study, it does not represent a significant cost, for example, in terms of extra time or labour. The principal cost is the risk that the experiment will not be successful. However, this is manageable due to the small scale of most farmer experiments. Furthermore, at the end of the day the carrying out of small-scale experiments reduces the risk of major failure. Farmer experiments therefore serve both the purpose of information and of risk control.

Strictly speaking, there may be a question of transaction costs in terms of time linked to farmer experimentation in the sense that the time used gathering information is prolonged. However, for most small-scale farmers in the Central Valleys of Oaxaca, the time spent carrying out farmer experiments is not a significant transaction cost in comparison to the risks implied, if he/she had decided not to do the testing on a small piece of land first. Furthermore, experiments which are normally established with relatively small amounts of

seed, are often used by farmers to multiply seed. If the farmer chooses to continue to plant that particular maize variety, he/she may decide to use the kernels harvested in the 'experiment' as seed, thereby avoiding the need to acquire seed again.

Trust and other elements of social capital in seed acquisitions

Trust is a key issue in seed transactions (Almekinders, Louwaars and de Bruijn, 1994; Seboka and Deressa, 2000; Tripp, 2000). This is directly related to the lack of transparency of seed. The findings indicate that seed acquired from people the farmer knows and trusts, in general is perceived as entailing less risk of crop failure due to inadequate seed, than seed acquired from unknown sources. In other words, the more the seed receiver knows and trusts the seed provider, the less the perceived risk related to incomplete or asymmetric information. Acquiring seed from trusted social relations can therefore be seen as a way of reducing the problem of lack of transparency in seed, which in turn reduces transaction costs in terms of perceived risk of crop failure due to inadequate seed.

Relations of trust are conducive to easy access and exchange of information at low costs. Acquiring seed through relations of trust may also enhance one's possibilities of preferential treatment: for example, in terms of the type of transaction, such as lending or exchange, which are almost exclusively carried out between people with prior social relations of trust, instead of purchase (Badstue et al. 2003a). However, in the case of asymmetrical relations, preferential treatment may occasionally come at a social cost in terms of the confirmation or reinforcement of the difference in status of the parties involved (e.g. where one person is dependent on the other).

The issue of trust may be influenced by either of the contracting parties' reputations**.** For example, acquiring seed to try out something new / experiment is accepted as a normal farming activity, as is the occasional complementation of seed. However acquiring seed every year, for want of practicing traditional seed selection and saving one's own seed, or, for lack of ability to save seed, easily earns one a reputation of being a lazy/poorly skilled farmer. This, in turn, is likely to influence the general perception of one's trustworthiness as well as the possibilities for preferential treatment. Nobody wants to lend or exchange seed with someone who is not likely to get a good crop, or who cannot be trusted to fulfil his part of the deal. If the seed seeker is rumoured to be unreliable or not a good farmer, any transaction is therefore likely to be a purchase, unless the seed provider feels a special obligation (e.g. is close kin or *compadre*). On the other hand, the seed supplier may achieve a negative reputation if the seed he /she provided to someone turns out to be of bad quality, or if the seed receiver feels wronged in any other way. This can be a problem for a commercial seed trader, but also for a farmer acting as seed provider. Interestingly the 'good farmer' appears in general to be trusted

much more than the seed trader, who could be argued to have a professional reputation to protect. This lack of trust in commercial seed merchants could be a major barrier for the establishment of a commercial seed sector and the introduction of new varieties in the region.

It is interesting to look at the issue of trust from a perspective of social capital. Reaching back to some of the perspectives presented in Chapter 8 (Different understandings of the concept of social capital) we can apply Fafchamps ideas on social capital (Fafchamps, 2002, Fafchamps and Minten, 2002) to the seed transactions in the Central Valleys of Oaxaca. When farmers in the study communities acquire maize seed from other farmers, they generally choose the seed provider among the people they trust. As is clear in several of the testimonies cited above, they do not believe that seed acquired in this way, would not be good. This can be interpreted as an expression of generalized trust or social capital as a 'stock' of trust in a group. However, many of the farmers will furthermore possess social capital in the form of 'an individual asset' or personalized trust established through repeated interpersonal interactions with their peers. Therefore, as far as seed transactions within the local community are concerned, it could be argued that both types of social capital are at work.

Meanwhile, the perceived risk of crop failure due to inadequate seed appears to be relatively high in seed acquired from commercial seed providers, be it agro-veterinary stockists, market vendors or petty commerce shopkeepers. The remarks and testimonies expressing farmers' distrust of commercial seed providers, makes an example of a situation in which there is neither personalized trust through interpersonal relationships, for example in the form of a previous record of transactions together; nor generalized trust. In fact it is almost the opposite, namely, a belief that the commercial seed seller will do anything to make a profit, including cheating. In other words, while local seed supply can be understood as facilitated by a high degree of both generalized and personalized trust, commercial seed sellers suffer from a general lack of trust. Furthermore, due to farmers' attachment to local maize varieties and the common practice of selecting and saving seed from one's own harvest, seed acquisition from other sources, such as commercial seed sellers, is relatively infrequent. This makes it difficult for individual commercial seed merchants to build up trust through repeated interpersonal interaction.

Others have taken a different perspective on social capital, as discussed in Chapter 8. For example, Portes sees social capital as the capacity of individuals to use networks in order to mobilize resources. However, in this particular case where the focus is on transaction costs, it is difficult to distinguish - and makes little difference - whether social capital is permanently present or if it is only brought into play in the transaction. With either view (Fafchamps'

or Portes') the conclusion is that social capital significantly reduces the risks involved in seed transactions.

In the examples used above, transaction costs consist mainly of an element of risk. However, there seems to be a clear relation between the level of trust in the relationship between the two parties and the risks perceived by the seed receiver, that is, the level of transaction costs. If the seed provider is from outside the community and a stranger to the seed receiver, meaning there is neither generalized nor personalized trust, the transaction costs in terms of perceived risk are high. On the other hand, if the seed provider is a farmer from the same community as the seed receiver and maybe furthermore a close social relation of his/hers, the level of trust may be high and the transaction costs low. The relation between the two can also be expressed graphically (Figure 9.2).

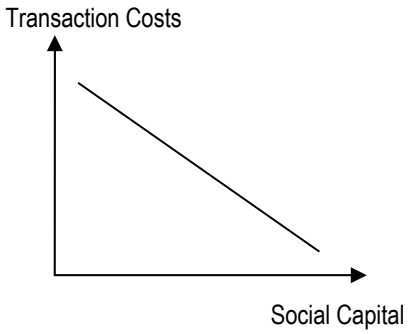

Figure 9.2 Social capital and transaction costs in seed transactions.

There seems to be a similar relation between transaction costs in terms of risk on one hand and local seed versus introduced seed, on the other hand, that is, seed that was not acquired from another farmer in the same community (see also Table 9.3 below).

To a large degree these perspectives coincide with Plattner's conclusion (1989) that the poorer the information, the higher the transaction costs, the riskier the exchange and the more valuable to invest in personalized relationships, which in this case would mean acquiring seed from people one knows and trusts. This furthermore seems to be supported by the work of DiMaggio and Louch mentioned in Chapter 8 (Section on Trust in relation to uncertainty and risk).

Plattner (1989) distinguishes between impersonal and personal modes of exchange. An impersonal mode occurs when transactors have no relation with each other beyond the short term of the exchange; and the personal mode refers to transactions between people who have a relationship that endures past the exchange. We could also look at the latter as transactions embedded in people's networks of social relations (Granovetter, 1985).

Previous research in the Central Valleys of Oaxaca has found maize seed acquisitions to occur on average 0.31 times per farmer per year, or approximately once every three years (Badstue et al., 2003b). Given this low frequency of seed transactions it would be difficult to establish trust solely based on seed transactions, as was also pointed out in Chapter 8. When transactions are carried out in a personal mode of exchange, the seed recipient hedges the risk of receiving poor seed against the whole social relation with the seed provider, thus the problem of establishing trust solely based on seed transactions is overcome. In principle, this would also mean less asymmetry between provider and receiver than in an ordinary market exchange, that is, relatively low transactions costs when acquiring seed within one's own community. The question is, whether this would apply equally to all farmers in the community?

Hardly any of the persons interviewed are completely without any social relations. Still, this does not mean they are all equally well 'connected' or can draw on equal resources in this respect (see for example the case of Miriam, mentioned in Chapter 8 in the section on Seed exchange in the study area from a social network analysis perspective). Nevertheless, for the farmers who are marginalized in one or several ways and are less well connected than others in their community, it is often, albeit not in all cases, even more difficult, troublesome and costly to engage in non-local transactions. If one's Spanish is very poor, if one is illiterate and has difficulty managing numbers, and if on top of that one has to travel a long way for non-local seed transactions, local seed transactions still have many comparative advantages, although it may be more difficult for some than for other people in the same community.

Comparing three different categories of seed

Table 9.3, below, presents a summary of the main factors influencing seed receivers perceived transaction costs in relation to seed acquisition. A distinction is made between locally acquired seed, that is, seed from the same community or nearby and introduced seed from further away. As seed produced by the farmers themselves is the most common source of seed, own seed has also been included in the table, though it obviously involves no transaction cost.

Clearly the transaction costs associated with acquiring seed appear to be negligible for farmers as long as the seed transaction happens within the farmer's social network and community. Not surprisingly, as described elsewhere (Badstue, 2003b and Chapter 8 here) most seed transactions occur within farmers' social networks and communities. Transaction costs may be substantially higher however, for a farmer who wants to acquire seed outside his/her social network and community.

Table 9.3 Seed receivers' perceived transaction costs in relation to seed acquisition a comparison of 3 different categories of seed.

Cost factors	Own seed	Locally acquired seed	Introduced seed
Information costs	None	Low or none	Potentially higher, but no investment being made
Negotiation costs	N.A.	Variable	Low
Enforcement costs (incl. possibility for compensation in case of failure)	N.A.	Not considered relevant – risk borne by receiver	Very low – risk borne by receiver
Perceived risk of germination failure	Low	Low	Higher
Perceived G x E risk	None	Low	Higher
Transaction types	N.A.	Various	Purchase
Price of seed	Nil*	Low	Higher
Type of seed provider	One self	Farmer from same community	Typically commercial seed seller
Motivation of seed provider	N.A.	Social responsibility	Profit
Trust and other types of social capital	High	High	Low (unless personalized trust)

* From the point of view of economic theory, there is a shadow value to using own seed, even though there is no market transaction. However, as pointed out by several authors (e.g. Buckley and Chapman, 1997; Sadoulet and de Janvry in Gabre-Madhin, 2001) transaction costs cannot be understood separately from issues of perception, and from the perspective of the small-scale farmers, who participated in this study, using own seed does not represent a cost as it is not bought – rather, it has the advantage of being free.

The CIMMYT/INIFAP project offered farmers the opportunity to acquire seed from a subset of maize landraces representing the regional maize diversity at the local price of maize seed (Bellon et al., 2003a; Smale et al., 2003). A total of 371 farmers took advantage of this opportunity, purchasing a total of 2,726 kg seed, mainly to carry out experiments (Bellon, 2004). The project created an information-rich environment in which farmers could see the materials in the field and could purchase seed immediately if desired. These results suggested that farmers are very interested in trying new seeds, but that accessing seed from the 'outside' may be constrained partly by the price itself, but probably just as much, or more, by the transaction costs of accessing information and the actual seed of 'foreign' varieties, (i.e. perceived risk).

The importance of trust and other elements of social capital in seed transactions have also been shown to be relevant in another study carried out by CIMMYT with both subsistence and commercial farmers in the coast of Oaxaca and the Frailesca region of Chiapas (Bellon et al., 2003b, 2005). In that

study, farmers were found to gather information about seed in very similar ways to those described here, and like the farmers in the Central Valleys, they had great confidence in their own seed or that of their family, neighbours and friends, but were distrustful of seed from 'outside'.

Conclusion

This study was based on the hypothesis that issues such as the cost of obtaining information, negotiation costs, and enforcement costs would make up a substantial part of the transaction costs in small-scale farmers' acquisition of maize seed. Nevertheless, the findings suggest that these costs are negligible in most seed transactions, as long as these take place within the village and farmers' social networks. In this case, no evidence was found of specific investments related to obtaining information, and the negotiation costs are generally small, though they may increase in the case where the receiver of seed is trying to obtain preferential treatment such as a lower price than normal. This benefit could then be argued to outweigh the increased negotiation cost. Enforcement costs are not considered relevant as, essentially, it is presumed that the seed receiver assumes the risk. Farmers therefore generally do not expect compensation for crop failure, even though a few examples were found of compensation for seed that did not germinate. However, in these cases the compensation only covered the seed itself, not the investment in land preparation and loss of harvest. It was therefore only a very partial compensation. In general, the information costs, negotiation costs and enforcement costs in the current seed transactions appear to be negligible or not relevant, and it would be very difficult to quantify these, as originally planned.

The risk of crop failure due to inadequate seed appears to be the main cost in relation to seed transactions. The problem can arise from two sources: either the seed is of poor quality and fails to germinate, or the germplasm is not adequate for the local environment and fails to yield adequately. Therefore, specifically related to the seed acquisition as such, the question is not whether or not the harvest will fail due to weather conditions, pest attacks or other. Rather, when acquiring seed the farmer's question is: 'Will this seed produce plants, which will perform successfully under the specific condition in my field, and will they produce maize that live up to the standards we expect in my household?' From this perspective, it may be beneficial to treat the issue here referred to as risk of crop failure due to inadequate seed quality or genotype x environment interaction, as a question of quality of information. This could also include the case of maize which turns out not to have the desired characteristics, for example with regard to consumption. In any case, a quantification of transaction costs should include the perceived risk of crop failure due to inadequate seed with regards to seed quality and genotype-by-environment interaction problems.

Trust and other elements of social capital play a key role in this system and serve to reduce transaction costs to a minimum. Trust as well as social and moral obligations create an environment that is conducive to relatively easy seed transactions. Furthermore, since farmers mostly produce their own maize seed and only acquire seed from other sources once in a while, the system works well. As seed providers, farmers from the same community are considered very trustworthy, and it is regarded as almost impossible that they would supply poor quality seed or provide inadequate information in relation to the seed. Transaction costs are high however, if a farmer wants to acquire seed outside his or her social network and community; particularly in terms of search costs and risk of crop failure due to inadequate seed. This is further emphasized by the fact that seed providers who are motivated by profit, such as commercial vendors at the markets and agricultural stockists, often are not regarded as trustworthy. In fact, they are widely suspected of being willing to sell anything without much scruple.

From a commercial seed sector point of view, a key problem in the system described here is that small-scale farmers' seed transactions often involve small quantities of seed and are relatively infrequent. In other words, it is not a regularly recurring event. Furthermore, many of these farmers require diverse maize varieties with different combinations of traits and quality characteristics and seem to be willing to pay only twice the price of maize grain for maize seed. Under these circumstances it is difficult for a commercial seed sector to develop and for individual seed merchants to build, through repeated interpersonal interactions, the trust required to be successful. For a commercial merchant the costs of selling seed of many diverse varieties, on an occasional basis and in relatively small quantities, are likely to be very high. With regards to enhancing farmers' access to seed of diverse maize varieties in terms of 'foreign' varieties, it would seem important to assess not only the transaction costs faced by the purchasers of seed, but also those faced by sellers who can bring interesting new varieties from the outside, but who are motivated by profit rather than social or moral obligations.

10. The dynamics of farmers' maize seed practices in the Central Valleys of Oaxaca, Mexico[53]

Within a general understanding of seed as a fundamental input for agriculture and a key source of crop genetic resource diversity, this research has sought to contribute to an improved understanding of the dynamics of local seed practices.

In the previous chapters I have examined a series of aspects relating to farmers' seed supply and crop genetic resources in general and to local maize seed practices among small-scale farmers in the Central Valleys of Oaxaca in particular. With the point of departure rooted in an overall actor-oriented approach, a number of analytical concepts and perspectives have been introduced and subsequently applied to various kinds of empirical findings, as part of the challenge of describing and analysing the dynamics of local maize seed practices from a farmer perspective.

Empirically, the objective has been to contribute to an increased understanding of the workings of local seed practices, in order to provide a relevant input to the debate on crop genetic resources and smallholder farmers' access to seed with interesting and desirable characteristics. At the same time, my goal has been to contribute to the debate concerning the relevance of the social sciences to agricultural research and development through the application of a series of analytical perspectives from socio-economics to farmers' seed practices.

The analysis has focused on four main issues, including:

- Farmer's seed practices as a form of local knowledge;
- The role of collective action in relation to the conservation of maize genetic diversity and local seed supply;
- The social organization of seed supply; and
- Farmers' perceived transaction costs in relation to seed acquisition.

In this concluding chapter the main findings are pulled together and the dynamics of local seed practices in the study area discussed. I end with a few concluding observations and a number of comments regarding the implications for policy considerations.

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[53] Another version of this chapter has been accepted for publication elsewhere: Badstue, L. B.; Bellon, M. R.; Berthaud, J. (Forthcoming): The dynamics of farmers' maize seed supply practices in the Central Valleys of Oaxaca, Mexico. *Journal of World Development*.

Key findings

Seed is a key input in crop-based farming everywhere. In addition to being the basis for the majority of the world's agricultural production, it is also a fundamental source of germplasm for crop improvement. Access to seed with desirable characteristics is thus an essential issue for farmers and of major importance for society in order to achieve food security.

As pointed out in Chapter 1, local practices for seed management and exchange remain the basis for seed supply for the majority of farmers in developing countries, and many studies have stressed their importance. Many farmers value local crop genetic resources and make special use of diverse crop varieties in their production systems. Decisions regarding varietal choice often depend on multiple considerations, not just yield.

In Mexico, which is a centre of domestication and genetic diversity for maize, farmers continue to play a key role in the maintenance and evolution of this diversity. In the Central Valleys of Oaxaca in Southern Mexico, the structure and evolution of maize genetic diversity depend on a combination of gene flow and farmers' selection (Pressoir and Berthaud, 2004). While gene flow allows new genes to enter the local pool of crop genetic diversity, farmers' seed selection, which is strongly influenced by local preferences and culture, allows for the differentiation between varieties from the same farmer or between farmers (Pressoir and Berthaud, 2004)[54].

The dynamics of farmers' seed supply practices have important implications, both for the conservation of crop genetic resources on-farm and for the design and implementation of interventions to support conservation (Bellon, 2004; Subedi et al., 2003). Moreover, in a broader perspective they also have important implications for the introduction of new varieties and seed sector development.

This concluding chapter provides an overview of a range of factors influencing farmers' local seed transaction practices. Together, these constitute a dynamic set of practices which, on the one hand, ensure an efficient and low-cost supply of a diverse array of maize germplasm to farmers in the study communities, and on the other hand, are efficient in maintaining and conserving maize genetic diversity at the local level.

The concept of seed and the lack of transparency

Farmers' maize seed concepts were discussed in Chapter 6. Farmers in the study area distinguish between *seed* for planting and *grain* for consumption or

[54] In another illustrating example of this, Perales et al. (2005) have shown that ethnolinguistic differences between ethnic groups in Chiapas could explain the morphological and agricultural differences found between varieties, while neutral markers showed no genetic differentiation. This means that genetic exchanges, i.e. gene flow, had been sufficient over time to eliminate genetic differentiation.

sale, even though, from a biological perspective, any healthy maize kernel could serve as either. Maize seed are specially selected based on a set of specific criteria. In this process farmers exercise selection in an attempt to enhance favoured varietal traits and lessen the influence of undesired ones. As pointed out in Chapter 6, this ensures that certain traits are passed to the next generation at a higher frequency, thereby influencing the evolution of local crop genetic diversity.

Nevertheless, farmers do occasionally use grain as seed. Therefore, although a clearly defined concept of seed exists (selected, clean, and of good quality), it is not rigid or static. Rather, the concept of seed is dynamic and negotiable, depending on the circumstances. This demonstrates the flexibility in farmers' categories and inclination towards experimentation and practical solutions.

The lack of transparency in seed means that the traits and performance of the plants that will grow from it cannot be assessed by merely looking at the seed. As noted several times, this plays an important role in seed transactions. With regard to traits and consumption characteristics, environmental adaptation, and seed quality, farmers therefore depend largely on the quality of the information offered by the seed provider.

Local knowledge

The relevance of an analytical perspective on local knowledge processes, when trying to understand the dynamics of farmers' seed management practices and strategies, was addressed in Chapter 6. This included elements related to the ambiguity of local concepts and terminologies with multiple meanings, and the differences between performative versus propositional or verbalized knowledge.

The various and rather 'fuzzy' local concepts of seed and variety, and practices such as mixing and complementing seed, served to exemplify the flexibility and negotiability of local concepts. It also served to demonstrate that rather than definitions in terms of clearly stated meanings, concepts, in this perspective, are 'dynamic mental representations'. They may vary from one person to another, and may continue to evolve in response to people's diverse experiences.

Chapter 6 also discussed the implications of the differences between propositional knowledge and performative knowledge, and the limitations of approaches to knowledge that emphasize, and are based on, linguistic models of knowledge. The point here is the difficulty in translating between the two, or rather, transforming one into the other, and the simplification that takes place in this process. For example, different factors influencing farmers' varietal choices were described as a series of individual, verbalized, criteria. However, as was also pointed out, this is very different from the complex process in which, at a glance, the farmer simultaneously compares a particular variety against his/her own idea of a good variety, which includes a stock of know-

ledge relating to the farm, the market, the seed supplier, household preferences and so forth. In other words, the attempt at verbalizing a complex process based on performative knowledge implies breaking it down into individual elements according to a logic which is rarely inherent in the original process. Farmers' seed management practices constituted another example of ambiguous categories and the difficulty of expressing performative knowledge in a verbalized form. Similarly, it was pointed out that farmers' experimentation can be seen as an acquisition of first hand information based on performative knowledge rather than just verbalized knowledge. As such, it constitutes a more comprehensive knowledge, which is readily incorporated into the farmers' existing stock of farming knowledge and practices.

It is not surprising that such ambiguity and poly-semic terminology, as well as the problems related to verbalized versus performative knowledge, challenge anyone who attempts to capture and describe farmers' seed practices. In the worst case, failure to recognize this may lead to serious misinterpretations and failure to understand farmers' knowledge and practices. However, if one is aware of the differences between local and scientific knowledge, including the aspects of ambiguity influencing local concepts and the issues surrounding performative versus verbalized knowledge, this may further the scientific enquiry. In addition this awareness underlines local knowledge as the driving force in development processes and emphasizes that the challenge for scientific knowledge is to achieve synergies with this - not the other way around.

Using own seed

The foundation of maize seed supply in the study communities is farmers' practice of selecting seed from the previous harvest and saving it for the next planting season. Of the farmers who participated in the seed flow tracer study, 75.8% relied entirely on their own seed in 2001. Furthermore, Smale et al. (1999) reported that approximately 90% of all seed lots in the study communities were selected by farmers from the previous harvest, while the rest were acquired almost entirely from other farmers.

According to informants, both in focus group discussions and individual interviews, selecting and saving seed provides a sense of security, as well as a chance to save money. Once seed is selected and safely set aside, one can rest assured that the seed for the next planting season is secured. Furthermore, the seed will be available when it is needed so the farmer will not incur planting delays. One can therefore avoid spending money and/or time acquiring seed at the last moment before planting, which is when prices typically increase and many households are struggling to raise the means necessary for land preparation and planting.

Farmers' seed selection practices in the study area reflect both the genotype-by-environment consideration and the issue of seed security: knowing the

performance of the plants the seed came from, farmers select maize seed according to a set of characteristics that they perceive as favourable in terms of their own particular needs. Due to social, cultural, and environmental conditions, a variety that is appropriate for one farmer may not necessarily be appropriate for another. Hence, what better option to fit one's needs and preferences than using the seed that one knows and has selected?

Moreover, for some of these farmers, their own maize seed is associated with a certain affection value. This aspect surfaced many times during individual interviews, but was also brought up by farmers during focus group discussions. Seed is often inherited, passed on from parents to children when the latter start farming independently. Often, the seed has been in the family for many years during which it has provided sustenance for the family, whereby it has acquired an inherent affection or symbolic value. Thus, for many farmers in the Central Valleys, the maize seed lot is something they have in trust, which links them with previous generations, and which they, in turn, must pass on to their descendants.

In their own way, each of the above mentioned aspects is part of what constitutes the local concept of 'a good farmer', a notion which can be said to lay out certain principles for what is considered appropriate behaviour of a good farmer (Badstue et al., 2003). This should not be understood in a fixed or prescriptive sense, but rather as a set of guidelines open to individual interpretation and negotiation. One aspect of appropriate behaviour of a 'good farmer' is to take good care of his/her seed (Badstue et al., 2003; Badstue et al., 2005). As the female farmers in one of the focus groups stated: "[losing seed]… is like hurting one's pride in being a good farmer – it is like a humiliation!" On the other hand, , it appears to be acceptable and legitimate to obtain seed from other farmers in a bad year or for experimentation, provided one is generally thought to manage seed with appropriate care. In this case, the seed receiver has a justifiable need for the seed, and is not someone who prefers to rely on others rather than make the effort of selecting and storing seed from the previous harvest. In other words, this person 'deserves' the seed and will appreciate the favour.

Clearly, for farmers in the study area, selecting and saving seed is not just a question of saving money, but a decision that has cultural, economic, and agroecological components (Badstue et al., 2005).

It has been pointed out that, although farmers select their own seed year after year, they may also, occasionally, substitute entirely, complement, or mix their own seed with seed from external sources. Initially a farmer would state: "I have planted this white [maize] for 20 years". However, further conversation would reveal that on one or more occasions the seed was complemented or mixed with external seed. These practices have also been noted by Smale et al. (1999) and from other regions in Mexico (Aguirre, 1999; Louette et al., 1997). Over time, these and other management practices, for

example, how the farmer selects seed, as well as naturally occurring pollen flow from other farmers' maize fields, may well change the genetic make-up of his/her maize.

Seed exchange

Although saving seed from one's own harvest is the backbone of local seed supply in the study area, farmers do acquire seed from other sources from time to time.

As shown in Chapter 6, the quantity of seed involved in farmer-to-farmer seed transactions is often quite small, in many cases less than 8 kg, which according to local standards is what is needed to plant approximately half a hectare. The number of seed acquisitions involving small or very small amounts of maize seed suggests that many of these acquisitions are for the purpose of farmer experimentation, or to complete the amount of seed needed, for example, in case of partial seed loss.

It is difficult to assess the frequency of seed transactions. As explained in Chapter 7 farmers do not keep records of such transactions, and estimates must rely on the memory of those interviewed. Despite this challenge an estimate of the frequency of farmers' maize seed transactions was calculated based on the data from the seed-flow tracer study. Seed transactions per farmer were found to be relatively infrequent, occurring on average once every three years (Table 7.4).

The role of collective action in relation to seed supply

Part of the research reported here examined the role of collective action in relation to farmers' access to seed of diverse maizes (Chapter 7). That study was based on the hypothesis that farmers would have strong incentives to participate in some form of collective action in order to ensure access to seed of more, diverse, kinds of maize than any one of them would be able to maintain individually. In order to examine this hypothesis a set of premises were defined, including 1) the existence of a particular group(s) of farmers with the purpose of facilitating access to seed; 2) the application of a particular set of rules or practices for the mutual supply of crop genetic resources; and 3) the identification of benefits derived from 'membership' in some form of collective action.

However, as described in Chapter 7, no evidence of collective action with specific relation to the mutual supply of maize seed was found within these three parameters. Firstly, in the event that any group of collective action for the mutual supply of maize seed existed, farmers would have been expected to be able to name other members of the same group. This was not the case - in fact, often farmers had trouble remembering with whom they had engaged in seed transactions, and while in general, farmers in the study communities are involved in various types of social networks, none of these appeared to be

focused specifically on seed supply. Secondly, seed transactions were bilateral and took place in diverse ways, even under similar circumstances. No particular procedure or framework for seed transactions was found, as would be expected in the case of collective action. Seed transactions did not appear to stand out against farmers' other dealings, favours or mutual help, but seemed to be negotiated on a case-by-case basis in the wider context of the social relation between the involved parties. Thirdly, despite the expectations underlying the hypothesis, no clear benefits associated with collective action in relation to maize seed supply were identified. Seed loss was found to be occasional rather than constant or recurrent. At the same time, since most farmers select and save seed from the previous harvest, generally putting aside more seed than they expect to need for their own planting, the challenge of obtaining seed in the case of seed loss appeared to be less of a problem than originally expected. Instead of investing time and effort in maintaining collective action for a specific problem which only happens occasionally, the maize farmers in the study area address problems of seed shortage or opportunities for accessing new interesting seed on a case-by-case basis. In this regard, the mobilization of social relations was found to play an important part in local seed transactions.

Farmers' transaction costs in relation to seed acquisition

Similar to the examination of the role of collective action (Chapter 7) the study aimed to identify the factors that influence farmers' transaction costs in relation to seed transactions. This also built on an underlying hypothesis, which was not confirmed by the findings, namely that maize seed acquisitions would entail high transaction costs for individual farmers in the study area. This turned out not to be the case. In fact, as described in Chapter 9, farmers' transaction costs in relation to maize seed acquisitions were low to negligible in most cases. This was found to be closely linked to the fact that most maize seed transactions in the study area take place among people who know and trust each other, or, alternatively, at least are from the same community. This makes for an information rich context, often complemented by relations of trust. Under these circumstances information and negotiation costs were described by farmers as minimal. On the other hand, in the situations where farmers acquire seed from unknown seed providers outside their own community, the context of the seed transaction is not as information rich. In addition, commercial seed vendors are sometimes suspected of being untrustworthy. Under these circumstances, farmers' transaction costs in relation to maize seed acquisitions tend to increase.

According to local practice, farmers normally do not expect compensation in the event that the acquired seed does not possess the hoped-for quality or characteristics. It is generally presumed that by deciding to accept seed for planting from another party of his/her own choice, the receiver of the seed as-

sumes the risk. From a farmer perspective, therefore, the issue of enforcement costs is hardly relevant.

Meanwhile, farmers' main concern in relation to maize seed acquisition, in particular with regards to seed acquisition from unknown, non-local sources, was found to be the perceived risk of crop failure due to inadequate seed. Regardless of the reason, crop failure or risk thereof would normally be considered as pertaining to the production process, and therefore not to be a transaction cost. However, in relation to reflections on the nature of the desired good in seed transactions, and due to the problems associated with the lack of transparency in seed, I have argued that in relation to seed acquisition farmers' perceived risk of crop failure due to inadequate seed should be treated as a problem of insufficient or asymmetric information. Essentially this is an example of the risk of getting the wrong product because of lack of information. Assuming this risk is a sacrifice for the farmer in search of seed. This can be a serious issue for individual farmers, and it should therefore be considered, when assessing the factors that influence farmers' seed acquisition strategies.

Seed transactions and social relations

In this analysis of the dynamics of local seed practices among farmers in the Central Valleys of Oaxaca, I have shown that farmers' maize seed transactions are embedded in concrete contexts, including networks of social relations.

As argued in Chapter 8, social networks affect the flow and the quality of information to a significant degree. At the same time they constitute an important source of reward and punishment, which often has a bigger impact when coming from others personally known and whose acceptance we seek. Finally, as Granovetter (2005) pointed out, the emergence of trust takes place in the context of social networks.

The presence of trust can provide a more secure environment for transactions and social exchange. DiMaggio and Louch, 1998 (see Chapter 8), have demonstrated that uncertainty about product characteristics or performance quality leads people to prefer sellers with whom they have non-commercial ties. This embeds the exchange in a web of obligations and holds the seller's network hostage to appropriate role performance in the economic transaction. In addition exchange frequency reduces the extent of within-network exchanges – that is, network relations are mostly used in connection with not-so-frequent acquisitions/transactions.

In the present study, farmers obtained maize seed from many types of seed providers (e.g. family members, *compadres*, neighbours, friends, acquaintances, strangers, and others). However, the large majority of seed transactions were found to take place between people who know each other prior to the seed transaction, and who often share a feeling of social obligation towards

each other (e.g. family members alone made up 46.5% of seed providers in the seed flow tracer study, Table 7.2).

Although particular types of transaction are not restricted to any one category of seed provider, it nevertheless appears that close social relations between the seed provider and receiver improve the latter's chances of preferential treatment, for example, in the type of transaction or with regards to its terms or rates (Chapter 7).

The key role of trust in these seed transactions is directly related to the lack of transparency of seed. In addition, farmers prefer seed providers who are easy to approach and believed to be willing to grant one's request, especially if one cannot pay for the seed with money and therefore depends on negotiating another type of transaction. Finally, the trustworthiness of the seed receiver is relevant to seed providers, for instance, with regards to the types of seed transactions that involve 'payment' forms other than money, and where the seed provider depends on the seed receiver upholding his/her part of the deal.

Seed acquired from people the farmer knows and trusts is generally perceived as entailing less risk of crop failure due to inadequate seed, than seed acquired from unknown or impersonal sources, such as market vendors or commercial seed traders. In other words, the more the seed receiver knows and trusts the seed provider, the lower the perceived risk related to incomplete or incorrect information.

Finally, relations of trust are conducive to easy access to trustworthy information at low cost. Farmers may already know the characteristics of varieties used by kin or close friends, and they can easily obtain more information. Thus, acquiring seed from social relations of trust can be seen as a way of reducing the problem of lack of transparency in seed. This, in turn, helps reduce farmers' transaction costs in relation to seed acquisition to a minimum (Chapter 9).

Reasons for acquiring seed

Farmers' reasons for acquiring maize seed from sources other than their own harvest were discussed in Chapter 6. The four main themes, motivating seed acquisition were: (a) experimentation, (b) to commence farming, (c) lack of sufficient seed for planting, and (d) initiative by other farmers.

Like farmers elsewhere, many farmers in the Central Valleys are curious and eager to learn and explore new options. While they are well aware that a maize variety that works for others may not work for them, they also recognize that other people's maize could have advantages or provide worthwhile traits. Furthermore, many farmers in the study area believe that 'foreign' seed can eventually 'acclimatize' to local conditions, if planted and selected under those conditions. These elements lead to many instances in which farmers 'try out' other materials they come across, combine them or even cross them with

their own materials to 'see if it works'. These farmer experiments usually involve only small quantities of seed or land, thereby minimizing the risks related to experimentation.

When new households start farming on their own account, they usually get seed from parents or other close relatives. Not surprisingly, therefore, this counts as an important reason for seed acquisition.

Lack of seed may be due to seed loss or to not being able or willing to save sufficient seed. Seed loss may occur because of low yield or total harvest loss, due to drought, water logging, insect attacks, weeds, hail, lodging, or poor management. Seed may be lost during storage due to insects or rodents. A farmer may not save seed, or at least not enough, because he or she had to sell or eat everything that was harvested including the seed set aside, as a result of insufficient production, an emergency, or a crisis. Farmers who produce maize for animal feed may harvest before seed is produced. Obviously, seed loss may also occur as the result of several converging factors. People who for some reason, for instance temporary migration, decide not to plant maize for some time face a similar situation when they take up planting again, due to the relatively fast decline in maize seed germination rate and vigour (Chapter 6).

Farmers sometimes receive seed from other farmers without having asked for it, for example, when they agree to another farmer's request for a seed-for-seed exchange. Even if a farmer has not actively looked for the seed, he or she may eventually decide to plant it, although this does not always happen. Also, farmers sometimes receive small amounts of seed as gifts. For example, one farmer's sister, who lives in another town, each year, brings small amounts of seed from her own maize field, when she comes to visit. Her brother plants this seed and explains that he regards it as a token of the affection between his sister and himself and as a way to stay 'close,' in spite of the distance that separates them. In any case, these reasons for acquiring seed are relatively infrequent.

In many cases seed loss appears to be associated with a certain social stigma, even though the cause for seed loss may be beyond the farmer's control. Informants explained that seed loss sometimes is associated with laziness, lack of knowledge, and inappropriate working practices. Meanwhile, never to have lost one's seed is a cause for pride for many farmers. Obviously, these circumstances do not motivate people to talk about the occasions on which they may have lost their seed, and it is possible that this influenced the answers to the tracer study.

Reasons for distributing seed

The flip side of acquiring seed is distributing it. The reasons provided by farmers for distributing seed to other farmers can be divided into two main themes: (a) to help the recipient and (b) to obtain something in return, such as

money or seed. This was discussed in Chapter 8, where, furthermore, it was argued that access to seed in the study area may be conceptualized as part of a general social responsibility for mutual assistance.

Though most acquisitions were purchases, relatively few seed providers were motivated exclusively by obtaining money in return. This, in turn, suggests that the primary motive for farmer-to-farmer seed distribution is rarely to generate a profit. Instead, findings suggest that there is a strong cultural value in the study area associated with being helpful to others, as long as one is able to do so while covering one's own needs. Indeed, most seed providers stated that they distributed seed to help the receiver. This fits well with the notion of 'the good farmer' and the idea that one should not refuse to help a fellow farmer asking for seed if one has sufficient seed to share. Finally, this seems to be part of a common sense of reciprocity; as one of the informants pointed out: "What goes around comes around." On the other hand the frequency of purchase as transaction type and the above-mentioned broad willingness to supply seed to a buyer, also suggest that monetary gain could often be part of the motive for supplying seed.

Discussion

A series of factors that influence farmers' local maize seed practices have been identified. In a number of respects, a certain similarity appears to exist across households and communities with regard to issues and frames of reference relating to maize seed practices. However, as demonstrated in the previous chapters, individual households' maize seed practices are shaped by a complex mix of factors, including the interests and production conditions of each farming unit, as well as various aspects of the social, economic and physical context, and farmers' interpretations thereof. Individual households' maize seed practices should therefore be seen as the outcome of a negotiation of circumstances. In relation to problems of seed supply, for example, households in the study communities negotiate solutions on an *ad hoc* basis. Similarly, although farmers in the study area have many things in common, considerable variation exists between them, even at the level of individual farmers, who on different occasions may respond differently to seemingly similar problems. Meanwhile, at the community level, farmers' various ways of dealing with issues relating to maize seed management and supply, may, in turn, be considered to constitute a set of flexible and dynamic practices, which embrace both conservation and innovation aspects.

The terms local, informal or farmer seed system are widely understood, in the literature and among practitioners, to refer to the sets of sources of seed and related information, practices and transactional arrangements on which farmers rely to obtain seed for agricultural production. However, the use of the term 'system' easily conveys the notion that these sets of seed sources, practices and arrangements are defined and function in a particular and sys-

tematic way. In order to avoid these somewhat deductive connotations, and to stress the flexible and dynamic characteristics of local crop genetic resource management, I prefer, instead, to talk about farmers' local seed practices.

The central principle of local maize seed practices in the study communities appears to be farmers' practice of selecting and saving seed from one year to another. This is the source of seed for the large majority of maize area planted in this region, and for the individual farmer this practice can help reduce perceived risk and costs. It is of further symbolic importance for some, who take pride in being self-sufficient in seed or regard the family seed as something valuable they have in trust and must pass on to subsequent generations. In addition, the common practice of saving seed is a vital element in maintaining seed security at community level. The widespread practice of saving enough seed for the next planting, and some extra for any contingencies, provides a buffer against seed loss at the household level, but also helps ensure that, in general, seed can be obtained locally when needed.

During seed selection farmers exercise selection pressure in an attempt to enhance favoured varietal traits and lessen the influence of undesired traits. Analysis of the genetic structure of maize landraces collected in the study communities has shown a strong structure associated with farmers and communities, when phenotypic traits are analysed (Pressoir and Berthaud, 2004). The structure of phenotypic traits indicate that varieties collected from the same farmer or same community are more similar in their characteristics—mainly ear and grain traits—than those that were collected from other farmers or other villages. This indicates that human selection is playing a key role in creating and maintaining different types of maize, and hence, phenotypic diversity (Perales et al., 2005; Pressoir and Berthaud, 2004).

The problem of non-transparency of seed and the issue of genotype-by-environment interaction entail certain fundamental problems, which mean that acquiring maize seed is not a trivial transaction. In most cases farmers' easiest source of knowledge and trustworthy information about maize and maize seed, as well as their preferred source of seed, is people they know and trust, who in many cases also farm in the same community. Furthermore, acquiring seed from another farmer from the same community has the advantage that one knows the seed was produced in that community, and therefore is likely to be adapted to local agro-ecological conditions. Even if environmental conditions vary within the same community, in most cases, the farmer would easily be able to determine the likelihood that the seed will be adapted to the conditions of his/her own land.

Finally, using social networks to acquire seed is effective because it embeds the seed transactions in a web of obligations and, as pointed out by DiMaggio and Louch (1998), "holds the seller's network hostage to appropriate role performance". Thus, acquiring seed via one's social network can be seen as a way of reducing the risk of planting inappropriate seed, that is, maize that does

not correspond to one's production or consumption objectives, or, which is not adapted to the local environmental conditions.

The notion of the 'good farmer' may also come into play in relation to maize seed transactions. As mentioned above, it is thought appropriate 'good-farmer-behaviour' to help other farmers in need, when possible and within reason. In as far as a farmer can spare the seed, this includes acting as seed provider on the request of other farmers who need seed. This sense of social responsibility linked to the notion of 'a good farmer' may well be triggered when a request for seed is brought forward. Meanwhile, failing to save seed is sometimes associated with a certain disgrace or loss of prestige. While this may play a role as an incentive for farmers to live up to this standard, it may also play a role in reducing the problem of free riders[55].

The applications and dynamics that make up the local maize seed practices in the study area appear to be grounded in a set of shared views and conditions, which in themselves are based on the agro-ecological, cultural, and social environments in which these farmers operate. Local seed supply in these communities is not based primarily on commercial motives. It is mainly part of a moral system based on trust and social responsibility.

It should be mentioned that once in a while a farmer may acquire seed at the regional market or elsewhere outside the community in order to deliberately avoid the various implications that may arise from acquiring seed from other farmers in the community; such as expectations of reciprocity and the feeling of 'indebtedness', or the 'stigma' of having lost seed. Likewise, it should be noted, that while the types of transactions not involving money payments may be attractive under some circumstances, under other circumstances a farmer may find that paying for the seed with money can provide a swift and less personal option, and thus be preferable.

When acquiring maize seed from a stranger, for instance at a regional market place, there are no means of knowing its genotype-by-environment adaptation or other characteristics apart from what the vendor claims. As several farmers exclaimed when referring to commercial traders: "They just want to sell their goods!" In general, acquiring seed from unknown sources is perceived by farmers as entailing a risk of acquiring inappropriate seed (Badstue, 2004).

Recognizing that other maize varieties may be useful or contain desirable characteristics, farmers experiment with and 'try out' seed of other kinds of maize than their own. This allows farmers to see for themselves the traits and performance of the maize variety in question and judge whether it is appropriate for their individual needs and preferences. Meanwhile, farmers in the

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[55] The fact that failing to save seed is associated with a certain loss of prestige may deter certain persons from just asking others for seed instead of going through the trouble themselves of selecting and saving seed.

study communities do not associate small-scale experimentation with significant costs in terms of, for example, extra time or labour (Badstue, 2004). The principal cost is the risk that the experiment will not be successful. However, this is manageable due to the small scale of most farmer experiments, which reduce the risk of major crop failure. Farmer experiments therefore serve both the purpose of information and of risk control. In addition these experiments are also used to multiply seed. If the farmer decides to incorporate the 'new' varieties into the household's maize repertoire, or alternatively mix it with seed of their own varieties in order to create new, desirable combinations, they may therefore not need to acquire seed again.

Pressoir and Berthaud's research on the genetic structure of landraces collected in the same study communities has shown an absence of structure in these populations when neutral markers are analysed (Pressoir and Berthaud, 2004). By definition neutral markers are not under selection. They provide information on the evolutionary history of a population, including migration, bottlenecks, drift. The fact that no structure was found indicates that migration (gene flow) among these populations has been strong enough to compensate for the effects of bottlenecks and drift.

The results on genetic diversity complement the present analysis of maize seed practices in the study area. First, farmers' practice of saving and selecting seed both constitutes the basis of the phenotypic diversity observed in the study area and the foundation of local maize seed supply. One could say that each farmer is creating and maintaining his/her own unique maize varieties. Second, gene flow is important in bringing new traits and modifying varieties to fit farmers' needs—as farmers do when they experiment with 'foreign' seeds, or mix them with their own. Third, gene flow may also be important to maintain the viability of these landraces in the face of deleterious mutations, or simply to avoid inbreeding depression. In their current form, local maize seed practices allow farmers to continue this process of experimentation and incorporation of new varieties or traits into their repertoire.

Given the limited, relative frequency of seed loss in the study area, farmers' current seed supply practices appear relatively efficient in terms of maintaining local crop genetic resource diversity. While the dynamics of local seed practices depend on sufficient opportunities for obtaining seed from others when the need arises, at the moment this does not appear to be a major limitation. From a population genetic point of view local maize seed practices appear to work well and be efficient in continuing to maintain a diversity of maize landraces and contribute to the conservation of maize genetic diversity (Bellon et al., 2003; Smale et al., 2003).

Conclusions

In the previous chapters I have analysed the dynamics of smallholder maize seed practices in the Central Valleys of Oaxaca. The core principle of local

seed practices in the study area is farmers' reliance on selecting and saving seed from the previous harvest. Farmer-to-farmer seed flow is an occasional event, which mostly involves relatively small quantities of seed; yet, it remains an essential element of farmers' seed practices in order to ensure local seed security and maintain local maize genetic diversity.

Even though farmers in the study communities live and farm under seemingly similar conditions, individual preferences, production conditions, and production objectives may vary considerably from one farming household to another. In this context, farmers' widely observed practice of selecting and saving seed from the previous harvest provides the basis for a pool of diverse and locally adapted maize varieties. Furthermore, at any one time the number of farmers in need of, or requesting seed from others, is limited. This, in turn, makes it easier for these farmers to find someone who can provide the seed they need at a relatively low cost and risk. Social relations and trust play key roles in this regard.

In combination with the occasional introduction of new maize genetic material from other farmers or elsewhere, the on-farm reproduction and selection of seed of preferred varieties provides a relatively efficient basis for the maintenance of local maize genetic diversity. Whereas no imminent threat to maize genetic diversity in the study area was identified in the research referred to here, the important role of geneflow in preserving the viability of farmer varieties in the area was pointed out.

Smallholder maize seed practices in the Central Valleys of Oaxaca are complex and dynamic, spanning both conservation and innovation aspects. Local concepts relating to maize and maize seed practices are often flexible and negotiable and small-scale experimentation in search of knowledge and practical solutions are an integral part of farming.

Furthermore, in their current form local maize seed practices in the study area provide a relatively secure seed supply of a range of valued farmer varieties. However, as mentioned, the farming systems in the study area are characterized by low productivity and maize production per area is low. The use of improved seed could be one option for increasing maize productivity. It is possible that this could help farmers produce sufficient maize on less land, thereby freeing up land for other, more income generating purposes, or for increased maize production.

Finally, local maize seed practices in the study area are efficient in supplying farmers with maize seed of varieties that correspond well to local consumption and production objectives, and which are able to perform under local agro-ecological conditions. In the few cases where improved varieties are used in the study communities, it is mainly for corn-on-the-cob and feed production, not for the production of grain for consumption. This suggests that the improved varieties available in the study area may be considered to have

inferior consumption characteristics from the point of view of the local population.

Implications for policy and research

From a policy point of view, the analysis of the dynamics of farmers' maize seed supply practices in the Central Valleys of Oaxaca raises several relevant issues. Findings point to both challenges and opportunities and may be relevant in a broader perspective, for example, in relation to commercial seed sector development in this area of Mexico, or for other initiatives related to the introduction of improved maize germplasm.

Farmers' production and consumption objectives, as well as production conditions, play key roles in relation to varietal choices. The importance of farmer demand for different maize types should be considered and the germplasm involved should be assessed in relation to local preferences and conditions. At the same time, farmers' local concepts and performative knowledge relating to maize and maize seed management should be considered in relation to the conventional scientific approach of most formal crop improvement. While this may prove a challenging exercise, it is also likely to lead to interesting innovations in the organization of agricultural research targeted at small-scale farmers in marginal areas.

Farmers' demand for seed of other types of maize is relatively infrequent, and mostly involves relatively small amounts of seed. Under these circumstances supplying seed may not be a profitable enterprise. Interventions such as those practised in the CIMMYT/INIFAP research project demonstrated farmers' interest in acquiring seed of other maize varieties. However, the average quantity of seed per acquisition was just 4.3 kg, which may not be a problem if the demand is only for one or two varieties. However, if the demand is for many different types of maize, the costs of producing, managing and selling seed may be too high for a commercial provider, since commercial seed enterprises most likely have to supply larger quantities of fewer varieties to be financially viable. This is an issue which merits further investigation.

Maize continues to play an important role in the study area in terms of food security. While farmers in these communities are often curious and interested in trying out new things, in many cases, they are also concerned about risks in relation to their maize production. Unstable seed supply, timeliness of seed supply, higher costs of improved seed - in the study area approximately 5-7 times the cost of farmer saved seed - all add to the more generic problem of non-transparency of seed, and could influence and hamper the adoption process. Under such circumstances one would expect farmers first to experiment for some time with small quantities of seed, before deciding whether or not to adopt. Emphasis should therefore be on medium to long-term interventions.

Farmer scepticism with regards to the trustworthiness of market traders and commercial seed vendors relates to information quality about seed traits and quality. However, it seems reasonable to think that it would also relate to additional aspects such as the stability, reliability, and timeliness of seed supply. Obviously, improving confidence in commercial seed traders presents a challenge, and serious thought should be given to this.

To a large extent many of these challenges lead back to the fundamental problem of non-transparency of seed, and to the importance of trustworthy information about maize seed of different varieties. Identifying ways of conveying the relevant information to the users of the seed in a straight-forward and trustworthy way would seem a useful contribution in this regard. Further research is needed on how to achieve this.

Despite a strong concern for risk avoidance, farmer interest in and willingness to experiment and learn about new and different maize types, presents an opportunity for the introduction of improved germplasm. Though this experimentation mostly involves small quantities of seed, it nevertheless presents a window of opportunity for the introduction of alternative maize germplasm. Many farmers in the study communities express an attitude of generalized trust in other farmers and farmer-to-farmer information flows can play an important role in relation to the spread of information regarding innovations and new technologies (e.g. Ryan and Gross, 1943). One opportunity could be to explore how this could be used actively in relation to seed and information about seed and other technologies. The concept of 'farmer-dealers' was for example an important element in the spread of hybrid maize in the US (Duvick, 1998). By using local farmers as their agents, seed companies and government extension agencies promoted their products through local channels that farmers felt comfortable with and could easily relate to.

In the study reported on here, no specialized seed-focused institutions of collective action were identified. Interventions based on collective action to support farmers' efforts to maintain maize diversity in this region, such as establishing community seed banks, may therefore not be successful. Initiatives directed more towards individual farmers, such as the CIMMYT/INIFAP research project, or which build on local institutions that serve other purposes, may be more effective.

Rather than maintaining specialized networks for seed needs, which occur relatively infrequent, farmers tend to 'piggy-back' seed needs on other networks of social relations on an *ad hoc* basis. The problem of non-transparency of seed is one of the factors, which may influence the decision to transact with a friend or a relative, as a response to the perceived risk or uncertainty this fosters. Under these circumstances, development interventions at the community level, whether directed towards conservation or introduction of improved seed, should focus on existing social organizations rather than trying to create new organizations dedicated to seed supply.

Finally, in relation to the conservation of crop genetic diversity on-farm, the study points to the importance of sustaining seed flows between farmers. In this regard, seed fairs and other interventions that promote knowledge-based information flows and access to 'new' and interesting varieties for experimentation at low cost and low risk, represent interesting options.

References

Adler-Lomnitz, L. and Sheinbaum, D. (2004). Trust, social networks and the informal economy: a comparative analysis. *Review of Sociology*, **10** (1): 5-26.

Aguirre Gómez, J. A. (1999). *Análisis regional de la diversidad del maíz en el Sureste de Guanajuato*. Ph.D. disertación. Universidad Nacional Autónoma de México, México, D.F.

Akerlof, G. A. (1970). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics*, **84** (3): 488-500.

Aldrich, S. R.; Scott, W. O.; Leng, E. R. (1975). *Modern Corn Production.* A and L. Publishing. Champaign, Illinois.

Almekinders, C. (2000). The importance of informal seed sector and its relation with the legislative framework. Paper presented at GTZ-Eschborn, July 4-5.

Almekinders, C. (2001). *Management of Crop Genetic Diversity at Community Level*. Eschborn, Germany, GTZ.

Almekinders, C. and Boef, W. de (2000). *Encouraging diversity: The conservation and development of plant genetic resources*. Intermediate Publications Ltd., London, UK.

Almekinders, C. and Louwaars, N. (2000). *Farmers' Seed Production: New Approaches and Practices.* Intermediate Technology Publications Ltd., London, UK.

Almekinders, C.; Louwaars, N.; de Bruijn, G.H. (1994). Local seed systems and their importance for an improved seed supply in developing countries. *Euphytica* **78**: 207-216.

Amanor, K.; Wellard, K.; Boef, W. de; Bebbington, A. (1993). Introduction. In: Boef, W. de, K. Amanor; Wellard, K. with Bebbingon, A. (eds.). *Cultivating Knowledge. Genetic diversity, farmer experimentation and crop research.* Intermediate Technology Publications Ltd., London.

Andersen, I.; Borum, F.; Hull Kristensen, P.; Karnøe, P. (1992). *Om kunsten at bedrive feltstudier – en erfaringsbaseret forskningsmetodik*. Samfundslitteratur. København, Denmark.

Arce, A. (1993). *Negotiating agricultural development: Entanglements of bureaucrats and rural producers in Western Mexico*. Wageningse Sociologische Studies 34. Agricultural University of Wageningen.

Arce, A. (2001). Experiencing the modern world: Individuality, planning and the state. In: Hebinck, P. and Verschoor, G. (Eds.). *Resonances and Dissonances in Development. Actors, networks and cultural repertoires*. Van Gorcum. Assen, The Netherlands.

Archer, Margaret (1988). *Culture and Agency*. Cambridge University Press, Cambridge.

Archibald, S. and Richards, P. (2002). Seed and Rights: New Approaches to Post-war Agricultural Rehabilitation in Sierra Leone. *Disasters*, **26** (4): 356-367.

Argenti-Pillen, A. (2003). The global flow of knowledge on war trauma: The role of the 'Cinnamon Garden Culture' in Sri Lanka. In: Pottier, J.; Bicker, A.; Sillitoe, P. (eds.). *Negotiating Local Knowledge. Power and Identity in Development*. Pluto Press. London. Sterling, Virginia.

ASARECA (2002). Harmonization of Seed Policies and Regulations in Eastern Africa. Results and Agreements. *ECAPAPA Monograph Series 4*. Association for Strengthening Agricultural Research in Eastern and Central Africa, ASARECA. Eastern and Central Africa Programme for Agricultural Policy Analysis.

Badstue, L. B. (2004). Identifying the factors that influence small-scale farmers' transaction costs in relation to seed acquisition. An ethnographic case study of maize growing smallholders in the Central Valleys of Oaxaca, Mexico. *ESA Working Paper No. 04-16*. Food and Agriculture Organization of the United Nations (FAO). Rome.

Badstue, L. B.; Bellon, M. R.; Berthaud, J.; Ramirez, A.; Flores, D.; Juarez, X.; Ramirez, F. (2005). Collective action for the conservation of on-farm genetic diversity in a center of crop diversity: An assessment of the role of traditional farmer's networks. *CAPRI Working Paper, no.38*. Washington: International Food Policy Research Institute (IFPRI).

Badstue, L.B.; Bellon, M. R.; Berthaud, J.; Ramirez, A.; Flores, D.; Juarez, X. (2003). The dynamics of seed flow among small-scale maize farmers in the Central Valleys of Oaxaca, Mexico. Paper presented at the International Workshop on Property Rights Collective Action and Local Conservation of Genetic Resources, Rome, Italy, September 29 – October 2, 2003.

Badstue, L.B.; Bellon, M. R.; Juárez, X.; Manuel Rosas, I.; Solano, A.M. (2003). Social relations and seed transactions among small-scale maize farmers: A case study from the Central Valleys of Oaxaca, Mexico. *CIMMYT Economics Working Paper 02-02*. Mexico City: International Maize and Wheat Improvement Center (CIMMYT).

Bänziger, M. and Cooper, M. (2001). Breeding for low input conditions and consequences for participatory plant breeding: Examples from tropical maize and wheat. *Euphytica,* **122**(3): 503-519.

Barnes, J. A. (1954). Class and Commitees in a Norwegian Island Parish. *Human Relations*, 7: 39-58.

Barth, F. (1966). *Models of Social Organization*. Royal Anthropological Institute Occasional Paper No. 23. Royal Anthropological Institute. Glasgow University Press.

Barth, F. (2002). An Anthropology of Knowledge. *Current Anthropology*, **43** (1): 1-18.

Beals, R. (1970). Gift, reciprocity, savings, and credit in peasant Oaxaca. *Southwestern Journal of Anthropology*, **26**: 231-241.

Beckert, J. (2003). Economic Sociology and Embeddedness: How Shall We ConceptualizeEconomic Action? *Journal of Economic Issues*, **37** (3): 769-787.

Bellon, M. R. (1996). The dynamics of crop infraspecific diversity: A conceptual framework at the farmer level. *Economic Botany* **50** (1): 26-39.

Bellon, M. R. (2001). Demand and Supply of Crop Infraspecific Diversity on Farms: Towards a Policy Framework for On-Farm Conservation. *CIMMYT Economics Working Paper 01-01*. Mexico, D.F.: CIMMYT.

Bellon, M. R. (2001). *Participatory Methods for Technology Evaluation: A Manual for Scientists Working with Farmers*. CIMMYT, Mexico, D.F., Mexico.

Bellon, M. R. (2004). Conceptualizing Interventions to Support On-Farm Genetic Resource Conservation. *World Development*, **32**, (1): 159-172.

Bellon M. R.; Adato, M.; Becerril, J.; Mindek, D. (2003). The impact of improved maize germplasm on poverty alleviation: The case of Tuxpeño-derived material in Mexico. *FCND Discussion Paper 162*. IFPRI, Washington, DC (available at www.ifpri.org/divs/fcnd/dp/papers/fcndp162.pdf).

Bellon M. R.; Adato, M.; Becerril, J.; Mindek, D. (2005). *The Impact of Improved Maize Germplasm on Poverty Alleviation: The Case of Tuxpeño-Derived Material in Mexico.* Mexico, D. F.: CIMMYT.

Bellon, M. R. and Berthaud, J. (2001). In-Situ Conservation of Maize Diversity, Gene Flow and Transgenes in Mexico. Paper presented at the OECD Conference on LMOs and the Environment. Raleigh-Durham, NC, USA, 27-30 November 2001.

Bellon, M. R. and Berthaud, J. (2004). Transgenic Maize and the Evolution of Landrace Diversity in Mexico. The Importance of Farmers' Behaviour. *Plant Physiology*, **134**: 883-888.

Bellon, M. R. and Berthaud, J. (2006). Traditional Mexican agricultural systems and the potential impacts of trangenic varieties on maize diversity. *Agriculture and Human Values*, **23**: 3-14.

Bellon, M. R.; Berthaud, J.; Smale, M.; Aguirre, J. A.; Taba, S.; Aragon, F.; Diaz, J.: Castro, H. (2003). Participatory landrace selection for on-farm conservation: An example from the Central Valleys of Oaxaca, Mexico. *Genetic Resources and Crop Evolution*, **50**: 401-416.

Bellon, M. R. and Brush, S. B. (1994). Keepers of maize in Chiapas, Mexico. *Economic Botany*, ***48*** (2): 196-209.

Bellon, M. R.; Hodson, D.; Bergvinson, D.; Beck, D.; Martinez-Romero, E.; Montoya, Y. (2005). Targetting agricultural research to benefit poor farmers: Relating poverty mapping to maize environments in Mexico. *Food Policy*, **30**: 476-492.

Bellon, M. R.; Pham, J.L.; Jackson, M.T. (1997). Genetic conservation: A role for rice farmers. In: Maxted, N.; Ford-Lloyd, B.V. and Hawkes, J.G. (eds.).

Plant Conservation: The In Situ Approach. London: Chapman and Hall. Pp. 263-289.

Bellon, M. R. and Risopoulos, J. (2001). Small-scale farmers expand the benefits of improved maize germplasm: a case study from Chiapas, Mexico. *World Development* **29**: 799-811.

Bellon, M. R.; Smale, M.; Aguirre, A.; Taba, S.; Aragón, F.; Díaz, J.; Castro, H. (2000). Identifying Appropriate Germplasm for Participatory Breeding: An Example from the Central Valleys of Oaxaca, Mexico. *CIMMYT Economics Working Paper 00-03*. Mexico, D.F.: CIMMYT.

Benda-Beckman, F. von (2006). Pak Dusa's Law: Thoughts on Law, Legal Knowledge and Power. *Journal of Transdisciplinary Environmental Studies*, **4** (2): 1-12. Available at: http://www.journal-tes.dk/vol_4no_2/NO3FRh.PDF

Bentley, J. W. (1989). What Farmers Don't Know Can't Help Them: The Strengths and Weaknesses of Indigenous Technical Knowledge in Honduras. *Agriculture and Human Values*, **6** (3): 25-31.

Bentley, J. W. and Baker, P. S. (2005). Understanding and getting the most from farmers' local knowledge. In: Gonsalves, J.; Becker, T.; Braun, A.; Campilan, D.; Chavez, H.; Fajber, E.; Kapiriri, M.; Rivaca-Caminade, J.; Vernooy, R. (Eds.). *Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook*. CIP-UPWARD / IDRC.

Benton, N.; Bell, G.; Swearingen, J. M. (2005). *Giant reed*. Alien Plant Working Group, Plant Conservation Alliance, PCA, http://www.nps.gov/plants/alien/fact/ardo1.htm. Last update 20 May 2005.

Berg, T. (1993). The science of plant breeding: support or alternative to traditional practices? In: de Boef et al. (eds.). *Cultivating Knowledge: Genetic diversity, farmer experimentation and crop research.* Intermediate Technology Publications. London.

Biggelaar, C. den (1996). *Farmer experimentation and innovation: A case study of knowledge generation processes in Agroforestry systems in Rwanda*. Food and Agriculture Organization of the United Nations, FAO, Rome.

Bloch, M. (1991). Language, Anthropology and Cognitive Science. *Man*, New Series, **26** (2): 183-198.

Boef, W. de, K. Amanor; Wellard, K. with Bebbingon, A. (eds.) (1993). *Cultivating Knowledge. Genetic diversity, farmer experimentation and crop research.* Intermediate Technology Publications Ltd., London.

Boettke, P. J. and Coyne, C. (2005). Methodological Individualism, Spontaneous Order, and the Research Program of the Workshop in Political Theory and Policy Analysis. *Journal of Economic Behavior and Organization*, **57**: 145-158.

Booth, D. (1985). Marxism and development sociology: interpreting the impasse. *World Development*, **13** (7): 761-787.

Booth, D. (1994). Rethinking social development: an overview. In: Booth, D. (Ed.). *Rethinking social development. Theory, research and practice*. Burnt Hill: Longman.

Bott, E. (1957). *Family and Social Network*. Tavistock. London.

Bourdieu, P. (1977). *Outline of a theory of practice*. Cambridge University Press. Cambridge.

Bourdieu, P. (2001 [1983]). The forms of capital. In: Granovetter, M. and Swedberg, R. (eds.), *The Sociology of Economic Life*. Westview Press, Boulder, Colorado.

Box, L. (1999). For the fun of it! *Indigenous Knowledge and Development Monitor*, (July): Column. Available at: http://www.nuffic.nl/ciran/ikdm/7-2/column.html.

Box, L. (2000 (1999)). The toils and the spoils: knowledge of soils and the soils of knowledge. Available at: http://www.fdcw.unimaas.nl/personal/websitesMWT/Box/downloads.html. [Also published in a different form in: Jerker Carlsson and Lennart Wohlgemuth (Eds.), *Learning in Development Co-operation.* Almqvist and Wiksell International, Stockholm].

Brown, M. F. (1998). Can Culture Be Copyrighted? *Current Anthropology*, **39** (2): 193-222.

Brush, S. B. (1986). Genetic diversity and conservation in traditional farming systems. *Journal of Ethnobiology*, **6**: 151-167.

Brush, S. B. (1991). A farmer-based approach to conserving crop germplasm. *Economic Botany*, **45**: 153-165.

Brush, S. B. (1993). Indigenous Knowledge of Biological Resources and Intellectual Property Rights: The Role of Anthropology. *American Anthropologist*, **95** (3): 653-671.

Buckley, Peter J. and Chapman, M. (1997). The perception and measurement of transaction costs. *Cambridge Journal of Economics*, **21**: 127-145.

Burt, Ronald S. (2000). The Network Structure of Social Capital. In: Staw, B. M. and Sutton, R. L.: *Research in Organizational Behaviour, 22*. Elsevier, JAI Press.

Byerlee, D. (1994). *Modern Varieties, Productivity, and Sustainability: Recent Experience and Emerging Challenges.* Mexico, D.F.: CIMMYT.

Cacho, O. J.; Marshall, G. R.; Milne, M. (2003). Smallholder agroforestry projects: Potential for carbon sequestration and poverty alleviation. *ESA Working Paper No. 03-06*. Agriculture and Economic Development Analysis Division, Food and Agriculture Organization of the United Nations (FAO). Rome. FAO (also available at www.fao.org).

Callon, M. and Law, J. (1995). Agency and the Hybrid Collectif. *South Atlantic Quarterly*, **94**: 481-507.

Callon, M. and Law, J. (1997). After the individual in society: lessons on collectivity form science, technology and society. *Canadian Journal of Sociology,* **22** (2): 165-182.

Campbell, H. (1996). Theoretical perspectives on the diffusion of GIS Technologies. In: Masser, I.; Campbell, H.; Craglia, M. (Eds), *GIS diffusion. The Adoption and Use of Geographical Information Systems in Local Government in Europe*. Taylor and Francis, London, UK.

Centro de Investigaciones Agrarias (1980). *El cultivo de maiz en Mexico*. Centro de Investigaciones Agrarias, Mexico.

Chambers, R.; Pacey, A.; Thrupp, L.A. (Eds.) (1989). *Farmer First: Farmer Innovation and Agricultural Research*. Intermediate Technology Publications Ltd., London, UK.

CIMMYT (2002). *CIMMYT in 2001-2002. Diversity to Heal the Earth and Feed it's People*. Annual Report. Mexico, D.F.: CIMMYT.

CIMMYT Maize Program (1999). *Development, Maintenance and Seed Multiplication of Open-Polinated Maize Varieties* – 2nd edition. CIMMYT, Mexico, D. F.

Cleveland, D. A. and Murray, S. C. (1997). The World's Crop Genetic Resources and the Rights of Indigenous Farmers. *Current Anthropology*, **38** (4): 477-515.

Cohen, J. H. (1999). *Cooperation and Community. Economy and Society in Oaxaca.* University of Texas Press, Austin.

Coleman, J. S. (1990). *Foundations of Social Theory*. Cambridge, Massachusetts: Belknap Press of Harvard University Press.

Consejo Nacional de Población, CONAPO (2000). *Índices de marginación, 1995*. CONAPO, Mexico D.F., Mexico. http://www.conapo.gob.mx/00cifras/4_1.htm.

Consejo Nacional de Población, CONAPO (2001). *Indices de Marginacion, 2000*. CONAPO, Mexico D.F., Mexico. http://www.conapo.gob.mx/publicaciones/indices/pdfs/005a.pdf.

Cook, K. S. (2005). Networks, Norms and Trust: The Social Psychology of Social Capital. *Social Psychology Quarterly*, **68**, (1): 4-14.

Cook, K. S.; Rice, E. R. W.;Gerbasi, A. (2002). Commitment and Exchange: The Emergence of Trust Networks under Uncertainty. Paper presented at workshop on Formal and Informal Cooperation, Budapest, November 22-23, 2002. http://www.colbud.hu/honesty-trust/cook/pub01.doc.

Cordero Avendaño de Durand, C. (1997). *La Vara de Mando. Costumbre Jurídica en la Transmisión de Poderes.* Biblioteca del 465 Aniversario, Oaxaca de Juárez, México.

Cromwell, E. (ed.) (1990). *Seed Diffusion Mechanisms in Small Farmer Communities. Lessons from Asia, Africa, and Latin America.* ODI Network Paper 21. Overseas Development Institute, London, UK.

CRS, ICRISAT, and ODI (2002). *Seed vouchers and fairs: a manual for seed-based agricultural recovery after disaster in Africa.* Catholic Relief Services, Nairobi,

Kenya; International Crops research Institute for the Semi-Arid Tropics, Nairobi, Kenya; Overseas Development Institute, London, UK.

Deutsche Gesellschaft für Technische Zusammenarbeit, GTZ (2000). *Support for the Informal Seed Sector in Development Cooperation. Conceptual Issues.* GTZ GmbH in collaboration with the Centre for Genetic Resources, The Netherlands (CGN).

DiMaggio, P. and Louch, H. (1998). Socially embedded consumer transactions: For what kinds of purchases do people most often use networks? *American Sociological Review*, **63** (5): 619-637.

Doebley, J. (1990). Molecular evidence and the evolution of maize. *Economic Botany*, **44** (3rd supplement): 6-27.

Doebley, J. (2003). *The Taxonomy of Zea. Laboratory of Genetics*. University of Wisconsin-Madison. http://www.wixc.edu/teosinte/taxonomy.htm.

Douglas, M. (1966). *Purity and Danger*. Penguin. London.

Dowswell, C.R.; Paliwal, R.L.; Cantrell, R. P. (1996). *Maize in the third world*. Westview Press, Boulder.

Dusseldorf, D. van, and Box, L. (1993). Local and scientific knowledge: developing a dialogue. In: Boef, W. de, K. Amanor and K. Wellard with a. Bebbingon (eds.), *Cultivating Knowledge. Genetic diversity, farmer experimentation and crop research.* Intermediate Technology Publications Ltd., London.

Ellen, R. (ed.) (1984). *Ethnographic Research. A guide to general conduct*. Academic Press, London.

Ellen, R. (2006). Introduction. *Journal of Royal Anthropological Institute*, **12** (s1): 1-22.

Eubanks, M. W. (1999). *Corn in clay. Maize paleoethnobotany in pre-columbian art.* University Press of Florida. Gainesville, Florida.

Evenson, R. E. and Gollin, D. (2003a). Assessing the impact of the Green Revolution, 1960-2000. *Science*, **300** (5620): 758-762.

Evenson, R. E. and Gollin, D. (Eds.), (2003b). *Crop Variety Improvement and its Effect on Productivity. The Impact of International Agricultural Research*. CABI Publishing, Wallingford, UK.

Fafchamps, M. (1992). Solidarity Networks in Preindustrial Societies: Rational Peasants with a Moral Economy. *Economic Development and Cultural Change*, **41** (1): 147-174.

Fafchamps, M. (2002a). Social Capital, Trust, and Development. Social Development Strategy. The World Bank. Available at: http://Inweb18.worldbank.org/essd/sdvext.nsf/62ByDocName/SocialCapitalTrustandDevelopment/$FILE/Fafchamps3.pdf

Fafchamps, M. (2002b). Social Capital and Development. Paper presented at the GPRG meeting held in Oxford, Oct. 10-11, 2002.

Fafchamps, M. and Gubert, F. (2005). The Formation of Risk Sharing Networks. *Global Poverty Research Group, Working Paper Series 037*.

Economic and Social Research Council. Available at: http://www.gprg.org/pubs/workingpapers/pdfs/gprg-wps-037.pdf

Fafchamps, M. and Minten, B. (2002). Returns to Social Network Capital Among Traders. *Oxford Economic Papers*, **54**: 173-206.

Fairhead, J. and Leach, M. (1994). Declarations of difference. In: Scoones, I. and Thompson, J. (Eds.), *Beyond Farmer First. Rural people's knowledge, agricultural research and extension practice*. Intermediate Technology Publications Ltd., London, UK.

Fajardo, H. (2001). Conflicting therapeutics: a Mexican case study of encounters of medical cultural domains. In: Hebinck, P. and Verschoor, G. (Eds.), *Resonances and Dissonances in Development. Actors, networks and cultural repertoires.* Van Gorcum, Assen, The Netherlands.

Fernandez de Castro, Veronica (1990). Restoration of tomb no. 5 of Huijazoo. Western Association for Art Conservation, *WAAC, Newsletter*, 12 (1): 5-8.

Feyissa, R. (2000). Community seed banks and seed exchange in Ethiopia: A farmer-led approach. In: Friis-Hansen, E. and Sthapit, B. (eds), *Participatory Approaches to the Conservation and Use of Plant Genetic Resources*. International Plant Genetic Resources Institute, Rome, Italy. Pp. 142-148.

Fine, B. (2003). Social Capital: The World Bank's Fungible Friend. *Journal of Agrarian Change*, **3** (4): 586-603.

Foley, Michael W. and Bob Edwards (1999). Is It Time to Disinvest in Social Capital? *Journal of Public Policy*, **19**: 141-173.

Foucault, M. (1979). *Power/Knowledge: Selected interviews and other writings 1972-77*. Colin Gordon (Ed.). Prentice Hall, New York and London.

Freeman, L. (2004). *The Development of Social Network Analysis: A Study in the Sociology of Science.* Vancouver: Empirical Press.

Friis-Hansen, E. (1999). The socioeconomic dynamics of farmers' management of local plant genetic resources – A framework for analysis with examples from a Tanzanian case study. *CDR Working paper 99.3*. Copenhagen.

Friis-Hansen, E. (2000). Nyt paradigme for bevaring og brug af planteressourcer. *Den Ny Verden, no.33.* Centre for Development Research, Copenhagen.

Friis-Hansen, E.; Boesen, J.; Gibbon, P.; Pedersen, P.O.; Ponte S.; Raikes, P. (Eds.) (2000). *Agricultural policy in Africa after structural adjustment*. Center for Udviklingsforskning, Copenhagen.

Fukuyama, F. (1995). Social Capital and the Global Economy: A Redrawn Map of the World. *Foreign Affairs*, **5**.

Fukuyama, F. (2001). Social capital, civil society and development. *Third World Quarterly*, **22** (1): 7-20.

Fukuyama, F. (2002). Social Capital and Development: The Coming Agenda. *Sais Review*, **22** (1): 23-37.

Fussell, B. (1992). *The story of corn*. Alfred A. Knopf, New York.

Fussell, B. (1999). Translating maize into corn: The transformation of America's native grain. *Social Research*, **66** (1): 41-65.

Gabre-Madhin, E. Z. (2001). *Market Institutions, Transaction Costs, and Social Capital in the Ethiopian Grain Market*. IFPRI Research Report 124, International Food Policy Research Institute, Washington, D.C.

Galinat, W. C. (1988). The origin of corn. In: Sprague G.F. and Dudley, J.W. (Eds.), *Corn and corn improvement*. (3rd ed.). Agronomy Monograph No. 18. Madison, Wisconsin: American Agronomy Association, Crop Science Society of America and Soil Science Society of America.

Gammeltoft, T. (2002). The Irony of Sexual Agency: Premarital Sex in urban Northern Vietnam. In: Werner, J. and Belanger, D. (eds), *Gender, Household, State: doi moi in Vietnam*. Ithaca, New York: Cornell University. Pp. 111-128.

García, E. (1998). *Precipitacion Total Anual. Escala 1: 1000000*. CONABIO, México.

Garfinkel, H. (2003(1967)). *Studies in Ethnomethodology*. Polity Press, Cambridge.

Garton, L.; Haythornthwaite, C.; Wellmand, B. (1997). Studying Online Social Networks. *Journal of Computer-Mediated Communication*, **3** (1).

Geertz, Clifford (1978). The Bazaar Economy: Information and Search in Peasant Marketing. *Supplement to the American Economic Review*, **68**: 28-32.

Gepts, P. 2004. Who Owns Biodiversity, and How Should the Owners Be Compensated? *Plant Physiology*, **134**: 1295-1307.

Giddens, A.; Duneier, M.; Appelbaum, R. P. (2003). *Introduction to Sociology*. 4th edition.WW Norton and Company, New York. Avaiable at: http://www.wwnorton.com/college/titles/soc/socio4/sample_chapters.htm.

Godelier, M. (1974). Anthropology and Biology: Towards a New Form of Co-operation. *International Social Science Journal*, **26** (4): 611-635.

Godoy, R. (1993). Beyond Chayanov: Investment Decisions in the Rural Third World – the Viewpoint of Farmers, Bankers, and the Central Government. *Human Organization*, **52**, (1): 25-31.

Goffman, E. (1959). *The Presentation of Self in Everyday Life*. Anchor Books, New York, New York.

Goodman, D. (1999). Agro-Food Studies in the 'Age of Ecology': Nature, Corporeality, Bio-Politics. *Sociologia Ruralis* **39** (1): 17-38.

Granovetter, M. (1973). The Strength of Weak Ties. *American Journal of Sociology*, **78** (6): 1360-1380.

Granovetter, M. (1983). The Strength of Weak Ties: A Network Theory Revisited. In: Collins, R. (ed.), *Sociological Theory*. Jossey-Bass Inc. Ltd. San Francisco, Cal.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, **91**: 481-510.

Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, **91**: 481-510.

Granovetter, M. (1992). Economic Institutions as Social Constructions: A Framework for Analysis. *Acta Sociologica*, **35**: 3-11.

Granovetter, M. (1995 (1974)). *Getting a Job: A Study of Contacts and Careers*. 2nd Edition. University of Chicago Press, Chicago.

Granovetter, M. (2005). The impact of social structure on economic outcomes. *Journal of Economic Perspectives,* **19** (1): 33-50.

Granovetter, M. and Swedberg, R. (Eds.) (2001). *The sociology of economic life*. Westview Press. Boulder, Colorado.

Greene, S. (2004). Indigenous People Incorporated? Culture as Politics, Culture as Property in Pharmaceutical Bioprospecting. *Current Anthropology*, **45** (2): 211-237.

Greenwood, D. J. (1966). *The Mayordomia System in Santa María Guelace*. Tri-institutional Field Training Program, Stanford University.

Gudeman, S. (1978). Anthropological Economics: The Question of Distribution. *Annual Review of Anthropology*, **7** : 347-377.

Gudeman, S. (2001). *The Anthropology of Economy*. Oxford: Blackwell Publishing Ltd.

Gullestrup, H. (1995). *Kultur, kulturanalyse og kulturetik – eller hvad adskiller og forener os?* Akademisk Forlag, København.

Hallauer, A.R. (1994). Corn genetics and breeding. In: Arntzen, C.J. and Ritter, E. M. (eds), *Encyclopedia of Agricultural Science*. Vol 1. San Diego: Academic Press.

Hannerz, Ulf (1989). The Cultural Shaping of Agency. *Antropologiska Studier*, **45**: 28-46.

Hardin, G. (1968). The tragedy of the commons. *Science,* **162**: 1243 -1248.

Hardin, R. (2002). Trust. In: Hardin, R., *Trust and Trustworthiness*. Russell Sage Foundation Publishers. N. Y.

Hardon, J.; Duvick, D.; Visser, B. (2000). Genetic diversity, conservation and development. In: Almekinders, C.J.M and Boef, W.S.de (Eds.), *Encouraging Diversity. Plant Genetic Resource Conservation and Crop Development*. IT Publications, London. Pp. 1-8.

Harker, R.; Mahar, C.; Wilkes, C. (1990). The basic theoretical position. In: Harker, R.; Mahar, C.; Wilkes, C. (Eds.), *An Introduction to the work of Pierre Bourdieu. The practice of theory.* Macmillan Press Ltd., Houndsmills, Basingstoke, Hampshire and London.

Harker, R.; Mahar, C.; Wilkes, C. (Eds.) (1990). *An Introduction to the work of Pierre Bourdieu. The practice of theory*. Macmillan Press Ltd., Houndsmills, Basingstoke, Hampshire and London.

Harlan, J.R. (1992). *Crops and Man.* 2nd edn. American Society of Agronomy and Crop Science Society of America, Madison, Wisconsin, USA.

Harriss, John (2002). *Depoliticizing Development. The World Bank and Social Capital*. Anthem Press, London.

Hastrup, Kirsten (1992). *Det Antropologiske Projekt. Om forbløffelse*. Gyldendal, København.

Hawkes, J. G. (1983). *The Diversity of Crop Plants*. Harward University Press, Cambridge, MA.

Hebinck, P.; Ouden, J. den; Verschoor, G. (2001). Past, present and future: Long's actor-oriented approach at the interface. In: Hebinck, P. and Verschoor, G. (Eds.), *Resonances and Dissonances in Development. Actors, networks and cultural repertoires*. Van Gorcum, Assen, The Netherlands.

Hernandez, E. (1985). Maize and the greater Southwest. *Economic Botany* **39**: 416-430.

Hilhorst, D. (2000). *Records and Reputations. Everyday Politics of a Philippine Development NGO*. Doctoral Thesis, Wageningen University, The Netherlands.

Hobbs, J. E. (1997). Measuring the Importance of Transaction Costs in Cattle Marketing. *American Journal of Agricultural Economics*, **79**: 1083-1095.

Hunn, E. (2006). Meeting of minds: how do we share our appreciation of traditional environmental knowledge? *Journal of Royal Anthropological Institute*, **12** (s1): 143-160.

Instituto Nacional de Estadistica, Geografia e Informatica, INEGI, (2001). *XII Censo General de Población y Vivienda 2000.* INEGI, Aguascalientes, Ags. Mexico.

Instituto Nacional de Estadistica, Geografia e Informatica, INEGI, (1998). *Información Básica del Sector Agropecuario. Oaxaca*. INEGI, Aguascalientes, Ags. Mexico.

Instituto Nacional de Estadistica, Geografia e Informatica, INEGI, (1994). *Sector Agropecuario. Resultados Definitivos. Censos Agricola, Ganadero y Ejidal, 1991*. (VII Censo agrícola ganadero, 1991). INEGI, Aguascalientes, Ags. Mexico.

Jaenicke-Deprés, V.; Buckler, E.S.; Smith, B.D.; Gilbert, M.T.P.; Cooper, A.; Doebley, J.; and Pääbo, S. (2003). Early Allelic Selection in Maize as Revealed by Ancient DNA. *Science*, **302**: 1206-1208.

Jarvis, D.I.; Myer, L.; Klemick, H.; Guarino, L.; Smale, M.; Brown, A.H.D.; Sadiki, M.; Sthapit, B.; Hodgkin, T. (2000). *A Training Guide for In Situ Conservation On Farm.* Version 1. International Plant Genetic Resources Institute, Rome, Italy.

Jones, R. B.; Longley, C.; Bramel, P.; Remington, T. (2002). The Need to Look Beyond the Production and Provision of Relief Seed: Experiences from Southern Sudan. *Disasters*, **26** (4): 302-315.

Kapferer, Bruce (Ed.) (1976). *Transaction and Meaning. Directions in the Anthropology of Exchange and Symbolic Behavior*. ASA Esays in Social Anthropology. Institute for the Stucy of Human Issues, ISHI, Philadelphia.

Keen, S. (2002). *Debunking Economics: The Naked Emperor of the Social Sciences*. Zed Books. London.

Keesing, R. M. (1981). *Cultural Anthropology. A Contemporary Perspective*. Holt, Rinehart and Winston, Inc.

Kimber R. (1981). Collective action and the fallacy of the liberal fallacy. *World Politics* **33** (2): 178-196.

Kjosavik, D. J. (2003). Methodological Individualism and Rational Choice in Neoclassical Economics: A Review of Institutionalist Critique. *Forum for Development Studies*, **30** (2): 205-245.

Knox, A.; Meinzen-Dick, R.; Hazell, P. (1998). Property rights, collective action and technologies for natural resource management: a conceptual framework. *CAPRi Working Paper No. 1*. Washington: International Food Policy Research Institute (IFPRI). Available at: http://www.capri.cgiar.org/-pdf/capriwp01.pdf.

Koppel, B., and Oasa, E. (1987). Induced innovation theory and Asian green revolution: a case study of ideology and neutrality. *Development and Change* **18**: 29–67.

Krippner G. R. (2001). The elusive market: Embeddedness and the paradigm of economic sociology. *Theory and Society* **30**: 775-810.

Latour, B. (1993). *We have never been modern.* Harvard University Press. Cambridge, Massachusetts.

Latour, B. (1998). On Recalling ANT. In: Law, J. and Hassard, J. (Eds.), *Actor Network Theory and After*. Blackwell, Oxford.

Lavine, S. A. (1974). *Indian corn and other gifts*. Dodd, Mead and Company. New York.

Law, J. (1992). Notes on the Theory of the Actor-Network: Ordering, Strategy and Heterogeneity. *Systems Practice* **5**: 379-393. Available at: Http://www.comp.lancs.ac.uk/sociology/soc054jl.html.

Lewis, V. and Mulvany, P. M. (1997). *A Typology of Community Seed Banks*. Natural Resources Institute and Intermediate Development Group. Chatham and Rugby, UK. www.ukabc.org/communityseedbanks.pdf.

Linnemann, A.R. and Bruyn, G. H. de (1987). Traditional seed supply for food crops. *ILEIA* **3**, 10-11.

Long, N. (1977). *An Introduction to the Sociology of Rural Development*. Tavistock Publications Ltd. London, UK.

Long, N. (1984). Creating Space for Change: A Perspective on the Sociology of Development. *Sociologia Ruralis*, **XXIV**, 3-4: 168-184.

Long, N. (1992). From paradigm lost to paradigm regained? The case for an actor-oriented sociology of development. In: Long, N. and Long, A. (Eds.), *Battlefields of Knowledge. The interlocking of theory and practice in social research and development*. Routledge, London, UK.

Long, N. (1997). Agency and Constraint, Perceptions and Practices. A Theoretical Position. In: de Haan, H. and Long, N. (Eds.), *Images and Realities of Rural Life*. Van Gorcum. Assen, The Netherlands.

Long, N. (2001). *Development Sociology. Actor perspectives*. Routledge. London.

Long, N. (2003). An Actor-oriented Approach to Development Intervention. In: Cruz, D. A. (Ed.), *Rural Life Improvement in Asia*. Asian Productivity Organization, APO, Japan.

Long, N. and Long, A. (Eds.) (1992). *Battlefields of Knowledge. The interlocking of theory and practice in social research and development*. Routledge, London, UK.

Long, N. and Villareal, M. (1994). The interweaving of knowledge and power in development interfaces. In: Scoones, I. and Thompson, J. (Eds.), *Beyond Farmer First. Rural people's knowledge, agricultural research and extension practice*. Intermediate Technology Publications Ltd.. London.

Longley, C.; Jones, R.; Ahmed, M. H.; Audi, P. (2001). Supporting Local Seed Systems in Southern Somalia: A Developmental Approach to Agricultural Rehabilitation in Emergency Situations. *Agren, Network Paper no. 115*, ODI Agricultural Research and Extension Network.

Longley, C.; Saide, M. A.; Dominguez, C.; Leonardo, W. J. (2002). Do Farmers Need Relief Seed? A Methodology for Assessing Seed Systems. *Disasters*, **26** (4): 343-355.

Louette, D.; Charrier, A.;Berthaud, J. (1997). In situ conservation of maize in Mexico: Genetic diversity and maize seed management in a traditional community. *Economic Botany*, **51** (1): 20-38.

Louette, D. and Smale, M. (1998). Farmers' seed selection practices and maize variety characteristics in a traditionally based Mexican community. *CIMMYT Economics Working Paper No.98-04*. Mexico, D.F.: CIMMYT.

Louwaars, N. (2000). Seed Regulations and Local Seed Systems. *Biotechnology and Development Monitor*, **42**: 12-14.

MacNeish, R. S. and Eubanks, M. (2000). Comparative analysis of the Rio Balsas and Tehuacan models for the origin of maize. *Latin American Antiquity* **11**: 3-20.

Mangelsdorf, P. C. (1974). *Corn. Its Origin, Evolution and Improvement*. Belknap Press of Harvard University Press, Cambridge, Mass.

Mangelsdorf, P.C. and Reeves, R. G. (1939). *The origin of Indian corn and its relatives*. Texas Agricultural Experiment Station, Bulletin no. 574 (Monograph). Agricultural and Mechanical College of Texas, Texas.

Mango, N. (2002). *Husbanding the land. Agrarian development and socio-technical change in Luoland, Kenya*. PhD Thesis, Wageningen University, The Netherlands.

Marchand, T. H. J. (1999). Mastering Making and Mastering Space: Reconsidering the language-biased analyses of the *what* and *where* in spatial cognition. *SOAS Working Papers in Linguistics*, **9**: 359-372.

Marchand, T. H. J. (2003). A possible explanation for the lack of explanation; or, 'Why the master builder can't explain what he knows': Introducing informational atomism against a 'definitional' definition of concepts. In:

Pottier, J.; Bicker, A.; Sillitoe, P. (Eds.) *Negotiating Local Knowledge. Power and Identity in Development*. Pluto Press. London. Sterling, Virginia.

Maredia, M. and Howard, J. (1998). Facilitating seed sector transformation in Africa: Key findings form the literature. *USAID Policy Synthesis, no.33.* USAID, office of sustainable development.

Marx Ferree, M.; Lorber, J.; Hess, B. B. (1999). Introduction. In: Marx Ferree, M.; Lorber, J.; Hess, B. B. (Eds.) *Revisioning Gender*. Sage Publications, London.

Matsuoka, Y., Vigouroux, Y., Goodman, M.M., Sánchez, J., Buckler, G.E., and Doebley, J. (2002). A single domestication for maize shown by multilocus microsatellite genotyping. *Proceedings of the National Academy of Sciences*, **99** (9): 6080-6084.

Mauss, Marcel (1954 (1925)). *The Gift: Forms and Functions of Exchange in Archaic Societies*. Free Press, London, UK. (Excerpts: pp1-10, 63-89).

Maxted, N.; Guarino, L.; Myer, L.; Chiwona, E. A. (2002). Towards a methodology for on-farm conservation of plant genetic resources. *Genetic Resources and Crop Evolution* **49**: 31-46.

Mayer, E. and Glave, M. (1999). Alguito para ganar (A little something to earn): Profits and losses in peasant economies. *American Ethnologist*, **26** (2): 334-369.

Mazhar, F. (2000). Seed conservation and management: participatory approaches of Nayahrishi Seed Network in Bangladesh. In: Friis-Hansen, E. and B. Sthapit (eds), *Participatory Approaches to the Conservation and Use of Plant Genetic Resources*. International Plant Genetic Resources Institute, Rome, Italy. Pp. 149-153.

McCann, J. C. (2005). *Maize and Grace. Africa's Encounter with a New World Crop, 1500-2000*. Harvard University Press, Cambridge, Massachusetts.

McCorkle, C. M. (1989). Toward a Knowledge of Local Knowledge and Its Importante for Agricultiral RD and E. *Agriculture and Human Values*, **6** (3): 4-12.

Meinzen-Dick, R. and Di Gregorio, M. (2004). Overview. In: Meinzen-Dick, R. and Di Gregorio, M. (eds.): *Collective Action and Property Rights for Sustainable Development*. IFPRI 2020 Vision. IFPRI.

Meinzen-Dick, R.; Di Gregorio, M.; McCarthy, N. (2004). Methods for studying collective action in rural development. *Agricultural Systems* **82** (3): 197-214.

Melhuus, M. and Stølen, K. A. (1996). Introduction. In: Melhuus, M. and Stølen, K. A. (Eds.), *Machos, Mistresses, Madonnas. Contesting the Power of Latin American Gender Imagery.* Verso, London, UK.

Mendez Martinez, E. (1995). *El Exconvento y Templo de San Pablo Huitzo*. Serie Investigación no. 3. Instituto Cultural Oaxaqueno, F.O.R.O., Oaxaca, Mexico.

Mendez Martinez, E. and Mendez Torres, E. (2000). *Historia Del Corregimiento De Guaxolotitlan (Huitzo) Durante La Colonia, Siglos XVI Al XIX*. Instituto Cultural Oaxaqueno, F.O.R.O., Centro de Estudios Historicos del Porfiriato, Mexico D.F., Mexico.

Mendoza Gonzalez, J. (2000). *Participacion de la mujer en la seleccion de semilla de maiz en los Valles Centrales de Oaxaca*. Tesis de Ingeniería Agrícola, Universidad Nacional Autonoma de Mexico. Cuautitlan Izcalli, Edo.Mexico.

Meng, E., Brush, S.B. (1998). Farmers' valuation and conservation of crop genetic resources. *Genetic Resources and Crop Evolution* **45**: 139-150.

Mises, L. von (1962). On Some Popular Errors Concerning the Scope and Method of Economics. In: Mises, L. von: *The Ultimate Foundation of Economic Science: An Essay on Method*. Princeton: D.Van Nostrand. Available at: http://www.mises.org/books/ufofes/.

Mitchell, C. J. (1969). *Social Networks in Urban Situations.* Manchester: Manchester University Press.

Montes Vasquez, J. (1985). Función de la gozona en el sistema económico y social entre los Zapotecos Cajonos de la Sierra Norte de Oaxaca. *Etnias* **2**: 23-28. Oaxaca: Centro de Educacion Continua Oaxaca (CECOAX).

Moock, J. and Rhoades, R. (1992). *Diversity, Farmer Knowledge and Sustainability*. Cornell University Press, Ithaca.

Morris, M. (Ed.) (1998). *Maize Seed Industries in Developing Countries.* Lynne Rienner Publishers, Boulder, Colorado.

Morris, M. (2002). *Impacts of International Maize Breeding Research in Developing Countries, 1966-98*. CIMMYT, Mexico, D.F.

Morris, M. and López-Pereira, M. A. (1999). *Impacts of maize breeding research in Latin America 1966-1997.* Mexico, D.F.: International Maize and Wheat Improvement Center (CIMMYT).

Morris, M.; Rusike, J.; Smale, M. (1998). Maize seed industries: A conceptual framework. In: Morris, M.L. (Ed.), *Maize Seed Industries in Developing Countries*. Lynne Rienner, Colorado. Pp. 35-54.

Muir, P. S. (1998). *The Green Revolution*. Oregon State University – Biology 301 – Human impacts on ecosystems. Avaiable at: http://oregonstate.edu/instruction/bi301/greenrev.htm (040604).

Musa, T.M. and Rusike, J. (1997). Constraint to variety release, seed production , and distribution: Sorghum, peral millet, groundnut, and pigeonpea in SADC countries. *Southern and Eastern Africa Region Working Paper no. 97/02*. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Southern and Eastern Africa Region. Bulawayo, Zimbabwe.

Museo Nacional de Culturas Populares (2002(1982)). *El maiz, fundamento de la cultura popular mexicana*. Tercera edicion. Museo Nacional de Culturas Populares, Mexico, D.F.

Mushita, T. A. (1993). Strengthening the informal seed sysem in comunal area of Zimbabwe. In: In: de Boef et al. (Eds.), *Cultivating Knowledge: Genetic diversity, farmer experimentation and crop research.* London: Intermediate Technology Publications.

National Research Council (1993). *Managing global genetic resources: Agricultural crop issues and policies*. Board on Agriculture. National Academic Press, US. 171p.

Neukom, H. and Büchi, W. (1979). Industrial utilization of maize. In: CIBA-GEIGY Agrochemicals; *Maize*. CIBA-GEIGY Ltd. Basle, Switzerland.

Nordvig Rasmussen, L. and Meinzen-Dick, R. (1995). Local Organizations for Natural Resource Management: Lessons from Theoretical and Empirical Literature. *IFPRI Environment and Production Technology Discussion Paper 11.* International Food Policy Research Institute (IFPRI), Washington.

Novellino, D. (2003). From seduction to miscommunication: The confession and presentation of local knowledge in 'participatory development'. In: Pottier, J.; Bicker, A.; Sillitoe, P. (Eds.), *Negotiating Local Knowledge. Power and Identity in Development.* Pluto Press. London. Sterling, Virginia.

Nuijten, M. (2001). Organisation and development: a practice perspective. In: Hebinck, P. and Verschoor, G. (Eds.), *Resonances and Dissonances in Developemnt. Actors, networkd and cultural repertoires*. Van Gorcum, The Netherlands.

Olson, M. (1971 (1965)). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Harvard University Press; Revised edition

Orlove, B.S. and Brush, S. B. (1996). Anthropology and the conservation of biodiversity. *Annual Review of Anthropology,* **25**: 329-52.

Ortega C., A. (1987). *Insectos nocivos del maiz: Una guía para su identificación en el campo.* Mexico, D.F.: CIMMYT.

Ortner, S. B. (1974). Is Female to Male as Nature is to Culture? In: Rosaldo, M. and Lamphere, L. (Eds.) *Woman, Culture and Society*. Standford University Press, California.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press. Cambridge, UK and New York, USA.

Ostrom, E. (2004). Understanding collective action. In: Meinzen-Dick, R. and Di Gregorio, M. (Eds.), *Collective Action and Property Rights for Sustainable Development*. IFPRI 2020 Vision. International Food Policy Research Institute (IFPRI), Washington.

Pandey, S. (1998). Varietal Development: Conventional Plant Breeding. In: Morris, M. (Ed.), *Maize seed industries in developing countries*. Lynne Rienner, Boulder. P. 57- 76.

Perales-Rivera, H. R.; Brush, S. B.; Qualset, C. (2003). Dynamic management of maize landraces in central Mexico. *Economic Botany* **57**: 21-34.

Pescosolido, B. A. and Rubin, B. A. (2000). The Web of Group Affiliations Revisited: Social Life, Postmodernism and Sociology. *American Sociological Review*, **65** (1): 52-76.

Pimbert, M. (1999). *Sustaining the multiple functions of agricultural biodiversity.* Gatekeeper series No. 88. International Institute for Economics and Development, London.

Pingali, P. L. (Ed.) (2001). *CIMMYT 1999-2000 World Maize Facts and Trends. Meeting World Maize Needs: Technological Opportunities and Priorities for the Public Sector*. CIMMYT, Mexico, D. F.

Piperno, D.R. and Flannery, K.V. (2001). The earliest archaeological maize (Zea mays L.) from highland Mexico: New accelerator mass spectrometry dates and their implications. *Proceedings of the National Academy of Sciences*, **98** (4): 2101-2103.

Pixley, K. (2006). Hybrids and Open-Polinated Varieties in Modern Agriculture. Chapter 17 In: Lamkey, K. R. and Lee, M. (Eds.), *Plant Breeding: The Arnel R. Hallauer International Symposium*. Blackwell Publ. Professional, Ames, Iowa.

Pixley, K. and M. Bänziger (2004). Open-pollinated maize varieties: a backward step or valuable option for farmers? In: Friesen, D.K. and Palmer A.F.E. (Eds.), *Integrated approaches to higher maize productivity in the new millennium: Proceedings of the 7th Eastern and Southern Africa regional maize conference, 5-11 February 2002, Nairobi, Kenya*. CIMMYT and KARI.

Plattner, Stuart (Ed.) (1989). *Economic Anthropology*. Stanford University Press, Stanford, California.

Polanyi, K. (2001 (1957)). The economy as instituted process. In: Granovetter, M. and Swedberg, R. (Eds.), *The Sociology of Economic Life*. Westview Press, Boulder, Colorado. Pp. 31-50.

Portes, A. (1997). Immigration Theory for a New Century: Some Problems and Opportunities. *International Migration Review*, **31**, (4): 799-825.

Portes, A. and Landolt, P. (1996). Unsolved Mysteries: The Tocqueville Files II. *The American Prospect*, **7** (26), available at: www.prospect.org/V7/26/26-cnt2.html.

Portes, A. and Sensenbrenner, J. (1993). Embeddedness and immigration: Notes on the social determinants of economic action. *American Journal of Sociology*, **98**: 1320-1350.

Poteete, A. and Ostrom, E. (2004). In pursuit of comparable concepts and data about collective action. *Agricultural Systems* **82** (3): 215-232.

Pottier, J. (2003). Negotiating local knowledge: An introduction. In: Pottier, J.; Bicker, A.; Sillitoe, P. (Eds.), *Negotiating Local Knowledge. Power and Identity in Development*. Pluto Press. London. Sterling, Virginia.

Pottier, J.; Bicker, A.; Sillitoe, P. (Eds.) (2003). *Negotiating Local Knowledge. Power and Identity in Development*. Pluto Press. London. Sterling, Virginia.

Pressoir, G. and Berthaud, J. (2004). Population structure and strong divergent selection shape phenotypic diversification in maize landraces. *Heredity,* **92** (2): 95-101.

Pretty, J. and Smith, D. (2004). Social Capital in Biodiversity Conservation and Management. *Conservation Biology*, **18** (3): 631-63.

Putnam, R. D. (1993). The Prosperous Community. Social Capital and Public Life. *The American Prospect*, **4** (13). Available at: www.prospect.org/print/V4/13/putnam-r.html

Putnam, R. D. (1995). Bowling Alone: America's Declining Social Capital. *Journal of. Democracy,* **6** (1): 65-78.

Putnam, R. D. (1996). The Strange Disappearance of Civic America. *The American Prospect*, 7 (24).

Quiroz, C. (1996). Local knowledge systems contribute to sustainable development. *Indigenous Knowledge Monitor* **4** (1). Available at: http://www.nuffic.nl/ciran/ikdm/4-1/articles/quiroz.html

Rack, M. (2003). Interfaces of knowledge: The revival of temples in West Hunan, China. In: Pottier, J.; Bicker, A.; Sillitoe, P. (Eds.), *Negotiating Local Knowledge. Power and Identity in Development*. Pluto Press. London. Sterling, Virginia.

Ravnborg, H. Munk (1993). Targeting International Agricultural Research towards the Rural Poor. *CDR Working Paper, 93.4.* Centre for Development Research, Copenhagen.

Ravnborg, H. Munk (1996). *Agricultural Research and the Peasants. The Tanzanian Agricultural Knowledge and Information System*. Centre for Development Research, Copenhagen.

Ravnborg, H.M.; Cruz, A.M. de la; Guerrero, M.P.; Westermann, O. (2002). Collective action in ant control. In: Meinzen-Dick, R.; Knox, A.; Place, F.; Swallow, B. (Eds.), *Innovation in Natural Resource Management. The Role of Property Rights and Collective Action in Developing Countries*. Johns Hopkins University Press. Pp 257-271.

Remington, T.; Walsh, S.; Charles, E.; Maroko, J.; Omanga, P. (2002). Getting Off the Seeds-and-Tools Treadmill with CRS Seed Vouchers and Fairs. *Disasters*, **26** (4): 316-328.

Rice, E.; Smale, M.; Blanco, J. L. (1998). Farmers' use of improved seed selection practices in Mexican maize: Evidence and issues from the Sierra de Santa Marta. *World Development*, **26** (9): 1625-1640.

Richards, P. (1985). *Indigenous Agricultural Revolution: Ecology and Food Production in West Africa.* Hutchinson, London and Westview Press, Boulder.

Richards, P. (1989). Agriculture as a performance. In: Chambers, R.; Pacey, A.; Thrupp, L.A. (Eds.) *Farmer First: Farmer Innovation and Agricultural Research*. Intermediate Technology Publications Ltd., London, UK.

Ritchie, S. W. and Hanway, J. J. (1982). *How a corn plant develops*. Special report no. 48. Iowa State University of Science and Technology.Cooperative Extension Service, Ames, Iowa.

Ritzer, G. and Goodman, D. J. (2003). *Sociological Theory*. 6th edition. McGraw-Hill, New York. Available at: http://highered.mcgraw-hill.com/sites/-0072817186/

Roberts, B.R. (2001). The New Social Policies in Latin America and the Development of Citizenship: An interface perspective. Paper for Workshop on Agency, Knowledge and Power: New Directions. Wageningen 14th-15th December. Available at: http://www.utexas.edu/cola/depts/llilas/content/claspo/PDF/workingpapers/newsocpolicies.pdf

Rohrbach, D. D. (1997). Farmer-to-farmer seed movements in Zimbabwe: Issues arising. In: Rohrbach, D.D.; Bishaw, Z.; Gastel, A.J.G. van (Eds.), *Alternative Strategies for Smallholder Seed Supply*. Proceedings of an International Conference on Options for Strengthening National and Regional Seed Systems in Africa and West Asia. March 1997, Harare, Zimbabwe. ICRISAT, India.

Rosaldo, M. Z. (1974). Woman, Culture and Society: A Theoretical Overview. In: In: Rosaldo, M. and Lamphere, L. (Eds.), *Woman, Culture and Society*. Standford University Press, California.

Rose-Ackerman, S. (2001). Trust, Honesty and Corruption: Reflections on the State-building Process. *Arch. Europ. Sociol.*, **XLII** (3): 526-570.

Rothstein, B. (2000). Trust, Social Dilemmas and Collective Memories. *Journal of Theoretical Politics*, **12** (4): 477-501.

Rucht, D. (2002). Summary of the main results and identification of research questions. Discussant's Comments. Cultural Diversity, Collective Identity and Collective Action - Consequences of the opening up of national borders, ESF Forward Look Workshop, April 2002, Italy. http://www.esf.org/articles/130/Section4.pdf.

Ruiz Garcia, Aida (2002). *Migración Oaxaquena. Una aproximación a la realidad.* Coordinación Estatal de Atención al Migrante Oaxaqueno. Oaxaca, Mexico.

Sahlins, M. D. (1968). Tribal Economics. In Sahlins, M. D.: *Tribesmen*. Englewood Cliffs, New Jersey.

Sahlins, M. D. (1972). *Stone Age Economics*. Aldine Publ. Co., New York, USA.

Salvador, R. J. (undated). Maize. Adaptation of an article originally published in *The Encyclopedia of Mexico: History, Culture and Society*, 1997, Fitzroy Dearborn Publishers. Available at: http://maize.agron.iastate.edu/maizearticle.html

Sánchez, J. J. G.; Goodman, M. M.; Stuber, C. W. (2000b). Isoenzymatic and morphological diversity in the races of maize in Mexico. *Economic Botany* **54**: 43-59.

Sánchez, J. J. G.; Stuber, C. W.; Goodman, M. M. (2000a). Isoenzymatic diversity in the races of maize in the Americas. *Maydica,* **45**: 185-203.

Sanjek, R. (1990). On Ethnographic Validity. In: Sanjek, R. (Ed.) *Fieldnotes: The Makings of Anthropology*. Ithaca, Cornell University Press: 385-418.

Sardan, O. de (2001). The three approaches in the anthropology of development. Presented at Workshop on Agency, Knowledge and Power: New Directions. Wageningen 14th-15th December. Later published as introductory chapter in: Sardan, O. de, 2005; *Anthropology and Development: Understanding Contemporary Social Change.* Zed Books. London, UK.

Sawkins, M.C.; De Meyer, J.; Ribaut J. -M. (Forthcoming). Drought tolerance in maize (*Zea mays ssp. mays*). In: Ribaut, J. -M. (Ed.) *Drought adaptation in cereals*. Haworth Press. New York.

Scoones, I. and Thompson, J. (Eds.) (1994). *Beyond Farmer First. Rural people's knowledge, agricultural research and extension practice*. Intermediate Technology Publications Ltd., London.

Scott, J. P. (2000a). Rational Choice Theory. In: Browning,G.; Halcli, A.; Webster, F. (Eds.), *Understanding Contemporary Society: Theories of The Present*. Sage Publications.

Scott, J. P. (2000b). The Development of Social Network Analysis. In: Scott, J.: *Social Network Analysis: A Handbook.* SAGE Publications; 2nd edition. London, UK.

Scott, J. P. (2005). Structural aspects of status and role. In: Smelser, N. J.; Baltes, P. B.: *International Encyclopedia of the Social and Behavioral Sciences*, art. 155. available at: http://privatewww.essex.ac.uk/~scottj/socscot9.htm

Seboka B. and Deressa, A. (2000). Validating farmers' indigenous social networks for local seed supply in Central Rift Valley of Ethiopia. *Journal of Agricultural Education and Extension* **6**: 245-254.

Secretaria de Educación Pública, SEP, (1991). *Oaxaca Tierra del Sol, Monografía Estatal*. México, D. F., México.

Secretaria de Educación Pública, SEP, (1999). *Oaxaca, Historia y Geografía*. México, D.F., México.

Semillas Berentsen information sheet for farmers: Las Mejores Semillas de Maiz. Semillas Berentsen, Celaya, Gto., Mexico.

Shaw, R. H. (1988). Climate Requirement. In: Sprague G.F. and Dudley, J.W. (Eds.) *Corn and corn improvement*. (3rd ed.). Agronomy Monograph No. 18. Madison, Wisconsin: American Agronomy Association, Crop Science Society of America and Soil Science Society of America.

Shepherd, C. J. (2004). Agricultural Hybridity and the "Pathology" of Traditional Ways. The Translation of Desire and Need in Postcolonial Development. *Journal of Latin American Anthropology*, **9** (2): 235-266.

Shepherd, C. J. (2005). Agricultural Development NGOs, Anthropology, and the Encounter with Cultural Knowledge. *Culture and Agriculture*, **27** (1): 35-44.

Sillitoe, P. (1998). The Development of Indigenous Knowledge: A New Applied Anthropology. *Current Anthropology*, **39** (2): 223-252.

Sillitoe, P. (2006). Ethnobiology and applied anthropology: rapprochement of the academic with the practical. *Journal of Royal Anthropological Institute*, **12** (s1): 119-142.

Sillitoe, P. and Wilson, R. A. (2003). Playing on the Pacific ring of fire: Negotiations and knowledge in mining in Papua New Guinea. In: Pottier, J.; Bicker, A.; Sillitoe, P. (Eds.), *Negotiating Local Knowledge. Power and Identity in Development. Pluto Press*. London. Sterling, Virginia.

Simmel, G. (2004 (1978, (1907))). *The Philosophy of Money*. 3rd edition, Routledge, London.

Smale, M.; Aguirre, A.; Bellon, M.; Mendoza, J.; Rosas, I M. (1999). Farmer management of maize diversity in the Central Valleys of Oaxaca, Mexico: CIMMYT-INIFAP. 1998 Baseline socioeconomic survey. *CIMMYT Economics Working Paper 99-09.* International Maize and Wheat Improvement Center (CIMMYT), Mexico D.F.

Smale, M. and Bellon, M.R. (1999). A conceptual framework for valuing on-farm genetic resources. In: Wood, D. and Lenné, J.M. (Eds.), *Agrobiodiversity: Characterization, Utilization and Management.* Wallingford: CABI Publishing. Pp. 387-408

Smale, M.; Bellon, M.; Aguirre, A.; Rosas, I.M.; Mendoza, J.; Solano, A.M.; Martinez, R.; Ramirez, A.; Berthaud, J. (2003).. The economic costs and benefits of a participatory project to conserve maize landraces on farms in Oaxaca, Mexico. *Agricultural Economics* **29**: 265-275.

Smith B. D. (1997). The Initial Domestication of Cucurbita pepo in the Americas 10,000 Years Ago. *Science* **276**, 932-934.

Smith, M. K. (2001). 'Robert Putnam', *The encyclopaedia of informal education*, www.infed.org/thinkers/putnam.htm. Last update: June 04, 2005.

Smith-Doerr, L. and Powell, W. W. (2005). Networks and Economic Life. In: Smelser, N. and Swedberg, R. (Eds.), *Handbook of Economic Sociology*, 2nd edition. Russell Sage Foundation and Princeton University Press.

Sperling, L. (2002). Emergency Seed Aid in Kenya: Some Case Study Insights on Lessons Learned During the 1990s. *Disasters*, **26** (4): 329-342.

Sperling, L. and Cooper, D. (2003). Understanding Seed Systems and Strengthening Seed Security. Background Paper presented in Rome 26-28 May, at the stakeholder workshop "Effective and Sustainable Seed Relief".

Sperling, L.; Heidegger, U.; Buruchara, R. (1995). *Enhancing small farm seed systems: Principles derived from bean research in The Great Lakes Region*. Network on Bean Research in Africa, Occasional Publications Series, No. 15, CIAT, Cali, Colombia.

Spradley, James P. (1979). *The Ethnographic Interview*. Holt, Rinehart and Winston, Inc., New York.

Sprague G.F. and Dudley, J.W. (Eds.) (1988). *Corn and corn improvement*. (3rd ed.). Agronomy Monograph No. 18. Madison, Wisconsin: American Agronomy Association, Crop Science Society of America and Soil Science Society of America.

Stalder, F. (1997). *Actor-Network-Theory and Communication Networks: Toward Convergence.* Available at: http://felix.openflows.org/html/Network_Theory.html

Starr, J.E.F. (1993). *Ideal Models and the Reality: From Cofradía to Mayordomía in the Valles Centrales of Oaxaca*, Mexico. Doctoral thesis, University of Glasgow.

Steins, N.A. (1999). *All Hands on Deck*. Doctoral thesis, Wageningen University, The Netherlands.

Stephen, L. and Barco, J. (1991). *Mayordomía: Ritual, Gender and Cultural Identity in a Zapotec Community*. Video. Center for US/Mexican Studies, University of California, San Diego.

Stern, S. J. (1995*). The Secret History of Gender. Women, Men and Power in Late Colonial Mexico*. University of North Carolina Press, USA.

Suvedi, M. (2000). *Evaluation of Alliance for the Country Side (Alianza para el Campo*). Consultancy report. Food and Agriculture Organisation of the United Nations, Mexico City, Mexico. Available at: http://www.msu.edu/~suvedi/Pages/PDF%20files/FAO%20report.pdf

Swedberg, R. (2004). The Toolkit of Economic Sociology. *CSES Working Paper Series, Paper #22*. Center for the study of Economy and Society. Cornell University, Ithaca, NY. [To appear In: Weingast, B. and Wittman, D. (Eds.) (2006) Handbook of Political Economy. Oxford University Press.]

Swedberg, R. and Granovetter, M. (2001). Introduction to the second edition. In: Granovetter, M. and Swedberg, R. (Eds.) *The Sociology of Economic Life*. Westview Press, Boulder, Colorado. Pp. 1-28.

Tarrow, Sidney (1996). Making social science work across space and time: A critical reflection on Robert Putnam's Making Democracy Work. *American Political Science Review* **90**: 389-397.

Thiele, G. (1999). Informal potato seed systems in the Andes: Why are they important and what should we do with them? *World Development* **27**: 83-99.

Thomas, Norman D. (1962). Mayordomia: Continuity and Change. *Kroeber Anthropological Society*, **27**. Berkeley, California, (fall).

Thrupp, L. A. (1989). Legitimizing Local Knowledge: From Displacement to Empowerment for Third World People. *Agriculture and Human Values*, **6** (3): 13-24.

Tootill, E. (Ed.) (1984). *Dictionary of Botany*. Penguin books Ltd. London.

Tripp, R. (2000). Strategies for seed system development in Sub-Saharan Africa: A study of Kenya, Malawi, Zambia, and Zimbabwe. *Socioeconomics and Policy Program, Working Paper Series no. 2.*, Overseas Development In-

stitute and International Crops Research Institute for the Semi-Arid Tropics

Tripp, R. (2000). The Organization of Farmer Seed Systems. Relevance for Participatory Plant Breeding. Paper presented for the symposium "Scientific Basis for Partipatory Improvement and Conservation of Crop Genetic Resources," Oaxtepec, Mexico, 8-14 October 2000.

Tripp, R. (2001). *Seed Provision and Agricultural Development*. Overseas Development Institute, London, UK.

Trutman, P.; Voss, J.; Fairhead, J. (1996). Local Knowledge and Farmer Perceptions of Bean Diseases in the Central African Highlands. *Agriculture and Human Values*, **13** (4): 64-70.

Turner, V. (1967). The Forest of Symbols. Aspects of Ndembu Ritual. Ithaca, New York: 19-47, 93-111.

United Nations Development Program, UNDP (2005). *Informe sobre Desarrollo Humano, Mexico 2004.* UNDP, Mundi-Prensa, Mexico D.F., Mexico. Avaiable at: http://saul.nueve.com.mx/informes/images/02%20-%20Resumen%20ejecutivo.pdf

UPOV (International Union for the Protection of New Varieties of Plants) (1991). *International convention for the protection of new varieties (1991 Act).* Geneva: International Union for the Protection of New Varieties of Plant.

Uzzi, B. (1996). The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect. *American Sociological Review*, **61** (4): 674-698.

Uzzi, B. (1999). Embeddedness in the Making of Financial Capital: How Social Relations and Networks Benefit Firms Seeking Financing. *American Sociological Review*, **64** (4): 481-505.

Vermillion, D.L. (2001). Property rights and collective action in the devolution of irrigation system management. In: Meinzen-Dick, R.; Knox, A.; Di Gregorio, M. (Eds.), *Collective Action, Property Rights and Devolution of Natural Resource Management: Exchange of Knowledge and Implications for Policy*. DSE/ZEL, Germany. Pp. 183-220.

Villareal, M. (1996). Power and Self-Identity: The Beekepers of Ayuquila. In: Melhuus, M. and Stølen, K. A. (Eds.), *Machos, Mistresses, Madonnas. Contesting the Power of Latin American Gender Imagery*. Verso, London, UK.

Villareal, M. (2001). Development and the reinvention of women. Paper presented at the seminar: "Agency, Knowledge and Power: New Directions in the Sociology of Development". Wageningen, The Netherlands, 14-15th of December, 2001.

Wallace, H. A. and Brown, W. L. (1988 (1956)). *Corn and its early fathers*. Revised edition. The Henry A. Wallace Series on Agricultural History and Rural Studies. Iowa State University Press. Ames.

Warren, D. M. (1992) Indigenous knowledge, biodiversity conservation and development. Keynote address at the International Conference on Conser-

vation of Biodiversity in Africa: Local Initiatives and Institutional Roles, 30 August – 3 Septemper 1992, Nairobi, Kenya. Available at: http://www.ciesin.org/docs/004-173/004-173.html.

Wellman, B. and Wortley, S. (1990). Different Strokes from Different Folks: Community Ties and Social Support. *The American Journal of Sociology*, **96** (3): 558-588.

Wierema, H.; Keune, L.; Vermeer, R.; Almekinders, C. (1994). *Small-scale Agriculture in Costa Rica, Nicaragua and Honduras. The Rationality of Local Systems of Seed Supply*. IVO Research report no. 43, Tilburg, The Netherlands.

Wiggins, S. and Cromwell, E. (1995). NGOs and Seed Provision to Smallholders in Developing Countries. *World Development*, **23** (3): 413-422.

Wodon, Q.; López-Acevedo, G.; Siaens, C. (2003). Pobreza en los estados del sur de Mexico. Draft document for the World Bank. Available at: http://www.consultoras.com/adjuntos/fichero_1426_20040308.pdf

World Health Organisation (WHO) (2004). The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification. Available at: http://www.inchem.org/documents/pds/pdsother/class.pdf

Wrong, D. H. (1961). The Oversocialized Conception of Man in Modern Sociology. *American Sociological Review*, **26** (2): 183-193.

Wu, B. and Pretty, J. (2004). Social connectedness in marginal rural China: The case of farmer innovation circles in Zhidan, north Shaanxi. *Agriculture and Human Values*, **21**: 81-92.

Data-bases and web-sites:

Countries and their cultures: http://www.everyculture.com/Ma-Ni/Mexico.-html

Enciclopedia de los Municipios de Mexico, (EMM): http://www.e-local.gob.mx/wb2/ELOCAL/EMM_oaxaca

FAO (2002) *FAOSTAT* database. http://faostat.fao.org/

FAO (2004) *FAOSTAT* database. http://faostat.fao.org/

Gobierno del Estado de Oaxaca. Oaxaca de Cara a la Nacion: http://www.gobiernodeoaxaca.gob.mx/web/index.php

The World Banks Social Capital web-site: http://www1.worldbank.org/prem/poverty/scapital/index.htm

Glossary

Agencia: Is a Mexican administrative term for branch or unit.

Almud: A volume measure still very common in the communities. One almud of maize kernels is approximately 4 kg. Over the past decades, the kilogram measure has spread widely, especially in the commercial sector, where it is now the dominant measure.

Almuerzo: 'Lunch'.

Arnero: Sieve consisting of a round wooden frame over which a piece of leather is strung with multiple perforations small enough so that maize kernels will not pass through any of them.

Arroyo: Little stream.

Atole: A warm and filling drink based on maize. Flavoring is often added, for example, chocolate.

Ayuntamiento: The municipal entity responsible for providing public services and infrastructure such as drinking water, electricity etc. Sometimes also used to refer to the municipal authorities in general.

Banda: A brass-based form of Mexican music.

Belatove: A kind of maize characterised by its red or purple colour. The name in Zapotec refers to the bright purple maguey worm (*Hipopta Agavis*).

Bonus pater familias: "Good father of family" is a legal concept referring to a certain standard of reason and conscientiousness applied when estimating a person's guilt. A bonus pater familias is expected to act with reason and care. The concept can be applied to practically all categories of persons, professions, and ages in terms of whether or not the person in question behaved in a reasonable and conscientious way under the given circumstances.

Caja de ahorro: Savings club.

Cambio de semilla: Seed-for-seed exchange.

Cantera: A type of stone used for construction.

Carrizo: Carrizo (*Arundo donax L.*) Giant reed of the grass family (*Poaceae*), also known as wild cane, is a tall, perennial grass that can grow to over 20 feet in height (Benton et al. 2005).

Cerro: Mountain or large hill.

Chayote: A common vegetable in Mexico (*Sechium edule*). The plant is a perennial vine similar in growth habit to cucumber.

Chicharron: Pork rind cracklings.

Compadrazgo (compadre, comadre): Fictitious kinship, refers to a way of formalizing a close relation of mutual help, reciprocity and confidence.

Communeros: Members of a community, who hold comunal land. Legally recognized comunal lands, the tierra comunal, belong to particular communities and are distributed according to tradition.

Consejo de vigilancia: Oversight committee.

Controlador de campo: Field inspector.

Criollo: Landrace.

Curandero: Healer.

Ejido: Refers to a land tenure scheme, which was established after the revolution. Ejido land is officially owned by the state, which confers usufruct rights to land reform recipients. The *ejido* also refers to the community of ejidatarios, and as such entails a form of social organization.

Elote: Corn-on-the-cob.

Folidol: Folidol is a methyl-parathion product, classified by the WHO as being "extremely hazardous to human health" The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2004 http://www.inchem.org/documents/pds/pdsother/class.pdf.

Gente de confianza: 'people who can be trusted'.

Gorgojo: Weevil *(Sitophilus zeamais),* an insect which can cause serious harvest losses, especially during post-harvest storage.

Guacamote: Cassava.

Guaraches: Typical leather sandals.

Guelaguetza: Also known as *go'ozona* or *guetza;* refers to ancient institution of mutual aid among the Zapotecs.

Guioxito: Zapotec word for 'little' or 'small'.

Guzano de maguey: Maguey vorm (*Hipopta Agavis*).

Higuerilla: Castor bean (*Ricinus Communis*). In Santa Ana Zegache, where firewood is scarce, this is the principal use of higuerilla. The seeds can be sold for processing. However, shelling and cleaning the seed is cumbersome and the price that is fetched in the end is relatively low.

Maguey: Agave (*Agave americana L.*), used for the production of mezcal.

Maíz: Maize (*Zea mays* L.).

Maquiladora, maquila: Factory or assembly plant.

Mayordomìa: Socio-religious institution responsible, among others, for organising the patron saint fiestas.

Mezcal: Agave liquor, similar to tequila. However, contrary to Tequila, which is based primarily on a particular kind of agave (agave azul) mezcal can be made from several kinds of agave including wild agaves. Similarly, whereas the processing of tequila is industrial, mezcal production is artisanal.

Milpa: Maize field, often intercropped with beans and/or squash or other crops.

Nixtamal: Maize is boiled with lime, rinsed and strained. A essential step in the process of making tortillas. The nixtamal is then ground and kneaded into a dough before the tortillas are shaped and baked.

Orejera: An activity which has the double purpose of weeding and piling soil up around the plants to diminish the risk of lodging.

Palomilla: Grain moth (*Sitotroga cerealella*) can cause serious damage to the maize harvest, both in the field and in storage.

Petate: Woven mat of palm leaves.

Phostoxin*:* Insecticide based on aluminum phosphide. Its common form is as solid tablets, which, once unwrapped, react with the natural air humidity creating a toxic gas.

Pila: Large stone or cement sink or basin.

Pinto: Multi-coloured, used about the types of maize that have kernels of mixed colours.

Pizcador: Large basket. Traditionally used for harvesting maize (pizcar = to harvest). It is carried on the back and as one moves forward, maize ears are torn off the stalks and thrown over the shoulder into the basket.

Rebozo: A long, rectangular shawl.

Saca: Huge baskets made of several mats woven from palm leaves.

Sombrero: Hat, cowboy-hat.

Tambo: A barrel or other large barrel-like container .

Tapa-pie: Refers to a planting method. The person planting follows the furrow. Every two steps (or more depending on the crop and the preference of the farmer) 2-4 seeds are dropped. With a scraping movement by the foot the seeds are covered with soil and subsequently stamped lightly with both feet. Two more steps, seeds dropped etc.

Tele-secundaria: Secondary school program by television.

Tempranero: 'Early', when used about crops the expression refers to a short growing cycle.

Tequio: A form of comunal work provided as a service to the community.

Tlayuda: Large tortillas from the Central Valleys.

Tostada: Tlayudas that are baked until crisp .

Troje: Granary.

Zócalo: Village or town square.

Appendices

Appendix 1: Chronology of fieldwork activities

	Year and quarter of activity											
	2001				2002				2003			
Activity	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Review of previous studies	x	x										
Initial qualitative survey	x	x										
Community characterizations			x	x	x							
Focus Groups			x	x								
Tracer-study					x	x	x					
Revision of seed acquisition data							x					
Analysis of formal maize sector							x					
In-depth ethnographic case-studies								x	x	x	x	
Transaction cost study												x

Appendix 2: The functions and responsibilities of the members of the municipal council

Presidente municipal: According to the Municipal Law of the State of Oaxaca the president is responsible for overseeing the correct administration of public funds according to the municipal budget and the corresponding laws. He/she is furthermore responsible for any agreements, contracts or other arrangements for carrying out administrative issues and public, municipal services. The president is furthermore responsible for negotiations with different governmental entities for the benefit of the community, as well as of informing, at regular intervals, the relevant entities regarding the use of funds. As municipal president he/she has the deciding vote in decisions where there are equal votes for and against a particular issue[56].

Sindico Municipal: The sindico municipal is in charge of legal issues and defending the interests of the municipality, as well as of overseeing issues related to public funds. He/she assists the ministry of justice and within the community it is his/her role to oversee the maintenance of law and order. In case of charges the sindico has the power to arrests and/or fine implicated parties.

Alcalde: The alcalde is responsible for the solution of conflicts regarding private property. In the case of conflict between neighbors the alcalde has the authority to define the boundaries of the properties in question. In several respects the role of the alcalde is that of a justice of the peace in the community.

Councilors for:

Education: responsible for all issues related to education, coordinates the school committees for different activities, represents the municipality in school meetings and has the power to negotiate on behalf of the municipality vis-à-vis the state institute for public education in Oaxaca (IEEPO). Finally the *regidor de educación* oversees the teachers working in the community.

Hacienda: responsible for the collection of drinking water fees and the maintenance of the water services in the community. In addition the *regidor de hacienda* administrates collection procedures and is the authority in charge of collecting taxes from a number of businesses, especially in relation to the fiestas in the community.

Public works: responsible for the coordination and overseeing of public works, such as the construction or maintenance of diverse types of infrastructure. Where the municipality has machinery, utensils and so forth, the *regidor de obras* is in charge of their maintenance and use.

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[56] Pedro Omar Ruiz, Municipal President, Huitzo, Personal communication, 2001.

Police: responsible for community security and coordinates local patrols and night watches, as well as security in connection to fiestas and other events. In case of arrests the *regidor de policía* informs the *síndico* for further action.

Health: responsible for public health and sanitation, and oversees the management of the local public health clinics in coordination with doctors and nurses.

Appendix 3: The roles of the representatives of agrarian authorities in San Pablo Huitzo

Presidente of the Comite de Bienes Comunales: leads the executive entity of the organization of comuneros and is the community authority with respect to agrarian issues and conflicts. The president has the authority to grant usufruct rights to a particular piece of comunal land to members of the community, or, with the approval of the general assembly, to members of neighboring communities.

Treasurer: attends to requests to use comunal resources, such as firewood, sand, gravel and so forth, and collects any fees in this regard. He/she manages the budget of the Comite, including any expenses and incomes generated by a arrangements or activities carried out by any of the members of the commission.

Secretary: is in charge of preparing any documents needed by the representation, and takes minutes of meetings and general assembly events.

The rangers: 18 community members from the 1st and 2nd sections form the group of rangers, whose role it is to control the use of natural resources authorised by the Comite de Bienes Comunales. They report any violation to the representante. In addition they also play the role of forest fire-fighters.

Commision de siembra: This group consists only of people from the 3rd section. Their responsibilities are the same as the rangers', but applied to the areas of comunal lands corresponding to the 3rd section.

Appendix 4a: Case study households in the municipality of Santa Ana Zegache

	Econ. level	House Hold size	Years of formal education.	Kinds of maize grown.	Land	Animals (sh = shareholding)	First language	Remittances	Off-farm income generating activities
Pablo H. and Emilia	+++	7	Pablo H.: 3 Emilia: 0	Black, white (2)	Aprox. 8.25 ha privately owned by Pablo and his family.	1 horse, pigs, a pair of oxen, chickens.	Zapoteco	No	No
Elías and Juana	+	2	Elías: 0 Juana: 0	White (1)	Besides working a piece of common land they work as sharecroppers on other plots. Elías and Juana do not own land of their own.	1 pig, chickens.	Zapoteco	No	Both work as a day laborer on other peoples land.
Catarina	+++	4	Catarina: 6	White, black and yellow (3)	Private, aprox. 2.25 ha.	1 pair of oxen (sh), 1 sow with piglets, 5 goats, 3 sheep, 11 chicken, 5 turkeys.	Spanish	Yes. Husband and two unmarried sons in US	No
Teodoro and Liliana	++	2	Teodoro: 0 Liliana: 0	White, yellow (2)	Private. 7 plots of land, in total approximately 5 ha.	1 donkey, 1 pig, 3 goats, 2 turkeys, 5 chickens.	Zapoteco	From one son in the US. Two other sons in Queretaro, Mexico.	No
Miriam	+	1	Miriam: 0	Black, white (2)	Miriam Works 0.25 ha of common land. She does not own any land of her own.	2 sheep, 3 chickens, 1 piglet (sh), 3 chickens(sh)	Zapoteco	No	Makes and sells tortillas, works as a day laborer on other peoples farms.
Lorenzo and Frida	++	4	Lorenzo: 0 Frida: 0	Black, white (2)	In 2003 Lorenzo worked approximately 5 ha. Of these, 1 ha is owned by him, 1 ha is owned by his son who is in the US, 1 ha is pawned to Lorenzo and 2 ha belongs to another person, but are sharecropped by Lorenzo.	3 oxen, 1 horse, 1 donkey, 11 turkeys, 10 chickens.	Zapoteco	Yes, from an unmarried son in US.	Sharecropping
Rosa and Jose	+	2	Rosa: 0 Jose: 0	White, yellow (2)	Approx. 4 ha privately owned. Jose and Rosa now only works a minority of this. The rest is rented out.	3 horses, chickens	Zapoteco	No	Makes and sells tortillas

	Econ. level	**House Hold size**	**Years of formal education.**	**Kinds of maize grown.**	**Land**	**Animals** (sh = shareholding)	**First language**	**Remittances**	**Off-farm income generating activities**
Irma and Jesus	+++	8	Jesus: 4 Irma: 6	White, black and yellow (3)	Approx. 4 ha privately owned. Of these, 2 belong to Jesus and Irma, 1 to their son Jesus and 1 to another son, Alejandro, who is in the US.	1 horse, 1 cow with a calf, 3 goats, a pair of bullocks, and chickens.	Spanish, although Jesus's first language is Zapoteco	Occasionally from a daugther and a son in the US	Masonry. Jesus is a mason, a skill he acquired as a construction worker in the US for several years.
Eduardo and Josefina	++	4	Josefina: 4 Eduardo: 6	White, black (2)	Approximately 3.5 ha of which 0.75 ha is private and owned by them.	1 calf, 2 pigs, 1 donkey, 6 sheep, 1 goat, 5 chickens.	Zapoteco	No	Musician

Appendix 4b: Case study households in the municipality of San Pablo Huitzo

	Econ. level	House Hold size	Years of formal education.	Kinds of maize grown.	Land	Animals (sh = shareholding)	First language	Remittances	Off-farm income generating activities
Lucio	+++	5	Lucio: first degree in agronomy.	VC 152 and another white landrace (2)	Together with his brother and his parents, Lucio works a total of 5 ha, of which 3 are private and 2 are rented.	12 dairy cows (sh), 3 young bulls, 2 calves, aprox. 50 goats and sheep, 4 pigs.	Spanish	No	Produces and sells bread. Rents tractoring service.
Francisco and Liliana	+	6	Francisco: 2 Liliana: 1	White, yellow and black (3)	Comunal land. Do not own any land of their own.	7 heads of cattle, 6 goats, chickens.	Mixteco	No	No
Ana María and Rodolfo	++	10	Ana María: 2 Rodolfo: 0	White (1)	Together with his sons and his brother Rodolfo work approximately 11 ha of comunal land. The majority of this has been assigned to them by the community authorities, the rest they have seized. They do not own any private land.	18 heads of cattle, 110 goats, 2 pigs, chickens and fighting cockerels.	Spanish	No	Doña Ana María makes and sells tortillas.
Eucario	+	2	Eucario: 0	White, yellow (2)	Eucario Works 2-3 ha. A part of this is comunal land which was assigned to him by the community authorities, the rest is rented to Eucario on very favorite terms by a woman, for whose parents Eucario worked as a sharecropper for many years.	Pair of oxen, 1 donkey, 6 chickens.	Spanish	No	Plows with oxen for other people
Jorge	++	6	Jorge: 9	H-311 acriollado, white, black (3)	Between Jorge, his brother and two sisters they have approximately 8 ha divided into 7 plots of land. 2 of the 7 plots are private, another 4 are comunal land and the last one, which make up almost 4 ha, is private land pawned to Jorge. Of the 7 plots 5 have some form of irrigation.	3 sheep, 18 goats, 1 cow with calf, rabbits.	Spanish	No	No
Camilo and Gregoria	+++	11	Camilo: 1 Gregoria: 9	White, black and yellow (3)	In the valley Camilo owns 1.25 ha. The household members which include a grown-up son and his family, furthermore work aprox. 10 ha. of comunal land in the hills above the community.	Aprox. 200 goats, 1 cow with calf, 1 horse, chickens.	Spanish	Yes, from an unmarried son in US.	Ocasionally works as a mason

	Econ. level	House Hold size	Years of formal education.	Kinds of maize grown.	Land	Animals (sh = shareholding)	First language	Remittances	Off-farm income generating activities
Bernardo and Irma	++	7	Bernardo: 6 Irma: 3	White (1)	Together with one of his sons Bernardo works aprox. 5 ha. All of it is private land, but part of it is owned by some of Bernardo's siblings.	1 horse, 1 pair of oxen. Chickens.	Spanish	Two sons in US, but we do not know whether they send remittances.	Buys and sells cattle for meat.
Ildefonso and daugthers Fiona and Socorro	++	4	Ildefonso: 3	H 311 acriollado, white (2)	Ildefonso owns 0.5 ha. of irrigated land. Besides that, they work approximately 3 ha of comunal land.	4 young bulls, 4 dairy cows, 5 donkeys, 8 sheep, 50 chickens and turkeys.	Spanish	No	Receives a small pay as responsible for distribution of irrigation water.
Pablo L. and Susana	++	4	Pablo L.: 6	White, yellow and sometimes a hybrid maize (3)	Pablo works 3 ha. Of comunal land in the hills above the community. Furthermore he works sharecropped or pawned land in the valley. In 2003 he worked aprox. 6 ha in total. They do not own private land of their own.	1 pair of oxen, 1 donkey, 6 sheep, chickens.	Spanish	No	No

Samenvatting

Zaad is een fundamentele input voor landbouw. Zaad is niet alleen de basis voor de productie van het merendeel van de gewassen in de wereld, zaad bepaalt ook de bovengrens van de opbrengst en daarmee de uiteindelijke productiviteit van de andere inputs. De zekerstelling van de toegang tot het juiste zaad van goede kwaliteit is daarom essentieel voor boeren en van groot belang voor de maatschappij in verband met het verwerven van voedselzekerheid. Zaad is ook een hoofdbron van germoplasma en een sleutelelement in het management en conservering van de genetische bronnen van gewassen. Toegang tot een brede genetische diversiteit stelt boeren en plantenveredelaars in staat gewassen aan te passen aan heterogene en veranderende omgevingen, en variëteiten te ontwikkelen met grote vermogens tot aanpassing aan biotische en a-biotische belastingen en menselijke voorkeuren. Vandaar dat conservering van de genetische bronnen cruciaal is voor het aangaan van toekomstige uitdagingen op het gebied van gewasonderzoek en -verbetering, gericht op vergroting van het aanbod van voedsel. Dit onderzoek presenteert een gedetailleerde analyse van de wijzen waarop lokale boeren met het zaad van maïs omgaan. Met het perspectief van boeren op kleinschalige maïslandbouw als vertrekpunt, beoogt deze studie bij te dragen tot het vergroten van het inzicht in de werking van lokale gebruiken van boeren op het gebied van het zaad van maïs, en relevante input te geven voor het debat over genetische bronnen van gewassen en over de toegang van kleine boeren tot zaad met interessante en wenselijke karakteristieken. Tegelijkertijd draagt het onderzoek ook bij aan de discussies over de relevantie van de sociale wetenschappen research en ontwikkeling voor landbouw. Vier hoofdvragen worden onderzocht:

De werkwijze van boeren met het zaad van maïs als een vorm van lokale kennis;
De rol van collectieve actie in relatie tot de conservering van genetische diversiteit van maïs en de lokale voorziening van zaad;
De sociale organisatie van de voorziening van het zaad van maïs; en
De transactiekosten van het verkrijgen van zaad zoals waargenomen door boeren.

Het onderzoek werd uitgevoerd onder kleine maïsboeren in de Central Valleys van Oaxaca in Zuid-Mexico. Zes gemeenschappen werden onderzocht, drie diepgaand. De gebruikte methodes waren onder andere diepgaande semi-gestructureerde interviews met sleutelinformanten, focusgroep discussies, case studies, en een "volg" studie van de uitwisseling van het zaad van maïs tussen verschillende boeren.

Het onderzoek werd gefinancierd door de CGIAR's (Consultative Group for

International Agricultural Research) Systemwide Initiative for Collective Action and Property Rigths, CAPRI, met additionele fondsen van de regeringen van Denemarken en Frankrijk, en de Voedsel en Landbouw Organisatie van de Verenigde Naties, FAO. Het onderzoek werd uitgevoerd bij International Centre for Maize and Wheat Improvement, CIMMYT, en bouwt voort op vooraf gaand onderzoek door CIMMYT, en het Mexican Research Institute for Forestry and Agriculture, INIFAP.

Het gebruik van eigen zaad

In de bestudeerde gemeenschappen werden ongeveer 90% van alle partijen van maïszaad door de boeren verkregen uit hun vorige eigen oogst, terwijl de rest bijna geheel kwam van andere boeren.

Volgens de informanten geeft het selecteren en bewaren van zaad een gevoel zekerheid en tevens een kans om geld te besparen. Eenmaal geselecteerd en veilig opgeborgen, is het zaad voor de zaaiing in het komende seizoen veilig gesteld. Bovendien is het zaad beschikbaar wanneer het nodig is, zodat er geen vertragingen in het zaaien optreden. Daarom kan het geld en de tijd worden bespaard, die anders besteed moet worden om zaad te verkrijgen vlak voor het moment van zaaien. Dan stijgen veelal de prijzen en worstelen veel huishoudens met het verkrijgen van de noodzakelijke middelen voor het prepareren van de grond en het zaaien.

Maïs is erg gevoelig voor agro-ecologische condities. De werkwijze van boeren voor het selecteren van zaad houdt hiermee, en met het vraagstuk van zekerstelling van zaad, rekening: de prestaties kennende van de planten waaruit het zaad afkomstig is, selecteren boeren het zaad van maïs op basis van een set van karakteristieken die zij als gunstig zien in termen van hun eigen behoeften. Door sociale, culturele en omgevingscondities hoeft een variëteit geschikt voor een boer niet noodzakelijk geschikt te zijn voor een andere. Wat is dan een betere optie passend bij eigen behoeften en preferenties dan het gebruiken van het zaad dat men kent en heeft geselecteerd?

Het bewaren van zaad is ook deel van wat het lokale concept van een "goede boer" vormt, een notie waaraan zekere principes ten grondslag liggen voor wat wordt beschouwd als behoorlijk gedrag van een goede boer. Dit moet niet worden begrepen in een vaste of voorgeschreven betekenis, maar meer als een set van richtlijnen voor individuele interpretatie en modificering. Een aspect van een "goede boer" zijn, is goed zorgen voor zijn maïszaad. Aan de andere kant schijnt het af en toe acceptabel te zijn zaad van andere boeren te krijgen, bijvoorbeeld in een slecht jaar of voor het doen van experimenten.

Het ruilen van zaad

Het is moeilijk de frequentie van transacties met zaad vast te stellen. Boeren

leggen zulke transacties niet vast, en schattingen moeten steunen op het geheugen van geïnterviewden. Ondanks deze uitdaging is een schatting van de frequentie van uitwisselingstransacties van zaad tussen boeren berekend, gebaseerd op de data van de "volg" studie van de uitwisseling van zaad. Zaadtransacties per boer bleken relatief infrequent; zij kwamen gemiddeld eens per drie jaar voor. De hoeveelheid van boer tot boer uitgewisseld zaad is per transactie dikwijls erg klein, veelal minder dan 8 kg; volgens lokale standaarden voldoende voor het zaaien van ongeveer een halve hectare. Het aantal acquisities van kleine of zeer kleine hoeveelheden suggereert dat vele van deze acquisities experimenten beogen, of het aanvullen van de benodigde hoeveelheid zaad, bijvoorbeeld in geval van gedeeltelijk verlies van zaad.

De redenen van boeren voor het verwerven van zaad uit andere bronnen dan uit eigen oogst, worden besproken. De vier hoofdredenen voor acquisitie zijn: experimenteren, het starten van een boerenbedrijf, gebrek aan voldoende zaad voor het zaaien, en initiatief van andere boeren. Zoals boeren elders, zijn veel boeren in de Central Valleys nieuwsgierig en gretig om te leren en nieuwe opties te exploreren. Alhoewel zij zich er welbewust van zijn dat een variëteit van maïs die werkt voor anderen, niet hoeft te werken voor hen, onderkennen zij ook dat zaad van andere mensen voordelen of waardevolle eigenschappen kan brengen. Bovendien geloven veel boeren in het bestudeerde gebied dat "vreemd" zaad kan "wennen" aan de lokale condities. Deze elementen leiden tot vele gevallen, waarin boeren andere materialen die zij tegenkomen "uit proberen", ze combineren en zelfs kruisen met hun eigen materialen om te zien of "het werkt". In deze experimenten zijn gewoonlijk kleine hoeveelheden zaad of land betrokken, waardoor de risico's verbonden met experimenten worden geminimaliseerd.

De door de boeren opgegeven redenen voor het leveren van zaad aan andere boeren kunnen worden onderverdeeld in twee hoofdthema's: het helpen van de ontvanger en het verkrijgen van iets in ruil, zoals geld of zaad. Het wordt betoogd dat toegang tot zaad in het bestudeerde gebied conceptueel kan worden gezien als deel van een algemene sociale verantwoordelijkheid voor onderlinge ondersteuning. Ofschoon de meeste acquisities aankopen zijn, worden slechts weinig leveranciers van zaad uitsluitend gemotiveerd door het vooruitzicht geld te ontvangen. Dit suggereert dat het primaire motief voor de verdeling van zaad van boer tot boer zelden het genereren van winst is. In plaats daarvan geven de bevindingen aan dat in het bestudeerde gebied het helpen van anderen, zonder de eigen behoeften te kort te doen, een sterke culturele waarde is. Inderdaad verklaarden in de "volg" studie de meeste verstrekkers van zaad dat zij zaad distribueerden om de ontvanger te helpen. Dit past goed in de lokale noties van hoe een "goede boer" zich gedraagt, inclusief het idee dat men niet weigert een medeboer te helpen, die om zaad vraagt, als men voldoende heeft om te delen. Dit schijnt, ten slotte, een deel te zijn van het gezonde verstand van de wederkerigheid; zoals een van de

informanten aangaf: "Wat rond gaat, komt weerom". Aan de andere kant suggereren de frequentie van aankopen als transactietype en de bovengenoemde brede bereidheid zaad aan een koper te leveren, dat geldelijk gewin dikwijls een onderdeel kan zijn van het motief zaad te leveren.

Lokale kennis

Een analytisch perspectief op lokale kennisprocessen is relevant, wanneer men de dynamica van de door boeren gevolgde werkwijzen op het gebied van management en strategie van zaad probeert te begrijpen. Dit houdt elementen in die verband houden met de ambiguïteit van lokale concepten, terminologie met meerdere betekenissen, en de verschillen tussen presterende en verwoorde kennis.

De verscheidene en nogal vage lokale concepten van zaad en variëteit, en handelingen als mengen en aanvullen van zaad, illustreren de flexibiliteit en modificeerbaarheid van lokale concepten. Zij laten, in dit perspectief, ook zien dat concepten eerder "dynamische mentale representaties" zijn, dan definities of duidelijk uitgedrukte betekenissen.

De implicaties van de verschillen tussen verbale en presterende kennis worden besproken samen met de beperkingen die het gebruik van linguïstische modellen voor het onderzoeken van kennis met zich meebrengen. Het punt is de moeilijkheid van het vertalen tussen de twee, of liever, het transformeren van het een in het ander, en de simplificatie die plaatsvindt in dit proces. De verschillende factoren, bijvoorbeeld, die de keuzes van boeren voor een variëteit beïnvloeden, worden beschreven als een serie individuele, verwoorde criteria. Dit verschilt echter sterk van het het complexe proces waarin, met een oogopslag, de boer een bepaalde variëteit vergelijkt met zijn/haar eigen idee van een goede variëteit. In deze laatste is een hoeveelheid kennis begrepen over de boerderij, de markt, de leverancier van zaad, de preferenties ten aanzien van de huishouding, en zo voort. Met andere woorden, de poging tot verwoording van een complex, op presterende kennis gebaseerd, proces impliceert het opsplitsen in individuele elementen volgens een logica die zelden inherent is aan het originele proces .De wijzen van managen van zaad door boeren vormen een ander voorbeeld van ambigue categorieën en van de moeilijkheid van het uitdrukken van presterende kennis in een verbale vorm. Een soortgelijke opmerking kan worden gemaakt over het uitvoeren van experimenten door boeren. Dit kan worden gezien als verwerving van informatie uit de eerste hand gebaseerd op presterende kennis, veel meer dan op slechts verwoorde kennis.

Ambiguïteit en meerduidige terminologie, en ook de problemen in relatie tot verwoorde en presterende kennis tarten pogingen de wijzen waarop boeren met zaad omgaan te vangen en te beschrijven. Dit niet herkennen, kan leiden tot ernstige misinterpretaties en onvermogen de kennis en werkwijzen van

boeren te begrijpen. Echter, bewustzijn van de verschillen tussen lokale en wetenschappelijk kennis, met in begrip van de ambiguïteit van lokale concepten en de vraagstukken rondom presterende versus verwoorde kennis, bevordert wetenschappelijk onderzoek. Dit onderstreept dat lokale kennis de drijvende kracht is achter ontwikkelingsprocessen en benadrukt de uitdaging voor wetenschappelijk kennis het bereiken is van synergie hiermee.

De rol van collectieve actie in relatie tot de voorziening van zaad

Een deel van de analyse is gericht op het onderzoek van de rol van collectieve actie in relatie met de toegang voor boeren tot zaad van verschillende typen maïs. Dit is gebaseerd op de hypothese dat boeren sterke drijfveren hebben deel te nemen aan enige vorm van collectieve actie om de toegang te verzekeren tot meer verschillende soorten maïs dan een boer alleen kan aanhouden. Om deze hypothese te onderzoeken werd een set van premissen gedefinieerd, waaronder 1) de aanwezigheid van een groep(en) van boeren met het doel toegang tot zaad te vergemakkelijken; 2) de toepassing van een bepaalde set van regels of werkwijzen voor het gezamenlijke voorziening van genetische bronnen van gewas; en 3) de identificatie van voordelen ontleent aan "lidmaatschap" van enige vorm van collectieve actie. Echter, binnen deze drie parameters werd geen bewijs gevonden van collectieve actie voor de gezamenlijk voorziening in het zaad van maïs. Ten eerste verwacht men, indien zo'n groep zou bestaan, dat boeren de namen van andere leden van de groep konden noemen. Dit was niet het geval - in feite hadden boeren moeite zich te herinneren met wie zij zaadtransacties hadden gehad, en terwijl in het algemeen, boeren in de bestudeerde gemeenschappen betrokken waren in verschillende typen van sociale netwerken, bleek geen van deze specifiek gericht te zijn op de voorziening van zaad. Ten tweede zijn zaadtransacties bilateraal en vinden op verschillende wijzen plaats, zelfs onder soortgelijke omstandigheden. Geen bijzondere procedure of raamwerk voor zaadtransacties werd gevonden, wat men wel verwacht in het geval van collectieve actie. Zaadtransacties schijnen geen bijzondere positie in te nemen naast andere transacties van boeren, gunsten of onderlinge hulp, maar blijken van geval tot geval onderhandeld te worden in de bredere context van de sociale relatie tussen de betrokken partijen. Ten derde zijn, ondanks de verwachtingen die aan de hypothese ten grondslag liggen, geen duidelijke voordelen van collectieve actie voor voorziening van maïs gevonden. Het verlies van zaad bleek zo nu en dan voor te komen in plaats van constant of regelmatig terugkerend. Tegelijkertijd, daar boeren zaad uit de vorige oogst selecteren en bewaren, en in het algemeen meer op zij zetten dan zij verwachten nodig te hebben, blijkt de uitdaging van het verkrijgen van zaad bij het verlies daarvan, een minder groot probleem te zijn dan oorspronkelijk verwacht. In plaats van het investeren van tijd en inspanning in het

onderhouden van collectieve actie voor een specifiek probleem, dat alleen maar af en toe optreedt, pakken de boeren in het bestudeerde gebied problemen van tekort aan zaad of mogelijkheden voor het verwerven van nieuw, interessant zaad op opportunistische wijze aan. In dit opzicht blijkt de mobilisatie van sociale relaties een belangrijke rol te spelen in lokale transacties met zaad.

Transacties met zaad en sociale relaties

De eigenschappen en de prestaties van de plant die uit een bepaald zaad zal groeien, kan niet worden vastgesteld door alleen maar te kijken naar het zaad. Dit speelt een belangrijke rol bij transacties met zaad; boeren vertrouwen daarom vooral op de kwaliteit van de door de leverancier gegeven informatie. Uitdeze studie blijkt, dat boeren zaad van maïs verkrijgen van veel soorten zaadleveranciers (bijvoorbeeld familieleden, *comprades,* buren, vrienden, kennissen, vreemden en anderen). Verre weg de meeste zaadtransacties bleken plaats te vinden tussen mensen die elkaar reeds kenden en die vaak een gevoel van sociale verplichting ten opzichte van elkaar deelden. De aanwezigheid van sociale netwerken en vertrouwen beïnvloeden in hoge mate de stroom en kwaliteit van informatie en dragen daarmede bij aan het creëren van een veilige omgeving voor transacties met zaad. De sleutelrol dat vertrouwen speelt bij zaadtransacties door boeren, houdt verband met gebrek aan transparantie van zaad. Bovendien geven boeren de voorkeur aan leveranciers die gemakkelijk te benaderen zijn en waarvan wordt geloofd dat zij bereid zijn te voldoen aan het verzoek om zaad, ook als men niet kan betalen met geld, en daarom afhankelijk is van het onderhandelen over een ander type transactie. Ten slotte, de betrouwbaarheid van de afnemer van zaad is relevant voor de leverancier van zaad, bijvoorbeeld, met betrekking tot transacties met andere vormen van "betaling" dan met geld, en waar de de zaadleverancier de levering van de afgesproken tegenprestatie door de ontvanger van het zaad nodig heeft.

De transactiekosten voor de boer van het verwerven van zaad

Dit deel van de research is gericht op het onderkennen van de factoren die de kosten van zaadtransacties voor de boer beïnvloeden. Dit startte met de hypothese dat in het bestudeerde gebied acquisities van het zaad van maïs gepaard gaan met hoge transactiekosten voor individuele boeren. Dit bleek echter niet het geval te zijn. In feite kwam naar voren dat de transactiekosten van het verwerven van maïs voor boeren in de meeste gevallen laag tot verwaarloosbaar zijn. Dit hield duidelijk verband met het feit dat in het bestudeerde gebied de meeste transacties met maïszaad plaats vinden tussen mensen die elkaar kennen en vertrouwen of, ten minste, deel uitmaken van dezelfde gemeenschap. Dit zorgt voor een informatie rijke context, veelal

gebaseerd op vertrouwensrelaties. Onder deze omstandigheden worden de kosten van informatie en onderhandeling door boeren als minimaal beschreven. Aan de andere kant is in situaties waar boeren zaad verwerven van onbekende leveranciers van buiten de eigen gemeenschap, de context waarin de zaadtransactie plaatsvindt niet zo rijk aan informatie. Bovendien worden commerciële zaadleveranciers soms onbetrouwbaar geacht. Onder deze omstandigheden neigen de kosten van transacties voor het verkrijgen van maïszaad voor boeren toe te nemen.

Conclusies

Het kernprincipe van de lokale werkwijzen met zaad is in het studiegebied het vertrouwen van boeren op het selecteren en bewaren van zaad uit de vorige oogst. Boer-tot-boer zaaduitwisseling is een niet vaak voorkomende gebeurtenis, waarbij meestal relatief kleine hoeveelheden zaad betrokken zijn; toch is het voor boeren een essentieel element in de verwerving van zaad om lokaal zaadzekerheid veilig te stellen en de plaatselijk aanwezige genetische diversiteit van maïs te handhaven.

Ofschoon de boeren in de bestudeerde gemeenschappen wonen en boeren onder schijnbaar gelijke condities, kunnen voorkeuren, productiecondities en productiedoeleinden aanzienlijk variëren tussen de ene boerenhuishouding en de andere. In deze context voorziet de breed waargenomen praktijk van het selecteren en bewaren van zaad uit de vorige oogst in een poel van verschillende aan lokale omstandigheden aangepaste variëteiten van maïs. Bovendien is op enig moment het aantal boeren dat zaad nodig heeft, of verzoekt om het zaad van anderen, beperkt. Dit maakt het voor deze boeren eenvoudiger iemand te vinden die het zaad kan leveren dat zij nodig hebben, tegen relatief lage kosten en risico's. Sociale relaties en vertrouwen spelen sleutelrollen in dit opzicht.

De wijzen van opereren met maïszaad door kleine boeren in de Central Valleys van Oaxaca zijn complex en dynamisch en omspannen zowel aspecten van conservering als van innovatie. Lokale concepten met betrekking tot de praktijk van maïs en zaad van maïs zijn dikwijls flexibel en veranderbaar en experimenten op kleine schaal in de zoektocht naar kennis en praktische oplossingen is een integraal onderdeel van het boerenbedrijf.

In hun huidige vorm zorgen de lokale wijzen van opereren met maïszaad voor een relatief veilige voorziening van een reeks voor boeren waardevolle variëteiten, die goed sporen met de plaatselijke consumptie- en productiedoelen, en die kunnen floreren onder de lokale agro-economische condities. Tegelijkertijd, in combinatie met de af en toe plaatsvindende introductie van nieuw genetisch materiaal van maïs van andere boeren of van elders, blijkt de reproductie en de selectie van zaad van gewenste variëteiten op de boerderij een relatief efficiënte basis te verschaffen voor de handhaving

van de lokale genetische diversiteit van maïs. Alhoewel in het studiegebied geen imminente bedreiging werd onderkend, wordt de belangrijke rol van geneflow in het bewaren van de levensvatbaarheid van boerenvariëteiten in het bestudeerde gebied onderstreept. Echter, de boerensystemen in dit gebied worden gekarakteriseerd door lage productiviteit en een lage productie van maïs per oppervlakte. Het gebruik van verbeterd zaad kan een optie zijn voor de verhoging van de productiviteit van maïs. Mogelijk helpt het boeren voldoende maïs op minder grond te produceren, waardoor land vrij komt voor andere, meer inkomen generende toepassingen, of voor verhoogde maïsproductie. In de paar gevallen waar in de onderzochte gemeenschappen verbeterde variëteiten zijn toegepast, is dit voornamelijk voor productie van "elote" (maïskolven als snack) en diervoeder , niet voor de productie van graan voor consumptieve doeleinden. Dit wijst erop dat de in het bestudeerde gebied aanwezige verbeterde variëteiten in de ogen van de lokale bevolking inferieure consumptieve eigenschappen hebben.

Curriculum Vitae

Lone Bech Badstue was born in Denmark in 1968. Following undergraduate studies at the University of Copenhagen, she lived and worked in Costa Rica and Nicaragua from 1993 to 1998, and in August 2000 she obtained the Masters degree in social anthropology from the University of Copenhagen. Her MA dissertation focused on the elopement of young girls and the negotiation of gender, and was based on long-term fieldwork among settlers in the agricultural frontier of South-Eastern Nicaragua.

In October 2000 Badstue joined the Social Sciences Group at the International Maize and Wheat Improvement Center as an Associate Scientist. At CIMMYT she was part of a multidisciplinary team studying the influence of local institutions and informal social networks on local maize seed flows and farmers' access to varietal diversity. The objective of this research was twofold: 1) to determine how these factors relate to the evolution and conservation of important maize genetic diversity; and 2) to achieve a better understanding of the dynamics underlying farmers' seed supply strategies and the role of traditional maize production in a context of social change. The outputs of the mentioned research has been published in a series of publications and also forms the basis for Lone Bech Badstue's PhD in rural development sociology under the supervision of Professor Norman Long, University of Wageningen.

Badstue's principal research interests include: Actor-oriented and interface analysis in particular in relation to development, knowledge processes; agriculture and natural resource management; and gender.

Her publications include:

Badstue, L.B., Bellon, M. R., Berthaud, J., Ramírez, A., Flores, D., Juárez, X. (Forthcoming). The dynamics of farmers' maize seed supply practices in the Central Valleys of Oaxaca, Mexico. *Journal of World Development*.

Badstue, L. B., M. R. Bellon, J. Berthaud, X. Juárez, I. Manuel Rosas, A. M. Solano and A. Ramírez (2006). Examining the Role of Collective Action in an Informal Seed System: A Case Study from the Central Valleys of Oaxaca, Mexico. *Journal of Human Ecology*, **34** (2): 249-273.

Badstue, L. B., M. R. Bellon, J. Berthaud, A. Ramirez, D. Flores, X. Juarez and Fabiola Ramirez (2005) *Collective Action for the Conservation of On-Farm Genetic Diversity in a Centre of Crop Diversity: An Assessment of the Role of Traditional Farmer's Networks*. CAPRI Working Paper #38. Washington: International Food Policy Research Institute (IFPRI). Available at: http://www.capri.cgiar.org/pdf/capriwp38.pdf.

Badstue, Lone B. (2004) *Identifying the Factors that Influence Small-scale Farmers' Transaction Costs in Relation to Seed Acquisition. An Ethnographic case study of maize growing smallholders in the Central Valleys of Oaxaca, Mexico.* ESA Working Paper No. 04-16. Food and Agriculture Organization of the United Nations, FAO. Available at: http://www.fao.org/es/esa.

Badstue, L. B.; Bellon, M.R.; Juárez, X.; Rosas, I. M.; Solano, A. M. (2003) *Social Relations and Seed Transactions Among Small-Scale Maize Farmers: A Case Study from the Central Valleys of Oaxaca, Mexico.* Economics Working Paper 02-02. Mexico City: International Maize and Wheat Improvement Centre (CIMMYT).

Badstue, L. B. (2000) *Pigerov. Forhandlingen af køn i et nicaraguansk nybygger-samfund.* Specialeafhandling. Specialerække nr. 161, Institute of Anthropology, University of Copenhagen.

Badstue, L. B.; A. Nygren; C. Tomé Valiente (1998) *Los Campesinos de Río San Juan.* Managua, Editora de Arte, S.A.