

11 Cultural Repertoires and Socio-Technological Regimes: Maize in Luoland

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This chapter explores the relationship between culture, markets, technology and agriculture. It will demonstrate the interfaces between the cultural repertoires of local people and the scientific repertoires of research institutions. In this chapter we seek to explain how local culture 'reads' local as well as scientific knowledge and new technologies (in this case the hybrid maize varieties and accompanying packages). We also explain how local culture forms part of a 'defence line' against the practices that are introduced and favoured by scientific knowledge. One major task is to explain why new maize varieties such as hybrids are no longer widely grown. Culture and kinship in particular shape agriculture to a large extent, and offer next to institutional issues of development, a contribution to such an explanation.

Empirically, the first part of the chapter explores the socio-technical networks through which maize spread in West Kenya, Luoland, and the Siaya region in particular. Maize is the most important cereal crop in East Africa, but is not an indigenous crop. When maize appeared in the Luo landscape at the end of the 19th century, it quickly became incorporated in people's lives. The normal cropping practices (e.g. sorghum, millet) were extended to maize and the seeds became family seeds (*koth dala*). A wide variety of this local maize is has been grown since its initial spread and is still planted today. When 'modern' maize varieties were introduced, through a variety of other socio-technical networks, rural people responded quickly and adopted the new varieties, albeit in a redesigned way.. Twenty or more years later, however, modern or hybrid maize varieties are hardly grown any longer, although 'local' varieties of maize remain widely grown. This chapter will explain why this has happened.

The second part analyses the different socio-technical regimes of maize that have emerged over time, e.g. the mass selection and breeding practices of local varieties of farmers themselves, and the 'modern' and hybrid maize breeding and selection programmes of the Kenyan Government and other organisations. Farmers prefer the local maize, the varieties that they grow and select themselves through mass selection. Scholars and plant breeders label these local varieties as landraces

(Louwaars and Marrewijk 1997:128). They are not registered nor formally marketed and exist only to the extent that they are used in farmers' fields. The seeds are maintained and developed through yearly mass-selection from the previous year's harvest and the local maize is distinctively different from the modern and hybrid varieties that are generated through maize breeding programmes.

The last part narrates what happens when 'modern' maize varieties encounter the breeding and cultivation practices of local people. Through analysis of contemporary patterns of maize production, we hope to answer the critical questions of whether, or not, these two technological regimes interact, and what specific forms this interaction takes in practice. The empirical material for this chapter is based on 3 years of fieldwork in the villages of Nyamninia, Muhanda and Muhoho, situated in the Siaya region of Luoland. The analysis draws on existing ethnographic literature and local people's accounts. Particular emphasis is given to the role that certain elements of the complex system of kinship relations among the Luo of West Kenya play in mediating choices and practices. This also serves to elucidate the complex set of social relations by which the Luo engage in production, distribution and consumption of resources and material goods. Kinship, or more precisely in this case study, the organising principle of seniority, is intrinsically embedded in Luo cultural repertoires. Practices like 'first sowing' (*golo kodhi*) and 'first harvesting' (*dwoko cham*) are based on seniority and, even today, remain important elements that shape agriculture, despite commoditisation, labour migration and the increasing influence of churches.

The elements of the cultural repertoire of the Luo that we analyse here can be understood as a configuration that works in the daily practice of farming, as it does not upset the social fabric of rural life in Luoland. This despite these cultural notions not being universally shared by the Luo. Analytically, we perceive the Luo cultural repertoire as part of a specific socio-technological regime of mass selection and breeding consists of a, more or less coherent, set of rules and conventions that are embedded in local knowledge repertoires, and in a variety of agricultural practices, institutions and networks that include various actors. The hybrid maize-breeding regime must be conceptualised in a similar way (see Moors *et al.* this book). Thus our analysis positions culture as part of a complex set of social relations of production that shape agricultural practices (Hebinck and van der Ploeg 1997).

Culture is often presented as a domain that stifles the optimisation of production, a view that one encounters in the field as well as in the policymaking domains in the so-called Third World. The crucial point we advance in this chapter is that the predominant socio-technical regime of hybrid maize packages misunderstands (or misreads) and therefore bypasses these culturally embedded notions about agriculture and 'how

to farm'. In the end, it is the people that create room for manoeuvre for themselves by maintaining and reproducing a particular cultural repertoire, despite it being sometimes contested and questioned. More interestingly, however, are the ways in which repertoires of local knowledge also question and contest scientific bodies of knowledge. Local people immediately counter claims made by experts (e.g. maize breeders) by referring to their own agricultural practices, such as mass selection. The debate on productivity and selection procedures clearly illustrates this. The processes of creating room for manoeuvre are based on distancing of actor projects rather than on interlocking with the predominant socio-technical regime that is organised by the state and market.

Socio-technical networks and the proliferation of maize in Luoland

The Luo originally planted sorghum and millet grains, but these have been gradually and largely replaced by maize as the major crop grown. Luo agriculture saw major transformations over the years and gradually moved from shifting cultivation to fallow based agriculture and later to a stage of permanent cultivation. During later periods (roughly since the 1940s) agriculture was transformed through the processes of commercialisation and intensification. More recently (from the 1970s onwards) agricultural can be characterised as being in decline, and subsistence production and localised trade predominate. The pursuit of off-farm income opportunities and careers outside agriculture have led to labour migration, which has been accompanied by population growth, a reduction in field sizes and a decline in soil fertility.

For the Luo people the ecology of northern Siaya presented new possibilities compared with the dryer areas from where they migrated. The heavier rainfall during the short rains made possible the gradual development of a second agricultural season from September to November. During the 1890s, in fact, the people of Nyamninia, Muhanda and Muhoho were still experimenting with different crops during the short rains and usually planted sesame, vegetables, or pulses. Later, with the incorporation of new varieties of rapidly maturing maize as a staple food, short rain cultivation became a fully-fledged part of the agricultural cycle.

Although maize was grown in small quantities well before the beginning of the 20th century it only came into prominence with the distribution of improved varieties of white maize during World War I (Heyer 1975:146). By 1930, maize was already well established in Nyanza province. Maize was popular because of its higher yielding potential, compared to indigenous cereals, in areas with satisfactory rainfall and free draining soil. It is seldom seriously damaged by pests or diseases in the field and is virtually untouched by birds, which can cause a complete crop loss in

some of indigenous cereals. Land preparation, weed control and harvesting all required little labour (when done manually) compared with some of the indigenous cereals, and threshing or winnowing and bird scaring is not required. Some people mention that maize is more palatable as an additional advantage, but this appears to be a recent and local adaptation of taste.

Networks

During our fieldwork we tried to trace the origin of the existing local varieties of maize in Siaya. This was done through consulting literature and through ethnographic interviewing of old, knowledgeable people who could still remember the introduction of the different maize varieties to the area and who themselves were active participants in propagating them. These sources of information confirm that maize came through different networks. These are treated and understood here as distinct socio-technical networks, each playing a role in bringing in different maize varieties in the Luolandscape. The networks thus connect Luoland with different sources of genetic material originating in different geographical areas. A second element that differentiates these networks is that different kinds of actors are involved, such as traders, migrants, returning soldiers from the First World War, settlers, plant breeders, and so on. Each had a distinct capacity and role to play in both the way that maize spread and the way that it became transformed. It is also useful here to distinguish between the voluntary and so-called informal trade networks from the formally organised networks based on breeding and selection programmes organised by state institutions in the country or outside Kenya, notably the United States and South Africa. The so-called informal networks involve the spread of land races, or what in this chapter we call local maize varieties. The formal networks on the other hand brought 'modern' varieties that were selected from exogenous germplasm and bred for its higher yielding capacity or better suitability for some of Kenya's ecological conditions. The analysis of these socio-technical networks will show that some of these networks overlap, coincide or amalgamate. Many of the maize varieties that came to Luoland through mechanisms other than intentional breeding programmes (e.g. through famine and relief programmes or labour migration) are connected to maize breeding and selection programmes in the United States of America, South Africa, and later, Kenya itself.

The roots of maize in Luoland can be traced back to the late 19th century. It was introduced and spread through four different networks (see Table 1). Trade networks were the first of these. Portuguese traders were the first to bring maize to East Africa in the 16th and 17th centuries (Acland 1971:124). Initially (up to the end of the nineteenth century) maize growing was limited to the coastal areas but later spread inland.¹ The Caribbean flint

types imported by the Portuguese are still found in the coastal regions of East Africa and, to a varying extent, among local varieties inland. Their spread accelerated with the opening of the interior to external contact in the latter part of the 19th century. Captain Grant found reported that Maize was '*very rare*' in 1863, but by 1897 H.H. Austin found the slopes of Mt. Elgon were '*thickly cultivated with bananas and Indian corn*'. In 1901 Sir Harry Johnston found '*Indian corn everywhere*'. (Landlands 1965:217). These latter references show that European settlers established lowland varieties of maize in the interior of Uganda and Western Kenya before the introduction of white maize after 1900. Thus neighbouring Uganda was a major source of maize varieties that found, and still do find, their way to Siaya through trade relationships.

A second network hinges around *food and famine relief programmes* organised by the colonial and post-colonial state. These led to mostly yellow maize being imported from the United States, to deal with acute food shortages. Some was reserved as seed for the next planting season. In fact both colonial records and oral history ascribe the gradual shift to maize from sorghum and millet to a series of famines that occurred in the late 19th and early 20th century. A third network is associated with *labour migration*. People returning from working in neighbouring Uganda or on the settler farms in the White Highlands, or soldiers returning from World War I often bought back new varieties of maize with them. Different migratory patterns brought different varieties of maize. A fourth network is linked to the various, but different, *maize research, selection and breeding programmes* of the Department of Agriculture of the colonial and post-colonial state, as well as with the white settlers who were looking for new varieties that were better suited to the inland climate, which they invariably found in South Africa.² The yellow maize varieties imported from the United States as part of famine relief programmes also derive from breeding programmes. Recently, some NGO-like institutions such as CARE-Kenya and Lagrotech started breeding programmes that have a quite different emphasis to those linked to formal research and breeding networks. Thus the socio-technical network based on research and breeding programmes is not entirely homogenous. Maize breeding has evolved over time and in different directions. What these networks share in common is that they invariably brought yellow and white varieties of maize, rather than the multi-coloured ones that spread through trade networks.

Together these networks brought a wide range of maize varieties (see Table 1), the cultivation of which spread rapidly among the African population, until it became the most important staple crop in Kenya (Gerhart 1975:1-3).

The proliferation of maize in Luoland

It is not exactly known when maize was introduced into Siaya or which variety came first. When Lord Lugard visited Nyanza in 1890, he saw 'little or no maize' (Hay 1972:95). Travellers to neighbouring Uganda first noticed the existence of maize in central Buganda and Bunyoro by 1862 and in Acholi by 1880 (Grant 1965:216-219). Thus it is possible that maize travelled along the main trade routes from Buganda and Bunyoro to Mumias (North Nyanza) and spread from there into central Nyanza during the 1870s or 1880s (Wright 1949:61-81). Through contacts with Waswahili (people from the coast) and Arab traders in the late 19th century, maize almost certainly found its way to Siaya. Through such trade routes, varieties like *radier* and *rachich* (the multicoloured varieties of maize) entered Luoland. At the turn of the century other varieties surfaced in the region. Ogwang Madara explains:

'I was born in 1914. I first saw my father in 1918, the year when *Ndege* (the aeroplane) passed by in our village. My father was just returning from the First World War. During this time people would run and hide in their houses when the aeroplane was passing high up in the sky. People thought that the sky was tearing apart. My grandfather was still alive then. He and another friend were working as porters for the first missionaries who came here. When they went with the missionaries to Baganda, they came back with these seeds. By then people were just trying them. He told me that this was before the railway line reached Kisumu in 1901. On their way to Uganda, he could also see fields of sorghum inter-cropped with maize.'

A white variety (*rachar*) was already being cultivated but was not widespread. Two other white varieties that were first to arrive and are still being planted today are the *oking* and *ababari*. These varieties are locally referred to as *mzungu* (white) maize since they were selected and bred by white people and first introduced by the Department of Agriculture of the colonial government. Both varieties came as part of famine relief programmes. *Oking* was introduced during the great famine of 1906-1907. *Ababari* and possibly other white varieties were introduced following the great famines of 1917-1919. Farmers still plant these two varieties of maize today and they identify them by their physical (phenotypic) characteristics. *Oking* means hard in *Dholuo* and has hard (dent) grains that cannot easily be attacked by weevils. *Ababari* was introduced into Siaya in 1917 by Mr. H.H. Holden a Luo-speaking West Indian, who was employed by the Department of Agriculture. *Jaduong* Odar Masa told us that Mr. Holden came to their farm when he was very young. He gave them seeds of maize, which they called *ababari* because it was larger than the seeds of *oking* and other earlier varieties of maize like *radier*. *Ababari*, according to Odar Masa, means a 'great thing'.

Table 1 Socio-technical networks of maize in Luoland

Networks	Key actors	Varieties	Colour	Year	Sources
Trade	Traders	Radier	Multi coloured	1890s	Coastal areas of East Africa via Uganda
		Rachich	"	"	"
		Rachar	White	"	"
		Rateng	Black	"	"
		Rapir	White with red stripes	"	"
		Uganda White	White	1982/84	Uganda
Food and Famine relief	Colonial and post-colonial state officers	Kawanda	White	"	Uganda
		Oking	White	1916	Unknown
		Ababari	White	1917	Unknown
		Nyamula	Yellow	1928/36/82	United States
		Hickory King	White	1950s	South Africa
Labour Migration	Migrants and former soldiers	Radier	Multi coloured	After World War II to 1970	Uganda
		Rachich	"	"	Uganda
		Rachar	White	"	White Highlands/ South Africa
		Kazigo	White	1922	"
Maize research and breeding programs	Research, extension and stockists	Kenya Flat White	White	1960	South Africa
		Kitale Synthetics	White	1961	Ki tale, Kenya
		Hybrid 511, 512,	White	1964	Embu, Kenya
		Hybrid, 614, 622, 625, 626	White	1970-90s	Kitale, Kenya
		PAN 5195	White	1990s	South Africa
		PH1	White	1990s	United States
		Maseno Double cobber	White	1996	Kisumu

Sources: Acland (1971) and farmer and traveler accounts

The spread of maize cultivation in northern Siaya took place earlier than in most parts of Luoland due to coercive intervention from Chief Odera Akango of Gem (in the North Eastern Siaya). According to *Jaduung* Ogwang Madara, Chief Odera Akango was an 'eye opener' to the people of Gem. He was a young chief who brought progress by force³. Everybody had to practice the farming methods of the white man. Although young,

he had a big home and a very large farm in Nyamninia village, where he even planted rice. He is remembered as a great chief.

'He was a ruthless leader, who was very strict with development activities. He observed seriously the date of planting. Once the elders had discussed the rain with the rainmaker, they were to plant immediately. Thereafter everybody had to plant. This was a must. Failure to do so you were caned. He hated lazy people and when he found them, he had them caned in public. He employed 30 askaris (soldiers) to look around for lazy people who did not cultivate their land and grew plenty of crops. These people were brought to his weekly barazas (meetings) and caned in public'.

Another informant, Jaduong Andrea Manyasi (who was born in 1912) echoed these sentiments of Ogwang Madara.

'Chief Odera Akango brought another white variety of maize when he came back from a visit to Uganda. This was somewhere in 1916. I was too young and I did not know much. My mother told me more about Odera Akango. Then soldiers who were returning from the First World War brought quite a number of maize varieties. In 1922 the Europeans brought another white maize variety, which they called kazigo. This variety cannot be traced now. When I was born, maize had already been introduced in Siaya. We used to grow radier and it used to do well. Wazungu (Europeans) brought yellow maize in 1928, at almost the same time they brought cassava'.

According to Andrea Manyasi, the first yellow maize came with cassava and sweet potatoes, which are drought tolerant crops. This yellow maize variety is still grown to date and is referred to as *nyamula*. Another local maize variety that is still grown in Siaya is *rateng* (black maize), which is common in the semi-arid areas. Its major advantage is its very short period of maturity (70 days). It can therefore potentially be planted later than other varieties. Its source is not known. Most farmers say that they just discovered it in their fields and continued propagating it. Other local multicoloured varieties are also grown in Siaya.

Manyasi recalls that the rain failed in 1936, resulting in a bad year and shortage of food in Siaya. Maize was imported from the United States of America and distributed to farmers as part of famine relief. Farmers tried to plant this yellow maize (*nyamula*) as well, but it differed from the first yellow maize that was brought by the Europeans and did not do very well.

At a later stage, the government introduced Hickory King maize and other varieties originating from South Africa to replace the yellow maize varieties. These responses to famine, (and the early activities exemplified by Mr. Holden) fit the general pattern of the colonial state being actively engaged in trying to introduce industrial crops (such as sesame and cotton in Nyanza) and improved varieties of food crops (see Kitching 1980).⁴ From the mid 1960s onwards various varieties of hybrid maize (such as H512, H511, H622 and H614) were introduced in Luoland and

the Siaya region. These, invariably white, varieties are the result of a fourth socio-technical network that is closely associated with planned state intervention and involves maize breeders and their breeding programmes in Kenya or elsewhere, as well as extension, credit, and marketing agencies. These maize breeding programmes will be discussed in the next section of this chapter. . These varieties are all bred by the Kenya Seed Company (KSC) in Kitale. At the time KSC held a monopoly position on the Kenyan seed market, but since market liberalisation in the early 1990's other seed companies are allowed to sell seeds to farmers. This resulted in more recent entries of hybrid varieties such as PAN5195 and PH1, which respectively are from maize seed companies in South Africa and the United States. These varieties (from Pannar and Pioneer) were issued to farmers in Siaya for almost free. Neither of these performed very well as our discussions with farmers confirmed, the seeds germinated poorly and fields where they had been planted had a desolate appearance. The spread of hybrid maize and the kind of varieties that were introduced will be discussed in detail later in this chapter. Hybrid maize is, however, not very popular in the Siaya region for reasons that we will discuss later. The most recent local maize variety, that is now widely grown in Siaya, can be traced back to 1982/83. It is called *nyauganda* (Uganda white) and found its way to Kenya through traders going to Uganda to purchase maize during the great famine of *Goro-goro*. It is quite popular in Siaya and widely cultivated. The *Goro-goro* famine, like earlier famines, triggered off state organised famine relief programmes. Again yellow maize from the United States was imported and the seed reserved for the next planting season. However, this variety (again) did not survive in the Siaya environment.

A very recently introduced white maize variety is the *Maseno Double Cobber* (MDC) developed by Lagrotech, a private seed company, and released in 1996. Although farmers were initially enthusiastic about MDC, it is no longer widely grown since farmers that have tried it have learned that yields decline when its seeds are used in the next planting season. Thus they continued to use more stable local varieties whose yields do not decline over time. (The difference between the breeding of the MDC and hybrids will be explained later on).

According to Cohen and Atieno Odhiambo (1989) the Luo generally responded in an ambiguous way to the introduction of white maize into the texture of Siaya life. In the twentieth century, the consumption of white maize meal in Siaya has been associated with 'Westernisation'. White maize first entered the local economy through the intervention of the colonial government, and the maize meal was first referred to as *Kuon Ongere*, the white man's *ugali* or white man's food. Those who went to school planted maize almost as if it were part of their curriculum. They valued maize and identified with the esteem accorded to it, and so maize

acquired another identity: as *kuon jonanga*, the *ugali* of the 'clothed' people. So, through a combination of pressure from colonial authorities and their agents in Siaya, and through appropriation of the special value to it by those coming to see themselves as new elite, maize gradually seeped into the diet and the production of the people. White maize was seen as a status symbol of local elites in Siaya (Cohen and Atieno Odhiambo 1989:64) and became associated with the adoption of new life styles, Westernisation and 'modernisation'. From this new elite the growing and consumption of maize gradually found its way into all segments of society (Van Kessel 1998:29). This perception was also extended to hybrid maize.

Technological regimes of maize: selection and breeding networks

Having described some of the phenomena concerning the proliferation of maize in Luoland and the Siaya region, we can now examine how to link the issues and social processes together. One way to do is to focus on the networks surrounding maize breeding and selection. Such processes are intimately linked with the way its cultivation spreads. For, it is through breeding and selection that maize is produced, multiplied, propagated and the planting material preserved.

We can distinguish here between *breeding and selection practices based on mass selection* and the *breeding of hybrids*. The maize from the mass selection and breeding network tends to float freely around the area and travels through trade relationships across the border with Uganda. This network seems to be locally specific and is organised around locally prevailing conditions such as taste preferences, cultural dimensions of farming, soil fertility and maturing characteristics. Such networks are socially and culturally regulated by the (changing) cultural repertoires of the Luo. The hybrid maize network on the other hand is based upon markets and specialised institutions in Kenya, and increasingly further afield, due to trade liberalisation and privatisation. Regulation in this network is basically based on the prevailing market and technology relationships. These two networks entail different actors, produce different artefacts, rely on different bodies of knowledge, and serve distinctive aims. Sometimes the two networks encounter each other and different bodies of knowledge that they generate and practise are contested. We will first describe the two different ways of maize breeding separately and then their interactions.

Breeding through mass selection

Local maize varieties are in a process of continuous change, through yearly mass selection of seeds from the previous year's harvest. The process of selecting seeds for the coming season begins in the field and is based on the *phenotypical* characteristics of the maize stalk and the cobs.

Only the large regular cobs are selected and only the seeds from the middle part of the spindle are used for sowing. Mass selection is effective in increasing gene frequencies for characteristics which are easily observed, such as plant type, dates of maturity, grain characteristics, disease tolerance, tolerance to drought and strength of the stalk. Other characteristics such as colour, taste and palatability also play an important role.

Maize is a typical open pollinated crop. In an open field, each plant has a different genetic composition and different individual characteristics. In practice, a farmer chooses his seed from desirable individual plants or cobs. The seed from these different plants are shelled, mixed, stored and planted *en mass* to produce the next generation. Practically all those farmers who select their own seeds for the next season do this. Through this process they reproduce their own local maize seeds. Their expressed preferences are for seed that matures early, can be grown under conditions of unstable rainfall, resists pests, has a reliable yield when cultivated without inorganic fertilisers and fits with specific end uses such as taste and palatability.

James Otieno Okatch, who resides in Nyamninia village, is one farmer who generates his own maize seeds. He first planted hybrid maize in 1989, when he and his wife took over his mothers' land following his mothers' death. But as he is the eldest son among three brothers, it was imperative that he had to *golo kodhi* before the families of the other brothers. In accordance with the principle of *golo kodhi*, he had to use family seeds, those passed down by his mother.. He was lucky to find some hanging above the fireplace in his mother's kitchen, which he used along side hybrid maize. He didn't buy fertiliser year as he was broke after the expense of his mothers funeral and he had enough zebu cattle to manure the hybrid maize and family seeds. After the funeral he returned to Nairobi, leaving his wife in charge of their homestead. To their great surprise the family seed grew better than the hybrid maize they had bought.

Most neighbours did not believe what they saw in Otieno's field. Many interpretations were offered. Some villagers thought that it was a blessing from Otieno's late mother as he had fed the guests well at her funeral. There was enough beer and food. The elders were pleased with Otieno, as 'he did not tie money in his pockets.' Before drinking beer they poured a little on the ground to honour his ancestors. In 1991, Otieno returned home to live. The performance of the maize seed inherited from his mother remains a source of pride. He shows it to every visitor who has an interest in farming. Since nobody knows exactly what type of maize variety it is, Otieno gave it a name, zero-type. This maize does very well with organic manure alone and *striga*⁵ is virtually absent. Most villagers have bought these seeds from him to try them out. However the majority of them,

including his brother, lost them during the hunger period when they ate the seeds rather than preserving them. After this Otieno was unwilling to pass any more seeds to his brother and his brothers' family have been obliged to plant other local yellow maize varieties ever since.

Otieno generates these seeds through mass selection, which begins in the field. He uses a number of criteria to select the cobs that he will use as seeds the following year. First he looks at the stem, which should be big and strong, then he looks for stems with leaves, which should be big and healthy, third the cobs of the maize should be drooping downwards after attaining physiological maturity. According to him, this ensures that water cannot get into the cob when the maize is left in the field to dry. Fourthly, the cob should not open to expose the grains to pest attack and water penetration. Fifth, the maize stalk should have prop roots up to the third node above the ground to resist lodging. Lastly the spindle of the maize should not have less than twelve lines and should be well filled with the grains. Otieno learned these criteria from his parents. He does not know much about hybrid and prefers to stick to the family seeds. Through yearly mass selection, Otieno has managed to maintain the zero type successfully. Like many other farmers, he does not use storage chemicals to preserve the seed, but instead uses ash from burnt cattle dung or from sedges, which grow nearby.

Otieno is representative of farmers that have sufficient manure from their cattle pen and good family seeds. As a result they are no longer linked to the market when it comes to maize production. The mass selection network is part and parcel of a development pattern that is de-linked, or repositioned itself, over the years from the state and markets as institutions generating maize seed for 'development'.

John Ndugu, a plant breeder stationed at KARI-Kakamega Regional Research Centre, is not convinced of mass selection as it is

'not effective in modifying characteristics such as yield, which is governed by many genes and cannot be recognised by the appearance of individual plants or cobs. Mass selection takes place on the basis of phenotypic characteristics. These only to a limited extent reflect the genotype for the yield-components and mass-selection is therefore not an efficient breeding technique for increasing yields. The ineffectiveness of mass selection in increasing yields results from: farmers inability to identify superior genotypes from the phenotypic appearance of maize cobs, as the criteria for mass-selection is the phenotypes; superior plants being pollinated from both inferior and superior ones, so that high yielding potential is not produced in all its progenies, and lastly strict selection for specific characteristics, e.g. maturity or grain type, which often leads to inbreeding depression and thus reduces yields'.

According to this plant breeder, high yield is very important in plant breeders' agendas. However, as we shall see later it is not necessarily a high priority for most farmers.

Hybrid maize breeding and selection

Deliberate maize breeding in Kenya first started in 1955 (Ogada 1969:5). The starting point for the breeding programme was a local maize variety called Kenya Flat White which originates in South Africa. According to Michael Harrison, the 'father' of hybrid maize in Kenya, Hickory King, Natal White Horsetooth, Ladysmith White, Salisbury White, Champion (Potchefstroom) White Pearl, and Iowa Silver Mine were the most successful maize varieties introduced from South Africa. The colourful names of these varieties reveal their origins; they were 'white southern dents' introduced to South Africa before the Boer War from the southern United States. They in turn are derived from the Mexican dent race 'Tuxpeño'.⁶ Once transplanted to the Kenya highlands, these varieties became inextricably mixed, and formed the genetic basis for a new variety called Kenya Flat White. This is a variable but reasonably stable mixed population with large white kernels. The ears are large and cylindrical and on average contain 12-14 rows. The plants are tall and late maturing and are relatively resistant to leaf blight. Over a period of thirty or forty years these plants were selected by leading settler farmers. When the originals were re-imported in the 1960s from South Africa and North Carolina for trial they were much more susceptible to disease, and yielded less than, the Kenya Flat Whites that they were compared with. Thus, well before the new Kenya hybrids were produced, local selection had produced a well-adapted parent population. It was fortunate that in Kenya maize was both a subsistence and an export crop, since elsewhere in Africa very little research was devoted to food crops compared to cash crops intended for export (Harrison 1970.:26)

The Kenya Flat White was thus developed through self-pollination from the varieties brought in by early settlers from South Africa (Acland 1971:12-6). This variety is best suited to highland climates for altitudes of between 900 and 2,300 metres (*ibid.*). The initial objective of the breeding programme was to increase yields of the maize varieties already present in Kenya and this work focused a great deal on the highland areas with a research station situated in Kitale. The programme developed rapidly and after only a few years was extended to include early maturing maize suited to the drier lowland areas. This work was started in 1957 at the Katumani research station in Eastern Province (Ogada 1969:8).

In 1959 germplasm was brought to the Kitale research station from different Central American sources. The introduction of these new genetic lines led to the development of a variety called Kitale Synthetic II that was commercially released in 1961 (*ibid.*:5). This new variety was used to breed I the first classical hybrid which was released in 1964.⁷ This had a yield potential that was at least 30 per cent higher than the Kitale Synthetic II⁸. The breeding programme initially intended to develop both

synthetic and hybrid varieties, as (even at this time) it was thought that small-scale farmers would not be prepared to buy seeds every year.

'Due to the yield advantage of hybrid seed, however, it became more or less impossible to sell synthetic varieties after 1964' (Harrison quoted in Gerhart 1975:4).

The breeding programmes therefore shifted towards exclusively breeding hybrids. This shift was strengthened by trials held in Kenya indicating that hybrids planted under 'traditional' husbandry conditions increased production by 35 per cent, while hybrids plus improved husbandry and fertiliser application raised returns by 300 per cent or more (Agricultural Input Review/World Bank 1985, vol. 1. Main Report, Chapter II.). As Gerhart (1976:56) concludes

'(...) although it is the combined package of practices (i.e., time of planting, good husbandry methods, rainfall regime.) that produces the most dramatic results, the use of hybrid seeds alone will raise yields substantially, probably as much as 50 percent under good conditions.'

It is widely accepted in agronomic circles that yields from hybrid maize are approximately 30 per cent higher than from local varieties. This perception is, as we will see later on, increasingly contested.

The production of hybrid maize seed is a process that takes four years.

'The basic theory behind the production of hybrid maize is that by selecting certain maize plant types and carrying out crosses in a pre-determined manner, it is possible to add together the good points of the parent plant types. When these good points are all present in the final hybrid plant, the effect is found to be much greater than the sum of the individual desirable characteristics'. (Stages and procedures in Hybrid maize production, KARI training course on seed technology, Kakamega, August 1997).

In this process deliberate selections are made of the characteristics sought in the final hybrid. Thus it is possible to create seed varieties adapted to specific environments. A primary focus of the Kenyan breeding programme was to adapt seed varieties to the wide differences in altitude (and subsequently, differences in rainfall and temperature). Kenyan hybrids are identified by three numbers. The first indicates the approximate altitude at which the crop has been bred: 6 for Kitale (at 6000 ft) and 5 for Embu (at 5000 ft), etc. The second number indicates the type of hybrid.⁹ The last number is a series number; a letter, which also denotes the series, sometimes follows it.

The disadvantage of classical hybrids, however, is that yields drop in succeeding generations and fresh seed should be purchased for every planting season. Thus, it is *not* possible to select seed from the previous harvests, which is the common practice when using local varieties. This is not the only difference between mass selection and hybrid breeding practices. Over the years Kenya has imported significant amounts of

exogenous genetic material for breeding purposes supplementing locally collected genetic resources.. Between 1964 and 1985, Kenya imported nearly two-thirds of all germ plasma accessions for breeding programmes, for the maize breeding programmes the figure was 88 per cent (Juma 1989 184-185).¹⁰ Juma (*ibid.* 190) comments that

'by emphasising increased food production as the main focus of breeding programmes Kenya has tended to drift towards a narrower genetic base in major commercial food crops.'

This shift does not, however, reflect the tastes of local consumers, who prefer greater variability in their food resources as well as the taste and colour of local varieties. Since beans and local maize varieties were introduced into East Africa, producers have been gradually adapted them to meet their preferences and those of consumers.. However, local knowledge about local varieties and taste and colour preferences are not the types of knowledge that informs R&D policy makers. The R&D community in Kenya has followed a different path, oriented towards maximising yields, with concomitant acceptance and adoption of monocultures, mechanisation and genetic uniformity.

Few expect the major breakthroughs that were made in the 1960s to be repeated today. Present targets are far more modest, they aim to increase e yields by about four per cent per annum. There is also a slight change of emphasis towards short-maturing varieties that are suited to double-cropping systems and inter-cropping. At the same time the environment in which breeding programmes are developed has changed. The Kenya Seed Company, is now a private company that has to satisfy its shareholders and their breeding programmes are now more market oriented. At the same time, KSC no longer enjoys a monopoly position, and must compete with other seed companies (such as Pannar and Pioneer from South Africa and the United States) who are now selling hybrid maize in Kenya.

One potentially significant innovation in the institutional landscape of maize breeding comes from a small private seed company Lagrotech (Lowland Agricultural Technologies) who released the *Maseno Double Cobber* (MDC) in 1996. Lagrotech started from the realisation of a group of plant breeders in the region that farmers in the lowland areas of Kenya are no longer keen on hybrid maize. They set out to develop a composite variety of maize that is high yielding but requires low inputs. Starting from local land races such as the Hamisi Double Cobber (a farmer-improved local variety from the neighbouring district of Vihiga) Lagrotech developed the MDC, which meets these criteria although not requiring inorganic fertilisers. However, Lagrotech does recommend the use of these to improve yields. Farmers can regenerate the seeds up to the third filial generation, beyond which yield starts to decline. These seeds are available in small (2-kg) quantities and at much lower prices than the

hybrid varieties. Between 1996 and 1998, farmers were very enthusiastic about this maize variety, but later they came to learn that its yield declines as they continue to reproduce it. In general however, farmers do feel that it is a better option than the normal hybrid, as it requires fewer inputs. They prefer however, to continue to look for more stable local varieties, whose yields do not decline over time.

Research on how to further develop the MDC is still ongoing. The Kenya Plant Health Inspectorate Services (KEPHIS) whose mandate is to test new cultivars of commercial seed for release in Kenya, does not test Lagrotech seeds and argues that the MDC should not even be on the market. However, the principal researcher of Lagrotech argues that

'the proof of the pudding is in the eating. Researchers who claim that their work is relevant for improvement of agriculture in the tropics should be given the obligation and the opportunity to test their ideas and put them in practice. It is on this basis that Lagrotech tries to come up with a maize variety that will be acceptable to my people.'

State intervention and hybrid maize: interlocking and distancing

The proliferation of local maize is very different from the way hybrid maize spread in the region. Hybrid maize came in the form of a technological package consisting of a series of recommendations. Like the mass selection and breeding of local maize it is embedded in a whole set of institutions and institutional arrangements. However, unlike the local maize, the establishment of the hybrid maize regime involved the state apparatus, parastatal companies, markets, farmers' unions, and so on, and was heavily reliant on foreign aid programmes and projects.

In the wake of the encouraging and visible outcomes of the breeding programmes of the 1960s the Kenya government initiated a national development programme aimed at increasing in the productivity of land and labour in maize cultivation. This programme involved disseminating a technology package, containing hybrid maize varieties, fertiliser and pesticides, and of a set of prescribed husbandry and management practices, notably mechanisation (Hebinck 1995:168).

This package presented through extension workers and extension programmes revolves around a set of nine recommended practices, presented in Table 2. A leaflet describing these is included in every package of hybrid maize seed.

An important aspect of the spread of hybrid maize in Luoland and the country at large is the institutional environment that was created to facilitate its spread. The Kenyan government launched an aggressive campaign through KARI, Ministry of Agriculture and Livestock Development (MOALD) the, then still state owned, KSC and the Kenya

Farmers' Union (KFA) to recruit and convince as many farmers as possible to grow hybrid maize.

Table 2 The prescribed hybrid maize technology package

- 1 Land Preparation: this should be made well in advance of planting and ensure a ready seed-bed clean of weeds at the onset of the rains;
- 2 Time of planting: planting should be made at the beginning of the rains, or shortly before;
- 3 Choice of hybrid: the right hybrid variety with respect to altitude and rainfall should be chosen.
- 4 Population and spacing: a high, but not excessively high, number of plants should be grown, this is achieved if planting is made in rows. The spacing depends on where the crop is grown.
- 5 Planting: two seeds should be placed in every hole and a later thinning should be made when the plants are 15 to 20 cm high. The seed rate is supposed to be 10 kg per acre.
- 6 Fertilisers: these should be used twice; at planting time when the farmer is required to apply 50kg of Diammonium phosphate fertiliser per acre and when the plants are at knee high after weeding when he applies nitrogen fertiliser at the same rate. .
- 7 Weeding: in addition to having a clean seed-bed early weeding is recommended and weeding should be a continuous process keeping the fields clear of weeds until the maize flowers;
- 8 Stalk borer protection: in order to prevent stalk borers (an insect attacking the maize) insecticides should be used on the growing maize;
- 9 Storage treatment against weevils: it is recommended that insecticides be applied to the harvested cobs before they are stored to reduce storage losses.

(Source: KSC instruction leaflet (in: Acland 1971))

The task of KSC was to multiply hybrid maize seed. The Kenya Farmers Association (KFA), as a wholesaler was responsible for distributing the hybrid seed, fertiliser and pesticides. It did so via a dense and efficient network of over a thousand licensed stockists in Western Kenya. Trucks that delivered *Coca-Cola* to the remote parts of the country always also carried hybrid maize seeds. The joint strategy of KSC and KFA was that participants at every stage of the chain, from factory to retailer, received a good share of the profit. Those profits provided incentives to sell as much as possible, which effectively made every stockist an extension worker (Gerhart 1976:9). For instance, Selina Okeyo a farmer in Nyamninia village stated that she received the advice to grow certain hybrid maize varieties from a KFA stockist.

George, who has been an extension worker at MOALD since 1968, recalls the early period of the hybridisation campaign and the important role that extension agents played in the dissemination of hybrid maize among farmers. They were charged with recruiting as many farmers as possible

in their areas. Contacts with farmers were made in many different ways. George himself had his 10 contact farmers he had to meet every week. Each season he had to organise field demonstrations in all the contact farmers' plots and teach farmers how to plant hybrid maize. These contact farmers had the task of spreading the hybrid maize message to other farmers in their area. This farmer to farmer contact was particularly important.

'But anyway, farmers learn more from other farmers than from extension workers. Often when you visit a farmer, other farmers are afraid to come. Immediately after you have left they will approach the farmer that you visited to ask what you came to do. So you must try as an extension officer to reach those farmers that are central within a community so that others can learn from them.'

He also had to pay individual visits to newly recruited farmers and help them with planting and the logistics of how to acquire seeds, fertilisers and pesticides. Every year George successfully used to organise a major field day on one of his best contact farmers' fields., Senior district and divisional government officials used to attend these days. They were supposed to throw their weight behind the extension workers in promoting government policies to promote hybrid maize. KSC field officers would also attend to meet farmers and sell their seeds. As it was cheaper to buy the seeds direct from the agents than from the stores, there was always a very good turnout on these field days.

Opinion leaders also became part of the hybrid maize proliferation efforts. George frequently approached church leaders in the region, since he noticed that the adoption of hybrid maize by church leaders often had a positive effect on the adoption rate by members of their church. Government officials like chiefs and assistant-chiefs also played a role in the promotion of hybrid maize at *baraza's* (public meetings) where information about topical subjects and current events was exchanged. Teachers of primary and secondary schools also popularised the growth of hybrid maize through young farmers clubs. *Jaduong* Patrick Odongo (80 years old) a retired primary school teacher was the headmaster of Muhanda primary school.

'When I was headmaster I encouraged the adoption of hybrid maize by allocating each class a plot to grow the crop. Each class was required to apply all the techniques that the extension officers recommended. Most villagers used to admire the school plots and this gave them a positive attitude towards hybrid maize. The students in their turn also urged their parents to grow hybrid maize.'

MOALD also organised agricultural shows where exhibits from the farms were displayed. George was always in charge of his division's stand at the agricultural show ground. He would collect the best exhibits from his best farmers and take them to their stand at the agricultural show ground

and he won several awards. Some of 'his' farmers who attended the shows used to visit his stand to learn more, which further motivated them to continue planting hybrid maize. Every year, there was series of week-long training sessions for farmers at Farmers Training Centres (FTC's) where they were taught about the virtues of and the right way to practise hybrid maize cultivation. Extension workers could recommend farmers who had adopted hybrid maize or who were potential adopters for these courses.

Early exposure is another factor that contributed to the uptake of hybrid maize in Siaya. Migrants who went to work on the white settler farms learnt about hybrid maize much earlier than others. When they returned to their villages for holidays, they brought hybrid maize with them. Abednego Ochieng for instance was born in 1950 in Kitale where his father was working as a mechanic a region known as the granary of Kenya, which is where he first saw hybrid maize. When Abednego returned to his village Muhanda in 1972, he decided to grow hybrid maize.

'I started serious farming in 1972 after completing secondary school. Before that, I tried teaching as untrained teacher in a primary school, but the pay was so low that I abandoned it. During this time the campaign for growing hybrid maize was at its peak. So I started straight away with hybrid maize. This is because of seeing its performance in Kitale and also having developed an interest in agriculture during my school days in Nyangori, which was very close to maize growing areas of Nandi district. I went to the Divisional Agricultural Office and told them my plans. The then locational extension officer Mr. Wasao very quickly organised a tractor for me and I had my plot dug for free. He issued us with a bag of fertiliser and 10 kg bag of H632. During those days we were being offered these farm inputs for free'.

With a strong backing from extension officers of MOALD, Abednego became a very successful farmer. He joined the ranks of contact farmers and his farm was frequently used as a demonstration plot for farmers in Muhanda village throughout the 1970s. He won various awards as the best farmer at district and provincial level.

In 1974 the District Agriculture Officer sent a tractor to prepare Abednego's plot for free. He was also given fertiliser and hybrid maize seeds for free. He was also 'assisted' in acquiring a loan from the Agricultural Finance Co-operation (AFC)" and received a lot of help with the work in his farm. He became such a well-known farmer in the region that KARI researchers used his plots for on-farm research and demonstrations, also supplying him with the necessary inputs. Students from Bukura and Egerton Agricultural Colleges came to his farm for their practical periods. In 1976 he was chosen to go on a field visit to Zimbabwe where he met farmers from South Africa from whom he learnt a lot about

hybrid maize. He also saw what Zimbabwean farmers were doing in their fields. This motivated him to work harder on his farm.

Another important component of the hybridisation campaign was the subsidies for fertilisers and ploughing that were available to farmers. Many farmers had their fields ploughed for free by the provincial government's tractor hire services in the 1960s and early 1970s. Kenya also has a long history of high levels of fertiliser subsidy (usually above 80 per cent), that go back to the 1950s (Gerhart 1975:11). The fertiliser subsidy, which was terminated in 1978, contributed substantially to the spread of hybrid maize in the country.¹²

A fourth factor that played a role in the spread of hybrid maize was its perceived profitability. Those who still grow hybrid maize (although in different portions), all share the belief that hybrid maize cultivation was, and still is, profitable. In their opinion the average yield gap between hybrid and local maize is sufficiently wide to finance the necessary inputs and make a good profit. The proximity of the National Cereals and Produce Board (NCPB) (some 6 km from their villages) depot that offers a ready market for their maize is also an incentive. From 1942 onwards the predecessor of the NCPB (the Maize Marketing Board) maintained guaranteed minimum prices for maize. George sees the creation of a market as contributing to the spread of hybrid maize.

'the government did not introduce hybrid maize for the farmers alone. It also had its own interest. It wanted to generate some income for itself. The government also introduced hybrid maize for commercial purposes. The government had its own agents to buy the maize, NCPB. So the government created a market for maize. They did not do the same for sorghum because sorghum could not be sold outside Kenya and it is also difficult within parts of Kenya. Although sorghum is much more adjusted to the local circumstances in the south of Siaya, maize was still promoted there.'

Jaduong James Wasawo a retired extension officer with 34 years experience recalls that, by the late 1970s, hybrid maize was far more profitable than any of the traditional crops.

'My calculations with farmers at the time showed that the net margin per hectare of hybrid maize was six times the net margin for the traditional sorghum and millet food crop mixture. Maize was seven times as profitable as one of the traditional crops such as cotton, and more than three times as profitable as sorghum inter-cropped with cotton.'

These higher returns per hectare made hybrid maize attractive to farmers facing a situation of increasing land scarcity. However, the increased profitability of maize was not due to output price changes favourable to maize, throughout this period changes in the price of maize remained comparable to that of competing crops. Other factors also influenced farmers' decisions:

'besides being a cash crop, maize was also a food crop, and therefore could be stored for consumption purposes if there were marketing problems. Maize, in addition, matured about a month and a half earlier than sorghum. This made it possible for farmers to sell stored maize for financing inputs at the beginning of the growing season, because a new maize harvest would soon be available to replenish their food stocks. While millet also matured early, low yields made it unsuitable as a cash crop.'

The market was designed and operated so as to minimise the risks of hybrid maize cultivation. Farmers were confident that maize prices would not drop at the moment they had to sell their maize to finance investments for the purchase of hybrid maize seed and inputs such as fertiliser (Gerhart 1976:14-15). Within today's neo-liberal discourse, the NCPB's role has been reduced substantially and private traders operate freely on the market.¹³ The minimum price guarantee has now been abolished. This system of a guaranteed minimum price and a relatively well operating market system, with nearby depots was in stark contrast to the marketing and pricing of the 'traditional' cash crops – groundnuts, cotton and sugar. These crops have been plagued by marketing problems, largely because of inefficient marketing boards.

The promotion of hybrid maize did not solely consist of emphasising its virtues. At the same time, local maize and other food crops like sorghum, finger millet and cassava did not receive sufficient coverage from extension officers. In the process, local maize, especially local yellow and red varieties, sorghum, finger millet and cassava came to be known as 'poor man's crops'. They were associated with backwardness and ignorance. Hybrid maize (which was all white coloured) was associated with progress. You were considered progressive if you grew hybrid maize. The combination of these factors and processes created a pro-hybrid maize attitude of 'modernity'.¹⁴ This change in attitude certainly facilitated the adoption of hybrid maize.

Despite all the different support mechanisms the adoption rate of hybrid maize in Siaya district was never very high in comparison to other parts of Western Kenya. In 1973 the uptake of hybrid maize for the whole of Siaya was still below 20 per cent, while districts like Trans Nzoia and Kakamega it had reached almost 100 per cent (Gerhart 1976:27). In other words most farmers in Siaya district decided not to adopt the presented hybrid maize package. Furthermore, the farmers who did adopt the technology package did not, in most cases adopt the total package. They adjusted, or redesigned, the package in many different ways (see Mango 2002).

Contemporary patterns of maize production: distancing

In an attempt to determine the contemporary pattern of maize cultivation in we conducted a survey in three of our research villages,. Forty farmers were selected at random in each village and asked what type of maize they were growing at the time of research. The results of this survey are shown in Table 3

Table 3 Type of maize grown by farmers in three villages

Type of Maize grown	Villages			Total	%
	Nyamninia	Muhanda	Muhoho		
No. of farmers growing hybrid and local maize	10	7	2	19	15,8
No. of farmers who have distanced from hybrid maize	20	22	21	63	52.5
No. of farmers who have never grown hybrid maize.	10	11	17	38	31.7
Total	40	40	40	120	100

The table shows that a majority of farmers have stopped planting hybrid maize. One difficulty with interpreting the responses to the survey is farmers who have planted hybrid maize once in their lifetime, often say that they always had planted hybrid maize. To avoid problems of interpretation like this we selected 23 of these farmers, through purposive sampling, to interview in more detail and try to understand the processes at work. We combined this information with field observations and offered them ideas as to why the initial adopters had distanced themselves in one way or another from hybrid maize. Of the sample, 22 farmers had at some time cultivated hybrid maize, of which only six were still growing it, all in combination with local maize varieties. Sixteen had distanced themselves from hybrids had reverted to growing local maize only, and one farmer has never grown hybrid maize at all. Most young farmers and in particular women farmers have never grown hybrid maize. Detailed discussions with these 23 farmers gave a whole series of reasons as to why the great majority of farmers do not use hybrid varieties. Farmers formulate their arguments in different ways, but they fall into three main groupings: *institutional failures and dilemmas*, *agronomic values* and *cultural values*.

Institutional failures and dilemmas

The issues related to market failures do not disqualify hybrids from an agronomic and/or cultural point of view, but hinge around the quality of relationships between maize cultivation and the set of institutions

surrounding and supporting it. For some people failures of this type do not constitute a reason to reject hybrid maize but rather to package and redesign the set of prescriptions that form the technology package surrounding hybrid maize. (See Hebinck 1990, 1995, and Mango, forthcoming for a more detailed discussion of this issue). For others these failures provide sufficient reason to distance themselves from the hybrids and the markets. One of the arguments for distancing from hybrid maize is the high costs of inputs, such as seed and fertiliser. This counters the arguments (brought forward earlier, and by the 6 farmers still growing hybrids along side local maize) that hybrid maize is a profitable crop to grow in Luoland. Lack of capital and of credit facilities to purchase the necessary inputs are also important issues. Difficulty in obtaining inputs and the perception that they (especially seeds but also fertilisers) deteriorate in quality were also mentioned as reasons to stop growing hybrid maize.¹⁵ Abednego, for instance narrated that

'growing maize as a commercial crop is not very economical. You use a lot of inputs and the output is not very encouraging. The farming practised here has got a lot of risks. Crops and animals are not insured. I do not like taking risks anymore. I am still servicing a loan I was given by the Agricultural Finance Co-operation. I do not have sufficient labour to manage the hybrid maize. Thus I have decided to plant local maize due to lack of capital. A lion can feed on grass when it reaches the worst. We are now opting for sorghum. Look at the lower section of my farm, I have decided to plant sweet potatoes there and the upper section I have decided to plant cassava as the soil in that upper part is more eroded and as such quite infertile but cassava does not need a very fertile soil. Besides these, I nowadays plant bananas which give me some income during difficult times. Fertiliser shortages are nowadays rampant. The government would rather re-export the fertiliser that has been brought by the donor agencies and make money instead of thinking about the farmers.'

The local frame of reference obviously is that during previous conjunctures, i.e. during the heyday of the hybridisation campaign – the markets for credit seeds, fertiliser, draught power, and so on worked. Nowadays there is a general reluctance to invest money earned through other sources (e.g. migration, remittances, odd jobs and so on) in cultivating hybrids. Selina, a woman farmer expresses this general distrust of the market:

'One other thing I forgot to tell you concerns the quality of hybrid maize seeds. Since there is market liberalisation, most of our good quality maize seeds are marketed in countries like Uganda, Tanzania and Rwanda. The government earns more money when Kenya Seed Company sell the seeds there. Big farmers in the Rift Valley Province take up the remaining good seeds. So what sometime reaches us is doubtful. Anybody can sell anything to you as hybrid maize seeds as long as it is dusted with the green chemical they use for real hybrid maize'.

Another issue that plays a role is the slimming down of the apparatus of the Kenyan State that has occurred, in accordance with the Structural Adjustment Programme of the International Monetary Fund (with the support of the World Bank). Since 1990, the government has implemented a retrenchment programme, which has included its extension service. Those leaving the service (through natural attrition) have not been replaced and the ratio of farmers to extension workers has been steadily increasing. In Siaya district this figure now stands at a 1000 to one and the geographical area that one extension worker is required to cover has almost tripled.

Thus most farmers do not get much support from extension workers for their problems with hybrid maize, and hence they distance from it. Some farmers told us that extension workers seem to have almost disappeared from their area and that they no longer get regular visits from them. Moreover, when they do visit they propagate hybrid maize despite farmers' reluctance to grow hybrids. Farmers feel that the extension workers who do visit are inexperienced and ill equipped, compared to those who they were used to in the 1970s and 1980s and that they have little new advice to offer.

The extension workers that were interviewed showed considerable understanding of why farmers are not eager to plant hybrid maize. Most extension workers have their own fields where they grow maize, and are confronted with the same problems. Some of these extension workers grow local maize from self selected seeds they generate themselves. They cite the same reasons for growing local instead of hybrid maize. This despite having a stable salary and being able to access credit in order to purchase inputs.

Despite understanding the circumstances of farmers, extension workers continue to present themselves (officially) as hybrid maize proponents. A government extension worker explains why.

'We are evangelists of hybrid maize and there is no way we can turn our back on it. We are promoting hybrid wherever we go, even when farmers do not prefer it. Personally I grow Uganda white. Let the government sack me but I will not hurt my family by engaging in impossibilities'.

This situation in a way represents a double dilemma. The extension workers are subject to pressure from their superiors to propagate hybrid maize to unwilling clients and hence are obliged cover up their efforts to support their clients' strategies that are based upon the distancing from hybrid maize.

Agronomic values

The second group of arguments hinges around agronomic issues, particularly the relative merits of hybrid and local varieties. (Although these cannot be entirely disconnected, from cultural related issues such as

taste). One of the most powerful arguments to stop planting hybrids and to return to local varieties is that local maize out yields hybrids when only farmyard manure is applied. Experience with local maize, the so-called zero-type,, provides a counter-argument to the claims of plant breeders that hybrids are superior in this respect.. When we visited James Otieno during one of our maize variety collection tours he pointed at the samples of maize that we held in our hand, he gave us one of his zero-type cobs and said:

'Look here. See for yourself. This cob is much bigger than the hybrid you have in your hand. So what is your judgement?'

In close association with this, farmers also claim that hybrid maize lodges more than local varieties; that the cobs from hybrids open resulting in cob rot and bird damage; that they are less resistant to weeds, pests, diseases and sudden changes in weather conditions. Hybrid maize also takes too long to mature. .. In addition, hybrid maize does not store very well and is easily attacked by weevils.

A second series of agronomic arguments hinge around soil fertility and the application of fertilisers. Soil fertility has become a major issue in Luoland. Official recommendations for maintaining soil fertility through the application of fertiliser are strongly contested. People claim that 'fertilisers spoil the soil', and that 'the soil becomes addicted to fertiliser', and that fertilisers stimulate the growth of *striga*. Selina for instance claims that

'it is true that fertiliser spoils the soil. Particularly if it is used without applying organic manure. Phosphoric fertiliser has got a tendency of staying in the soil. There it changes the nature of the soil to be very fine, which can easily be carried away by wind or when it rains, the floods.. Water also does not get down into the soil. Personally I like using manure. If I use fertiliser, then I just put a little bit.'

Ochieng Monye grows both local maize and several cultivars of hybrid maize depending on the season. Alongside this he also grows sorghum. The hybrid maize is grown on trial plots where CARE-Kenya (an NGO) or the Ministry of Agriculture carries out demonstrations. At a distance plot he grows local maize. In some of his trial plots with CARE-Kenya he grows also local maize that is selected by CARE-K's extension staff. CARE-K is involved in varietal screening of maize to ascertain which one is suitable for that particular area. Asked why he has given a large acreage to local maize, Monye said that

'the advantage of local maize is that they are early maturing. The fact is that local maize is as good as hybrid maize. It does not demand a lot of input and is not as labour intensive as hybrid. Sorghum is even better as one weeding is sufficient for it. Local varieties are hardy and can resist pest attack in the

store. They can even be stored up to three years. Normally when I see local maize somewhere, I bring it to this place.'

Monye maintains that he is growing hybrid due to the encouragement he receives from extension agents. He used hybrid for the first time in 1985 and since then he has been growing at least one cultivar of hybrid maize. However he has some problems with the hybrid maize.

'Sometimes I do not get hybrid maize seeds in good time even when I prepare my land early. The seeds are not always available. Hybrid maize needs a lot of inputs. Hybrid 622, which is recommended for this place, but when approaching maturity the cobs normally open up. When it rains, the water gets inside the cob and it starts rotting particularly from the base. The opening of the cob also exposes it to serious bird damage. The stalk of hybrid maize is weak. It will lodge when there is a strong wind'.

Cultural repertoire and taste preferences

The third group of arguments captures the cultural elements that inform and shape agriculture. One issue of quality and values reflects the notion that porridge (*ugali*) from hybrid maize is light and less satisfactory than the *ugali* made from local maize. Some people, particularly the women, argue that *ugali* made from hybrids requires twice as much maize as *ugali* from local maize. Hybrid maize is also less sweet than local maize. In addition, certain local varieties are excellent when boiled, others are perfect when roasted; qualities that hybrid maize does not have.

'Ugali from hybrid maize is light and does not satisfy children easily. Children need to eat more of it. Local maize is tastier than hybrid maize when roasted or boiled. This is because local maize has high starch content and when in milk stage the grains have got higher amounts of sugar'.

Colour is a further argument in favour of local maize.

A second issue is that hybrids are not in line with the Luo culture of first sowing (*golo kohdi*) and first harvesting (*dwoko cham*). Hybrid maize is perceived as a strange seed and unlike local maize does not become part of the family seed, and is therefore incompatible with Luo cultural repertoires. It remains an 'outside seed' (*nyareta*).

When the long rains start in early February, Abednego prefers growing H626. It is long maturing but yields well. When the rains come later, he goes for H622, H614 or H512 or even H511. In the short rain season he grows H512. But,

'my wife is the one who plants local maize variety (Uganda white). She grows it because it is early maturing more or less like the local maize. She reproduces her own seeds'.

Abednego apparently does not seem to be very interested in growing local maize. When we sat down with Abednego during the long rainy season of 1997 we asked him which seeds he was going to use during the

golo kodhi ceremony. He said he will use Uganda white. When we asked why, he said, he has to follow the *golo kodhi* principle.

'I have to follow the Luo customs. I am the eldest son in my father's family and failure to do so might impede the progress of my other brothers in farming as they cannot put any seed in the soil before I do so. Once my remaining Uncle Odongo and my mother have planted, then I can also plant followed by my two younger brothers'.

When we asked which maize variety he starts with given that the maize must be ready before that of your brothers, he answered:

'In the ceremony of golo kodhi, it is required that you use family seeds. Most people do not understand what family seeds are but today I want to tell you the secret behind it. Family seeds are the ones that were passed on to us by our ancestors. They are the ones that we try to regenerate and in case of any calamity, we can use them to offer sacrifices to the ancestors. They are able to recognise them. Furthermore the first harvest comes from these seeds we use to brew beer from and that we offer back again to our ancestors during the ceremony known as fuachra.'

But, as always with local cultural repertoires, they are sometimes contested and reworked. It seems that if the relation between relatives is good, a solution can more easily be found for solving (some of) problems generated by *golo kodhi*. For instance when the mother of Oketch Bundmawi and Oduor Lomo was delayed in her land preparation activities and therefore could not sow in time, she just sowed a few square metres of maize, after which her sons started sowing their plots. When there are disputes between relatives – and these occur frequently – elders can use *golo kodhi* to display and continue their authority or to punish youngsters who in their opinion do not show respect to them. One other informant specifically mentioned that one way to circumvent the *golo kodhi* ceremony is to purchase seed on the market and plant them immediately, without bringing them home.

Conclusions

The two maize breeding and selection regimes differ substantially from each other. In this concluding section we compare these two regimes to summarise the main differences and similarities.

A major difference is that yield of the (classical) hybrid drops in succeeding generations and in order to retain the yield advantage of hybrids fresh seed must be purchased every season. If a grower uses second-generation seed, the resulting population is very variable, owing to genetic segregation, and yields are poor. Thus, it is *not* possible to select seed from the previous harvests, which is the common practice with local varieties. Hybrid maize seed production has to take place under specific and controlled circumstances. A major characteristic of hybrid maize

regime is that production is embedded in, and presupposes, the expansion of commodity relations, the commoditisation of the objects of labour, and requires the supporting institutions (such as commodity markets and knowledge exchange) operate efficiently. It also is designed to be fertiliser responsive and needs reliable rainfall patterns and relatively good soils. Furthermore, hybrid maize has a built in optimal planting time. If planting is delayed by two weeks yields may be reduced by 50 per cent. According to a trial done at the Kitale Research Station 70-80 kg grain/ha. is lost for each days delay after the first week of the rains. The time of planting is thus crucial for realising the potential of hybrid maize. This creates seasonal peaks in labour demand, which farmers mention as a critical issue.

All these characteristics are stark contrast with the mass selection and breeding practices that generates seeds that are (relatively) freely available and exchangeable. These local maize varieties do relatively well under conditions of stress (lack of water, no fertiliser application, etc.) and are more resistant to drought and variable patterns of rainfall. Although, labour is also a critical issue with local maize, the greater flexibility in planting times makes it a less pressing problem.

Another major feature of hybrid maize regime is the emphasis it places on the organisational and institutional arrangements for the production, import and distribution of inputs. The externalisation and institutionalisation of farm related tasks in specific institutions such as seed companies, financial institutions such as banks, extension services and advice, marketing bodies, seed quality control centres, and input distributors is imperative for this regime. The technology associated with the high-yielding maize varieties is not a merely a package of physical inputs, it also incorporates a package of new agricultural practices. The new technology follows a new crop calendar, given the longer maturing period of the new maize varieties and brings about changes in cropping patterns and crop rotation, as farmers are advised not to inter-crop with other food crops such as beans. Each of the 'new' inputs brings with it a new set of agricultural practices and recommendations. The farmer must now know how much seed to plant, how much fertiliser to apply on which type of soil, when, and what proportion of nitrogen, phosphorus, and potash to use. Similarly, the farmer must understand which type of seed is vulnerable to which type of pest, and what are the various options for pest control, with varying implications for timing in the use of chemicals, human labour, crop pattern and rotations. Maintaining relationships with research and extension and advisory agencies is critical in the production of hybrid maize, although this is not always easily achievable.

The local maize mass selection and breeding regime, on the other hand, is not embedded in such institutional arrangements, but is distanced from

them, and is predominantly shaped by non-commoditised relationships and the character of the local society and economy. The way the Luo breed local maize, select, exchange and produce seeds is largely fashioned by localised institutional arrangements such as *golo kodhi* and *dwoko cham*. Despite these being sometimes contested, they remain part and parcel of the dynamics of the local technological regime. In contrast, the establishment of the hybrid regime is (or was) the product of a project implemented by the state apparatus, which in turn was enrolled, and supported, by foreign aid relationships. In the 1960s this was the cornerstone of state agricultural policy, which aimed to increase productivity and attain national food self-sufficiency (Hebinck 1990:209 ff.; National Food Policy paper 1981:1¹⁶). It represented a 'new' technological regime that prescribed and shaped agricultural development towards operating within the domain spanned by markets and technology supply (Hebinck and van der Ploeg 1997).

The hybrid maize regime is very distinct from the mass breeding of local maize networks in that it is the outcome of ongoing 'progress' in agrarian sciences, notably in plant breeding, production ecology, soil science, agricultural engineering and agricultural economics. The development of this technology package has been accompanied by, and predicated on, the assumptions and the perception that hybrid maize is an profitable crop for farmers to grow (as it increases the returns to labour), and that it is superior to local land races, as it out yields them. Scientific knowledge (of breeding and selection) in other words, is presented as superior to local knowledge, which then is, or becomes, superfluous. The starting point has always been the technological superiority of hybrids over local varieties. One may question, however, whether hybrid maize varieties really do produce higher yields than local varieties or whether they have contributed to an increase of food security at household level.¹⁷

The mass selection of local maize, in contrast, hinges on a technological regime of local knowledge regulated by institutions such as kinship relationships and seniority. Cross border trade and exchange among kin and neighbours are the means by which it proliferates. Preservation and (re)production is shaped and characterised by non-commoditised relationships and the character of the local economy. The local ecology plays an important role as an endogenous resource, and as a gene pool for further experimentation.

Interactions between the two different technological regimes have taken specific forms. The 'modern' and hybrid maize varieties that are bred through the application of scientific principles do not fit with cultural practices, and as a result are no longer widely planted. Farmers who still plant hybrids do so in a redesigned way. This suggests that there is hardly any interaction or at least an interaction with a limit impact. Secondly, the results of earlier breeding programmes (invariably undertaken outside

Kenya) brought varieties through early colonial state interventions. These varieties still feature today and, most certainly, have added to the existing regional gene pool. The hybrid maize regime on the other hand has never completely managed to fulfil its 'mission' in the region. It is now being contested and criticised by scientists (e.g. plant breeders) themselves. The Lagrotech seed company shows that alternative ideas and practices are emerging from plant breeding circles, evidence that the technological breeding regime, based on the scientific principles of breeding, is neither homogenous or fixed. A variety of approaches to maize breeding exist at present in Kenya. If the technological approaches interact more regularly with the mass selection and breeding regimes then there is hope for the future.

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Notes

1 By 1643 maize was being grown on Zanzibar and Pemba islands to supply the Portuguese garrison at Mombasa. There is some evidence that it spread inland along the routes followed by the Arab slave caravans. Among the Nyika of Tanzania the root word for Maize is 'Pemba', which is presumably derived from the island Pemba, which was a base for Arab slave operations in the area (Miracle 1966:113).

2 This is not surprising as a lot of Kenya's white settlers originate from South Africa.

3 He was the chief of Gem region between 1915-1916.

4 In spite of the enormous support for white settler and estate agriculture, colonial state officials stationed in the Reserves, in Nyanza and Kikuyu land in particular, encouraged cash crop production by Africans. The fact that some sections of the colonial administration were actively engaged in encouraging agricultural development in the Reserves might be read as an indication that the colonial state was not a monolithic apparatus and was capable of perceiving wider interests, beyond those of white settlers. However, such support was largely motivated by the desire to generate cash incomes for Africans to pay tax in money instead of in livestock, which the administration then had to dispose of.

5 A virulent form of weed that competes with maize.

6 During a 1959 visit to Mexico, Harrison reported, he saw true Tuxpeño ears and found them 'indistinguishable' from their long-removed Kenyan cousins (Harrison 1970).

7 Commercial production of F1 hybrid seed began in the early 1930s in the United States and developed quite rapidly. In the early 1930s the area of hybrid maize in USA was only about 0.4 per cent, and in 1956 about 98 per cent. This success made the USA the biggest maize producer and exporter in the world both by volume and value (Song 1998: 79, see also Kloppenburg 1988). Following its wide adoption in the USA during the 1940s, hybrid maize spread quickly throughout the developed countries, and also aroused interest in the developing world. However, the results in most developing countries were not good, though there were a few cases of successes, in Zimbabwe, Kenya and northern part of China in environmentally favoured areas (*ibid.*: 79). The spread of hybrid maize and the institutional framework, in which it is embedded to the so-called Third World, was one of the features of *The Green Revolution*.

8 Selection of synthetic varieties is done differently. These are formed from a large number of inbred lines and have a greater genetic variability. Thus it is not necessary for farmers to purchase seed every year (Ogada 1969:5). A development from the classical hybrids are the composite varieties, varietal crosses, bred with the aim of retaining a larger genetic variability than is found in the classical hybrids. Composite varieties may be crosses of classical hybrids, crosses between hybrid and synthetic varieties or hybrid crosses with single inbred lines. These are also less sensitive to yield reductions in subsequent generations, but preferably, new seed should be purchased every year in the composite varieties (*ibid.*: 6). The genetic characteristics of the improved seeds will have consequences for the farmers and suppliers that significantly influence their adoption.

9 1 for a varietal hybrid (when a variety is used as one of the parents); 2 and 3 for classical hybrids (when inbred lines are used as the parents). 2 is used for double crosses, e.g. (GxD)X(AxF), and 3 is used for three-way crosses, e.g. (FxG)XG.

10 Similar trends can be noted in forest and livestock species. In 1985 nearly 95 per cent of Kenya's planted forests were exotic, and nearly 93 per cent of the germ plasma used in artificial insemination programmes was from exotic dairy breeds (Ayrshire, Friesian, Guernsey and Jersey) (Juma 1989:184-186). The reduction of the genetic diversity of local livestock breeds was effectively undertaken in the colonial period, although ownership of graded cows was restricted to the settler community (Cowen 1974)

11 Abednego never repaid the loan. According to him, he did not request the loan. However, he is still being asked to repay it.

12 Most of the fertilisers that Kenya imports are financed or donated under bilateral aid agreements.

13 Although that we did not collect data on this issue we strongly believe that the present maize consumption market is chaotic and characterised by price fluctuations, which create uncertainty for farmers

14 In Yala it became almost a taboo to provide visitors with *ugali* made from yellow maize or sorghum. As many people stated, women from Yala who married men from the South of Siaya, where more sorghum and local maize was grown, were often considered to be difficult in their new homes since they were reluctant to prepare and eat sorghum *ugali* and local maize *ugali*.

15 In an on-farm research report the CARE and the parastatal KEFRI support the notion that farmers lack confidence in inorganic fertilisers (CARE/KEFRI 1996:8).

16 Later versions of the Nation Food Policy paper (1994) echo the same ideas and images. The institutional framework has, however, changed dramatically due to privatisation and trade liberalisation. The KSC was once a major vehicle for the state for the implementation of its food policy; nowadays KSC is a private company that serves the interests of its shareholders.

17 This issue was already advanced in the mid 1980s by Greer and Thorbecke (1986).