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LEISA

Magazine on Low External Input and Sustainable Agriculture



Valuing crop diversity



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Woman harvesting teff, Eritrea.

Photo: Caroline Penn, Panos pictures.

*The editors have taken every care to ensure that the
 contents of this magazine are as accurate as possible.
 The authors have ultimate responsibility, however,
 for the content of individual articles.*

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8 Roselle in Senegal and Mali

Nathan McClintock

Roselle (*Hibiscus sabdariffa*) is a
 versatile plant with a number of useful
 properties. These enable it to fill many
 different agroecological as well as socio-
 economical niches in Senegal and Mali.
 It is intercropped with staple crops or
 planted along field boundaries, requires
 little care and its leaves, seed capsules and
 stems are used in a number of local dishes
 and in traditional medicines. Women are
 usually responsible for the growing of
 roselle and add value to the crop by
 developing products which they sell at the
 market.



**16 Fonio: a small grain with
 potential**

Jean-François Cruz

Fonio (*Digitaria exilis*), a traditional
 cereal crop from West Africa, is popular
 because it is well adapted to local
 conditions and has good nutritional and
 culinary properties. But manual
 processing of fonio is a difficult and time-
 consuming task because of the tiny size
 of its seeds. Fonio is, therefore, rarely
 available on the market. To make fonio
 available to consumers and worth growing
 for farmers, a CIRAD initiated project
 has been working together with local
 stakeholders to develop better equipment
 for mechanical processing and cleaning
 of the fonio.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options
 open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about
 the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of
 external inputs. It is about the empowerment of male and female farmers and the communities who seek to
 build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also
 about participatory methodologies to strengthen the capacity of farmers and other actors to improve
 agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and
 scientific knowledge, and to influence policy formulation in creating an environment conducive for its
 further development. LEISA is a concept, an approach and a political message.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture. ILEIA seeks to
 promote the adoption of LEISA through the LEISA magazines and other publications. It also maintains a
 specialized information database and an informative and interactive website on LEISA (www.ileia.org).
 The web site provides access to many other sources of information on the development of sustainable
 agriculture.

Readers are welcome to photocopy and circulate articles.

Please acknowledge the LEISA Magazine, however, and send us a copy of your publication.

14 Growing and marketing Andean grains

José-Luis Soto, Wilfredo Rojas and Milton Pinto



Quinoa (*Chenopodium quinoa*) and cañahua (*Chenopodium pallidicaule*) are two traditional grain crops from the high Andes region, grown at altitudes of 3000 - 4500 m. The grains are very nutritious and there is an increasing demand in the urban markets for products made from them. However, cultivation has decreased over the years and genetic diversity has now reached critical levels. PROINPA in Bolivia is trying to revive the interest amongst farmers in growing these crops. Varieties are selected and developed in accordance with farmers' criteria, and farmers are linked up directly with small processing units, which enables them to get a better price.

18 Taro in Vanuatu: towards a dynamic conservation strategy

Sophie Caillon, José Quero-García and Luigi Guarino

Taro (*Colocasia esculenta*) is an ancient root crop which is closely integrated into society and culture in the Pacific. Taro has never received much interest from research, but the devastation caused by the outbreak of *Taro Leaf Blight* in Samoa in 1993 has led to a renewed interest in this crop, in particular in its genetic diversity. Gene banks have been established, but it is also necessary to work directly with farmers on *in-situ*, or on-farm conservation to keep the crop useful and competitive in a changing environment.

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DEAR READERS

During our recent International Editors Meeting we discussed ways to get our readers more actively involved in reporting and commenting on their experiences with LEISA. At the moment each edition of the *LEISA Magazine* covers one particular theme through a number of quite long articles and there is little space for shorter observations, messages or comments. This is going to change. In the next edition of the magazine we are starting a new column called **Field Notes** for readers who want to share experiences or knowledge about LEISA that might be interesting to other readers.

Please use this opportunity to write to us about what is going on around you, in your community, project or organization. Keep the text short so we can include as many of your contributions as possible. Your opinions and ideas about the *LEISA Magazine* are of course also very welcome!

We would like to express our gratitude to Ms Irmgard Hoeschle-Zeledon, Coordinator of the *Global Facilitation*

Unit for Underutilized Species (GFU) based at the IPGRI headquarters in Rome, Italy, for her help with the sourcing of interesting articles for this edition of the magazine.

We hope you enjoy reading the current issue on minor crops, crops that many of us know, use and enjoy but which do not receive the attention or support they deserve. As you will see from the Networking section, however, there are many organizations working to improve the situation.

With this edition of the magazine is also a CD Rom, *LEISA Magazine 1984 - 2003*, containing all articles published in the *ILEIA Newsletter* and *LEISA Magazine* since the start in 1984. We hope you will find it interesting and useful. If you are unable to use it yourself, please pass it on to someone who can.

The Editors

Valuing crop diversity

Editorial

A complex diversity of plants and other species, their interactions with each other and with the specific environments in which they have developed, keep life on earth in balance. Healthy ecosystems are relatively stable and the diversity they contain enables them to adapt to changing circumstances. It is this diversity that provides us with our food, shelter and other material goods. Ecosystem functions regulate the environment in which we live and we have always found ways of manipulating our environment and the biodiversity they contain to satisfy our needs. In doing so we have had an enormous impact on the world's ecosystems and in many places they can no longer cope with the demands made on them or the speed of change. Agriculture, is of course, a major example of how human beings have intervened in natural ecosystems.

Over time we have identified and learned to use nearly 8000 species for our food and well-being. However, as cultivation technologies developed, our attention has become increasingly focused on a limited number of species. Today, after millennia of agricultural development, we derive more than 50% of our food requirements from just three crops (maize, wheat and rice) and 95% of our energy needs from less than 30 plant species.

Modern agricultural research has concentrated on increasing the productivity of a few crops and breeds. As a result, a few crops have come to replace other, locally grown crops and there has been an enormous simplification of our agricultural systems. We now cultivate a few species on vast acreages of land according to the principles of industrial agriculture: simple cultivation, easy processing and storage, and a uniformity that makes transport and marketing efficient in economic terms. This concentration on a few major staple crops has resulted in an alarming reduction not only in crop diversity but also in the variability within crops. It has also meant that our food security today depends on a very few species, which are traded globally and are available at very low prices.

For small-scale farmers in marginal areas this has not been a positive development. Traditionally dependent on many different plant species for exchange and subsistence, many farmers have been drawn into agricultural economies based on cash cropping commodity crops with little regard for the complexities and multi-functionalities of existing agricultural systems that have developed over time and in close contact with local ecosystems. In many cases, rural communities have abandoned the cultivation of food crops and are now dependent on cash for their everyday needs. The tendency of world commodity prices to fluctuate violently over time makes this a very risky strategy. Over the past few years, for example, the prices of many commodities have fallen so low (Chimwala, p. 21) that they do not even compensate production costs. Farmers are unable to fill this income gap from their present agricultural system, and there is a growing realization that diversification of production is an urgent necessity.

For other farmers, especially those living in areas unsuitable for the cultivation of improved varieties or commodity crops, agrobiodiversity is basic to survival. The more diversified their farming systems (Gamarra, p. 24) – the greater the chance of self-sustainability and self-reliance. In such areas so-called underutilized species (Padulosi, p. 5) are particularly useful. They have been selected over time to withstand such stresses as



Photo: Anita Ingevall

Field with quinoa outside Cuzco, Peru.

drought and floods (Mulaama, p. 26; Oakley, p. 22), and they can be produced in a sustainable way using available, low-cost, input practices. In many cases these species are also valuable sources of the micro-nutrients and vitamins needed (McClintock, p. 8) to overcome the problem of “hidden hunger” – the lack of essential nutrients in diets consisting mainly of carbohydrate staples – which often affect the young and the elderly (Johns, p. 7).

Although useful and often nutritious, very little is known about these underutilized crops. Cultivation requirements, yield improvement potential and other properties are seldom investigated and rarely documented (Caillon, p. 18). Usually these crops have not been commercialized and little has been done to develop markets for them (Soto, p. 14). It is difficult to find information on them and the traditional knowledge that used to be integrated into rural culture and handed down from generation to generation within local communities is disappearing rapidly with the “modernization” of agricultural practices and the outward migration of young people (Woods, p. 11).

The displacement of local biodiversity is a major challenge not only for local food security but for the long-term sustainability of our global food system and the ecosystems that support it. Recognizing our increasing vulnerability, initiatives like the *Convention on Biological Diversity* (CBD) have become important vehicles for ensuring the maintenance of a safety net of diversified crops that can meet the material needs of future generations.

The CBD and the *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture* are examples of initiatives that recognize the role of biodiversity in food and livelihood security (for other initiatives see Networking, pp. 34-35). The *Plan of Action* resulting from the *World Food Summit 2002* called for immediate action to combat hunger. One of the measures suggested was to renew efforts to enhance the production and use of culturally appropriate, traditional and underutilized food crops. For this and other similarly important declarations to be realized, however, major changes are required to our present agricultural system. ■

Underutilized plant species: what are they?

Stefano Padulosi and Irmgard Hoeschle-Zeledon

The use of the term underutilized to refer to categories of wild and cultivated plants invariably gives rise to a discussion of what the word actually means. In general it is commonly applied to species whose potential has not been fully realized. Fair enough. Unfortunately such an interpretation is *all-inclusive* and may also refer to local varieties of major crops and commodities currently abandoned by farmers or in decline but which could be revived through specific interventions such as adding value or marketing.

Many of us who are engaged in promoting the better use of plant biodiversity to deal with problems of poverty, food and nutritional security, income generation and environmental health, prefer a more specific definition. Here we define underutilized species as “those non-commodity crops, which are part of a larger biodiversity portfolio, once more popular and today neglected by users’ groups for a variety of agronomic, genetic, economic, social and cultural factors.”

Farmers cultivate them less than in the past because these species are no longer competitive with the crops that have come to dominate the world food supply and that are supported by seed supply systems, production and post-harvest technologies and extension services. In addition, their markets are well-established and consumers are accustomed to using them. In order to bring underutilized species back into cultivation, their competitiveness has to be addressed and new opportunities such as new food and lifestyle trends and the developments taking place in production and post-harvest technologies have to be explored.

This is, however, not the whole story. A lack of competitiveness may be an important factor for underutilization but, in itself, this tells us little about the geographical (underutilized where?), social (underutilized by whom?) and economic (underutilized to what degree?) reasons associated with the decline of local crops. For instance, with regard to geographical distribution, a species might be underutilized in some regions, but not in others. Cowpea (*Vigna unguiculata*) is a good example. It is a staple for many people in Sub-Saharan Africa, but considered underutilized in Mediterranean countries where it was once widely used and is now grown only in some restricted areas. Similarly, chickpea (*Cicer arietinum*) is considered an underutilized species in Italy, but is a main pulse in Syria and many other countries in West Asia. Other examples are leafy vegetables. From a social point of view it is hard to define leafy vegetables, a group of several species used by millions of people in Sub-Sahara Africa, as being underutilized. Yet, poor marketing conditions make them largely underutilized in economic terms.

Time is another factor that must be taken into consideration. Underutilized crops may suddenly become popular in one country while in another they continue to be poorly researched, marketed and managed. A good example of this is the dark green salad vegetable known as rocket – the collective name for the species *Eruca sativa*, *Diplotaxis tenuifolia* and *D. muralis*. Rocket has become a highly priced vegetable in Europe through innovative cultivation and commercial practices, while in Egypt it remains one of the country’s cheapest vegetables and a rich source of micronutrients for the poor.

Underutilized crops are often presented as ‘new crops’, not because they are ‘new’ but because they have been taken up by

commercial companies and researchers for a new market. In reality, local communities have used these species for generations but the current loss of local knowledge means that their traditional uses are being forgotten. Many underutilized species can make an important contribution to a better diet for local communities. Oca (*Oxalis tuberosa*), ulluco (*Ullucus tuberosus*) and mashwa (*Tropaeolum tuberosum*), three traditional Andean tuber plants are all much richer in Vitamin A and Vitamin C than the well-known potato (*Solanum tuberosum*). Quinoa (*Chenopodium quinoa*), cañahua (*Chenopodium pallidicaule*) and amaranth (*Amaranthus caudatus*), all underutilized grains in the Andean region, contain far higher amounts of certain essential amino acids than wheat. The leaves of black nightshades (*Solanum nigrum*) provide appreciable amounts of minerals including calcium, iron and phosphorous, Vitamins A and C as well as proteins and amino acids such as methionine, scarce in other commonly marketed vegetables.

In categorizing a species as underutilized, we should also consider the level of underutilization: when can a species be said to be underutilized and when does utilization become unsustainable over-utilization?



Photo: N. McClintock

Harvested green calyces of roselle.

Common understanding

Orphan, abandoned, new, underutilized, neglected, lost, under-used, local, minor, traditional, forgotten, alternative, niche, promising, underdeveloped: these and other terms are often used as synonyms for underutilized species. Perhaps the best way to understand what the term really means is to identify the features underutilized species have in common and show how these relate to our lives. Underutilized species are:

- **important in local consumption and production systems:** they are an integral part of local culture, present in traditional food preparations and are the focus of current trends to revive culinary traditions;
- **highly adapted to agroecological niches and marginal areas:** they have comparative advantages over commodity crops because they have been selected to withstand stressful conditions and can be cultivated using low input and biological techniques;
- **ignored by policy makers and excluded from research and development agendas:** special efforts are needed to improve

the cultivation, management, harvesting and post-harvesting of underutilized species and studies are needed on issues such as marketability, nutritional status and policies and legal frameworks to regulate their use;

- **represented by ecotypes or landraces:** most underutilized species require some degree of improvement;
- **cultivated and utilized drawing on indigenous knowledge:** cultivation and use can be enhanced by using farmer-based knowledge and by introducing innovative cultivation practices. Unfortunately, processes such as urbanization and changing farming methods are contributing to the rapid erosion of traditional knowledge;
- **hardly represented in *ex situ* gene banks:** efforts are needed to rescue and conserve the genetic diversity of underutilized species. Without characterization and evaluation the useful variation of these species will remain poorly understood. It is important to combine *ex-situ* with *in-situ* (on-farm) conservation efforts as large-scale conservation efforts are unlikely to be made for these species. A "conservation through use" approach, therefore, becomes particularly important;
- **characterized by fragile or non-existent seed supply systems:** efforts need to be made to provide planting material to farmers in order to make the cultivation of underutilized species more feasible and sustainable over time.

New approaches

There are several strategic factors that need to be taken into account if we are to successfully promote underutilized species and, at the same time, ensure that benefits are equally shared among community members. These include:

- **focusing on local values, indigenous knowledge and uses:** such an approach will strengthen the link between diversity and sustainable uses and is important in considering marketability;
- **recognizing underutilized species as a public good** to ensure the continued availability and accessibility of plant genetic material to present and future generations;
- **focus on groups of species as models through case-study approaches** to make the best use of limited resources and facilitate for scaling-up and mainstreaming results;
- **promote cooperation among stakeholder groups and create national, regional and international synergies:** this is not an option but a necessity, isolated efforts and success stories need to be linked and disseminated;
- **analyze and enhance demand using market-oriented strategies:** such an approach will create sustainable markets and reduce the risk of over-estimating economic potential;
- **empower rural poor and strengthen their capacity to negotiate with the private sector and government:** such interventions will ensure that the poor and underprivileged receive their rightful share of the benefits resulting from our promotion process. This is an important part of the livelihood approach and essential because many underutilized species are cultivated in poor areas where they represent one of the few - if not the only - asset of the local community;
- **mainstream gender-sensitive approaches in management and use:** these will allow groups like women - who are too often marginalized - to enhance their capacity to manage, conserve and use underutilized species in a sustainable way and - in doing so - strengthen their economic status;
- **inter-disciplinary work:** such an approach is critical if the opportunities of underutilized species - including nutritional, economic and social aspects - are to be tapped at all levels.

The tools and methods used to pursue such an agenda must be relatively simple and inexpensive given that underutilized species have a low priority amongst policy makers and that there are

Photo: Anita Ingevall



Field intercropped with peas, beans and quinoa, Pitumarca, Peru.

limited resources for their development. Partnerships need to be built amongst stakeholders involved in the collection, conservation, use, enhancement, marketing and commercialization of underutilized species. A participatory approach is essential in ensuring that local actors' needs are adequately addressed. In this process policy makers should be involved because they have an important contribution to make in institutionalizing work on underutilized species and in helping to protect local communities trying to realize benefits from local agrobiodiversity.

Moving forward

The *International Plant Genetic Resources Institute* (IPGRI) in close cooperation with the *Global Facilitation Unit for Underutilized Species* (GFU) is actively engaged in several initiatives aimed at enhancing the use of underutilized species to realize social and economic benefits that will improve the living conditions of people worldwide. More information on these activities can be accessed through IPGRI's web page on neglected and underutilized species at www.ipgri.cgiar.org/nus/ and the GFU website www.underutilized-species.org/

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Underutilized species and new challenges in global health

Timothy Johns

Underutilized crops make important contributions to the nutrition and health of people in developing countries. Whereas these potential benefits provide a good reason for conserving agrobiodiversity, this link receives little attention nationally and internationally. However, as the growing dependence of populations worldwide on a few staple crops leads to increasing health problems, more attention is being given to biodiversity and the interdependence between human and environmental health.

The *International Plant Genetic Resources Institute* (IPGRI) is concerned with the maintenance and use of plant genetic resources for food and agriculture. A recent initiative *Dietary diversity: a challenge linking human health with plant genetic resources* emphasizes nutrition and health. As threats to biological diversity accelerate, the plant genetic resources that guarantee the current and future production of healthy foods, beverages and medicines must be better used to improve the well-being of those whose food security and health is at risk.

Biodiversity ignored

Biodiversity often has a low priority on the development agenda. While different sectors and institutions concerned with health, agriculture, environment or economic development may be committed to sustainable food production and consumption, they approach development problems in different ways.

Nutritionists emphasize the importance of deficiencies in micro-nutrients such as iron, Vitamin A, iodine and zinc - so-called hidden hunger - to diet quality and disease resistance. In Latin America, South Asia and Sub-Saharan Africa supplements and food fortification dominate nutrition programmes. Common treatments include extra doses of vitamin A and fortifying staple foods such as wheat, maize flour or sugar with iron to prevent anaemia. While very effective in many cases, these measures are difficult to sustain.

Even food-based approaches tend to focus on a few, often-exotic species such as carrots and sweet potatoes with recognized nutrient values. Nutritionists' preoccupation with single nutrients has led to new efforts to biofortify staple crops such as rice or wheat with nutrients like beta-carotene and zinc through genetic modification. While offering potential new tools for solving specific malnutrition problems, these approaches treat nutrition simplistically. They ignore both the physiological and socio-cultural reasons that favour diets balanced by a variety of quality foods.

Underutilized crop species are often viewed as irrelevant and uneconomic solutions to global nutrition problems. Wild and cultivated biodiversity is ignored in dietary surveys, laboratory analyses of food composition, FAO Food Balance Sheets on national food consumption and in policy and decision-making. However, underutilized crops do make essential contributions to adequate diets. Studies on home gardens, for instance, clearly link diversity and nutritional status. Fruits, minor vegetables, sauce ingredients, condiments, spices and medicines grown in small quantities are inexpensive and healthy complements to diets that would otherwise be predominantly carbohydrate.

Changing needs and attitudes

Increasing attention to the importance of agrobiodiversity might be seen as an unexpected consequence of modern agricultural success. The widespread availability of high-energy staple foods such as rice, wheat, edible oil and sugar at relatively low cost has contributed to a double health burden in developing countries. Nutrient deficiencies increasingly co-exist with obesity and diseases such as diabetes and heart disease in many parts of the world.

A diet that includes fruits, vegetables, legumes, coarse cereals and animal protein contributes to health. Most essential nutrient deficiencies can be eliminated by small increases in the variety of food consumed. Many underutilized species, like the beta-carotene rich palm fruits from Brazil, are rich in nutrients. Millet is a good source of iron, and the recent decline in the consumption of millet couscous in Senegal, for example, in favour of less expensive imported rice can be associated with an increase in iron-deficiency anaemia.

Moreover, a growing number of medical studies demonstrate that optimal health requires more than just essential nutrients. Such findings emphasize the potential value of underutilized species. Foods derived from buckwheat and finger millet, for example, reduce the risk of heart disease while bitter melon and fenugreek contain compounds that directly improve the body's ability to respond to insulin. The benefits of leafy vegetables and other plants containing carotenoids such as lycopene and lutein are also well recognized. These carotenoids have no nutrient value but they do act as antioxidants and help prevent damage to cells and tissues.

At the *World Summit of Sustainable Development* there was a call to adopt a holistic approach to securing the sustainability of biodiversity, water, energy, health and agriculture. Dietary diversity is not a medical, conservation or economic issue alone and this is reflected, for example, in IPGRI's current approach to promoting the benefits of underutilized species for rural and urban consumers through multi-disciplinary partnerships. ■

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Roselle in Senegal and Mali

Nathan McClintock

Whenever a bus or taxi rolls to a stop during a trip anywhere in Mali, a crowd of young girls and women selling snacks and beverages is sure to quickly surround the vehicle. “*Ji suma bè! Da bilenni bè!* There’s cold water! There’s *da bilenni!*” For CFA25 (US\$0.05), passengers can buy a little plastic bag of the frozen - but quickly melting - beverage. On a hot day, you might see an entire bus load of passengers sucking the sweet, dark red juice from the bags.

The red juice is extracted from *Hibiscus sabdariffa*. Choosing a name in layman’s terms is not easy. In Bambara/Dioula spoken in Mali, Burkina Faso, and Ivory Coast, the red beverage is called *da bilenni*, the plant itself, *da*. In neighbouring Senegal it is known by its Wolof name, *bissap*. In French, *oseille de Guinée*, in Spanish, *Flor de Jamaica*, and across North Africa, *karkadé*. In English, the most common names are roselle and sorrel.



Green calyx of roselle.

A stroll through any peanut field in Senegal or Mali will provide glimpses of this multi-functional plant whose origins are much disputed. While many wild varieties can be found in Senegal and Mali, the varieties most commonly cultivated are the red-stemmed *ruber*, and the greenish-yellow *albus*. A taller, woodier variety is also grown for its fibres. The climate of the Sudanian agroecological zone stretching across West Africa is ideal for roselle production. The plant needs between 800 to 1600 mm of continuous rainfall, with a minimum of 100 to 150 mm per month during its vegetative growth. It is a short-day plant and requires temperatures between 18 and 35° C. Roselle can grow to heights of 2.5 m, though it rarely reaches this height under cultivation. Across West Africa, roselle is intercropped with other staple crops. While not among the primary food crops grown, it fills various spatial, temporal, ecological, dietary, medicinal, economic and cultural niches in the region’s farming systems and diets.

Roselle in the diet

First and foremost, roselle fills an important dietary niche as an ingredient in sauces. In rural Mali, green leaf sauces are an

important part of the daily diet of farmers and their families. Meat and fish are luxury items, enjoyed now and again or on special occasions. By and large, diets are carbohydrate heavy – the national dish *tô* is a congealed porridge made from maize or millet that is dipped in a watery sauce made of leaves or onions and dried mudfish (*manògò*). Leaf sauces are usually based on roselle, baobab (*Adansonia digitata*), amaranth (*Amaranthus* spp.) or bean leaves. In southern Mali, baobab trees are a communal resource and, therefore, the quantity one family is allowed to harvest is limited. A field crop such as roselle or amaranth, on the other hand, is individual property and families can harvest as much as they need.

Farmers begin to harvest roselle leaves for use in sauces six to eight weeks after planting. They usually harvest leaves two or three times during the five to six month growth cycle, as pruning increases the number of flowering shoots. Once the plant matures, the 3 - 6 cm long seed capsule, or calyx, is harvested. An average plant may yield between 1 - 1.4 kg of calyces. The *ruber* or “red roselle” is the most common variety and its calyces are readily available in local markets, but also the yellowish-green calyces of the *albus* or “white roselle” are used for sauces. Both in Mali and Senegal, red and white roselle are generally interspersed in the field, and then separated at harvest. In Senegal, average calyx yields are around 4600 kg/ha fresh weight, or 740 kg/ha dry. Researchers in Nigeria found that roselle yields were greatest when intercropped with legumes such as cowpea and peanuts.

In Senegal, white roselle calyces are cooked down to make a thick, sour sauce called *bèkèj*, served with the national dish, *céebu jën* (rice with fish). In rural areas, prior to harvesting, the calyx, both red and white roselle leaves and stems are sautéed in oil and served with *céebu wéx* (fried rice with vegetables). In Mali, roselle leaves are boiled down to make sauce for *tô*. Later in the season, white roselle calyces may be added to fish sauces eaten with rice or *tô*.

Roselle is rich in iron, phosphorus and calcium. The protein content of fresh calyces ranges from 1.5 - 3.5% and seed protein is nearly 17%. Fat concentration is between 1 - 2% and sugar content is high, around 12%. Roselle also has a number of medicinal uses. In Africa, India, and Mexico it is used to treat high blood pressure. Salves made from the herbage are used to heal sores and ulcers. Many of these medicinal uses can be attributed to the high concentrations of malic, ascorbic, and especially citric acids in roselle. Across southern Mali, people recognize its restorative powers. People say: “If you catch a cold, you should drink *da bilenni* to get better and it cleans the blood.”

Roselle as a crop

Roselle provides food throughout the latter half of the year, since farmers can harvest roselle for sauce both during its vegetative stage and at maturity. It matures after the end of the rainy season at a time when other important rainy season foods are becoming scarce and before cool season irrigated vegetables and amaranth become available. In many fields in both countries, roselle plants remain green for several weeks following the harvest of the primary field crops of peanuts, millet, beans or sorghum. By straddling the two cropping periods, it meets the need for green leaves for sauces at a time when other food crops are unavailable.

Roselle will also grow in places where other field crops are likely to do badly and farmers often plant it along field boundaries. Madame Ngom, a Wolof farmer interviewed in Thiawène, in the heart of Senegal's Peanut Basin, described a system of using roselle to divide 10 - 20 m strips of peanuts. Elsewhere in the village, long lines of roselle border fields of cowpea (*Vigna unguiculata*).

Farmers also grow it because it requires little attention. It grows vigorously, yet is rarely invasive. In Keur Banda, Ibrahim Niang grows roselle in clusters throughout his peanut fields. While he planted some of these plants intentionally, many are volunteer plants that he has left and allowed to grow. "When they come up by themselves, I just leave them alone!" Volunteer roselle is a common sight in most millet, sorghum, peanut, and cowpea fields in the Sudanian zone of West Africa. Farmers consider this "free food" - it requires no planting, labour or attention, apart from harvesting the leaves or calyces when needed. After the calyx and seed have been harvested, farmers sometimes collect the stalks and use their fibre to make ropes for tying thatch, fencing gardens and weaving fishing nets. Roselle yields as much as 1 - 1.5 tons of fibre per hectare dry weight.

Farmers in southern Mali also use roselle to demarcate field boundaries or sub-plots. In the village of Dialakoroba, farmer Birama Koné for example uses roselle to separate his sorghum field into a grid of 5 x 5 m. Within these squares, he plants peanuts between sorghum plants. He claims that his system of intercropping has improved his yields. "My father thinks it's bad, that it will reduce the yield, but I've had better yields than he has since I started planting things together." When asked where he learned to intercrop, he laughed and said, "I don't know, I just started experimenting."



Intercropping peanut and roselle under *Acacia albida*. Farmer Ibrahim Niang and technician Oury Diallo in Keur Banda, Senegal.



Photo: Author

Roselle leaves are used for many purposes.

He is not alone. Intercropping, particularly with roselle, is common throughout Mali. Another Dialakoroba farmer, Noumoutie Koné, intercroops peanuts both with clusters and rows of roselle. He has also integrated small hills of sweet potato (*Ipomoea batatas*) into his peanut fields. Typical of the parkland agroforestry practised throughout the Sahel, his fields lie in the middle of a small group of baobab trees. Other tree species integrated into the farming systems of southern Mali are *shea* (*Vitellaria paradoxa*), *nèrè* (*Parkia biglobosa*) and *jujube* (*Ziziphus mauritiana*) the fruits of which are important sources of energy in the Malian diet. In Senegal's Peanut Basin, baobabs and the nitrogen-fixing *Acacia albida* are commonplace in fields intercropped with roselle, peanuts and millet.

Such biological diversity is critical in the resource poor Sudanian zone. Indeed, intercropping is widespread across West Africa and practised on 80% of the farmland. On the degraded soils of the semi-arid savanna, where fertilizer use is both costly and inefficient, yields are mostly a function of rainfall. In times of drought, when cereal crops may fail, a diversity of crops in the farming system guarantees a minimum of food and financial security. Intercropping serves as a buffer against the extreme climatic variability of the Sahel, improving the resilience and stability of the region's agriculture. The numerous benefits of intercropping - including nitrogen-fixation, erosion control, moisture retention, weed control, and the reduction of soil surface temperature - give resource-poor farmers a good ecological alternative to costly inputs.

Not much is known about the interaction between roselle and other flora and fauna in this region. Its canopy is lower than that of a grain crop such as millet and higher than legumes such as beans or peanuts. Research has revealed that diverse crop canopy heights attract beneficial insects - which help control pests - and it is possible that roselle's sticky calyces may contribute to this. Its growth may benefit from the so-called "edge effect" when planted on a field's boundary. At the field edge, a crop receives more light and is not shaded by any companion crop on the outer side. As it is a different species from the crop grown in the field, it is not competing for the same nutrients at the same time. Because it does not grow very high, it

Photo: Author

will not compete with other crops for light. It may also act as a physical barrier slowing the spread of weeds, pests and pathogens.

Generating income

For African women, access to land and labour are often factors that limit their farming activities. However, since roselle can be farmed along the boundary of a field, a husband will often allow his wife to use what would otherwise be wasted space. For women farming in urban, peri-urban, and rural areas with regular access to markets, the economic benefits of roselle production are considerable. Huge quantities are sold at markets throughout Senegal and Mali. Women and girls generally benefit from these sales, since they are often the ones growing the crop. More importantly, however, the sale of value-added

and juice in the markets of both countries shows it plays a significant role.

With a changing global economy demanding specialization for agricultural exports, male and female farmers alike will be pushed towards export cash cropping. There is potential for roselle in this market too, but unlike the cotton grown in this part of West Africa, roselle can also be consumed for subsistence and sold locally. As cotton prices continue to fall, several Malian farmers interviewed in Dialakoroba have reduced their area of cotton to increase their cultivation of other cash and food crops such as roselle. Fluctuations in peanut prices in Senegal have led farmers, interviewed in several Peanut Basin villages, to intensify production of secondary crops such as roselle.

Roselle's rich red colour has led to its widespread use in Europe as a natural colouring agent in foods. The nutritional content and its medicinal properties have also brought it to the attention of Western consumers. Europe is the largest importer of roselle, with Germany importing 80% or 3000 tons annually, at US\$2500 a ton. Sudan, Mexico and Egypt are major exporters of roselle.

In conclusion, the little red and green calyces and leaves of roselle fill several important agroecological, economic, and dietary niches in the food and farming systems of Senegal and Mali. Roselle's role, while understated and subtle, has widespread implications for farmers like Birama Koné and Ibrahim Niang. Women farmers like Madame Ngom, in particular, profit from roselle sales in local markets across West Africa. While some of these niches could be filled by other crops, roselle's prominence in the cultural and food traditions of several West African societies is irreplaceable. Roselle's integral role in the farming systems of the Sahelian sub-region of West Africa may be used as a model for intercropping projects in tropical farming systems elsewhere in the world, providing both food and fibre to farmers, while improving crop diversity and filling ecological and economic niches in both cash and subsistence agriculture. By promoting the use of this underutilized species, extension workers can help diversify farming systems throughout the tropics, thereby increasing food and economic security on marginal lands.



Roselle intercropped with cowpea. Farmer Ibra Diop in Thiawene, Senegal.

Photo: Author

roselle products such as *da bilenni* (juice/syrup) provides revenue that is directly controlled by women. Food preparation is culturally a woman's domain, so many women are able to earn money by cooking and selling foods on market days - bean fritters, fried plantains or boiled cassava, among others. Roselle juice and syrup sales play an important part in these small-scale trading activities. Red roselle calyces are boiled in water for several hours to extract the dark red colour, often at a ratio of 1 kg of calyces to 5 litres of water and large amounts of sugar are added to reduce the sour flavour. Women and girls then sell the concentrate in recycled spring water bottles. To make *da bilenni*, they water down the syrup, sometimes mixing in mint or ginger, and refrigerate or freeze it in small plastic sacks. A French study estimated that one person could produce about 300 litres per day, using 1 kg of roselle for each 80 litres of *da bilenni*. While the actual economic importance of roselle to the livelihoods of Malian and Senegalese women has yet to be quantified, the high visibility of women selling roselle calyces

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Additional online resources

<http://www.herbs.org/africa/hibiscus.html>



One of the many varieties of cañahua.

Cañahua deserves to come back

Adriana Woods Páez and Pablo Eyzaguirre

In the harsh and unpredictable upland plains (*altiplanos*) of Peru and Bolivia, cañahua (*Chenopodium pallidicaule*) has flourished and diversified where few other crops can grow. The grain grows well between 3500 - 4100 m and is highly resistant to frost, drought, salty soil and pests. Cañahua requires little care in the field, but harvesting and processing is laborious. Although the Aymara and Quechua communities who live in the region have been growing cañahua for centuries, the area under cañahua cultivation is decreasing and the future of the crop is uncertain.

A downward spiral

Indigenous Andean crops have been declining in importance ever since the time of Spanish colonization. Over the last 400 years new, foreign crops have been introduced and plants that have been the staple food of the poor for centuries have suffered a serious decline in social status. Traditional food ingredients of high quality have been, and continue to be, replaced by low-cost products such as rice and pasta. At the same time rural communities are being marginalized and pressured to grow other crops or so-called "improved" varieties. These negative impacts on the cultivation and consumption of

indigenous Andean crops combined with socio-economic pressures such as urban migration and the absence of a steady market have further weakened their position.

In the past cañahua has been considered a weed, misrepresented as a wild variety of quinoa, and, when confused with this crop, even banned from agriculture. Cañahua has a great variety of local names depending on the region and its language as well as the plant's variety and form. Some of the names by which it is known include *isawalla hupa*, *ahara hupa*, *ajara*, and *cañahua* in Aymara; *cuchiquinua*, *ayara*, *quitacañagua*, and *kañagua* in Quechua, and *cañigua*, *cañagua*, *cañihua*, or *cañahua* in Spanish. Its many names have only added to the confusion surrounding its identity and value, but at the same time they reflect its historical importance as a crop with a deep cultural value.

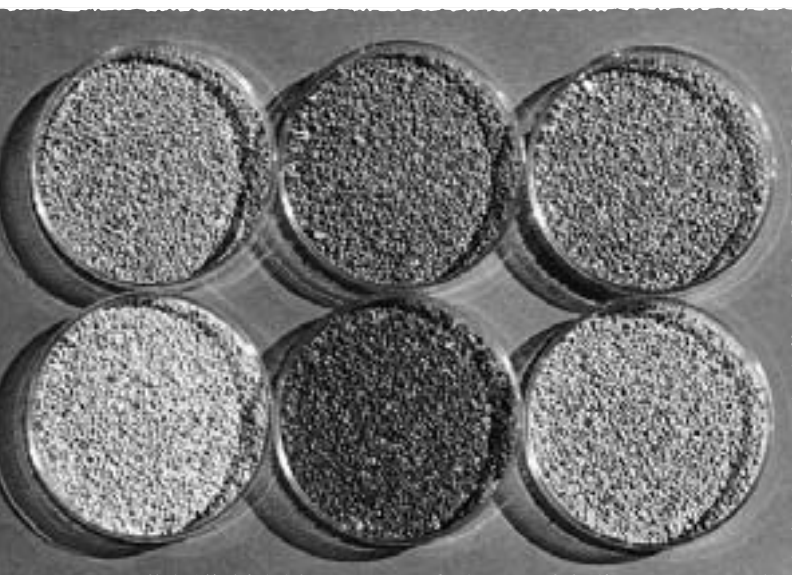
Characteristics

Cañahua is a highly variable, self-pollinating annual plant that can reach a height of 20 - 60 cm. It produces numerous seeds of about one millimetre in size and there are several varieties, each with their own plant shape and seed colour. Sowing is usually done by broadcasting unselected seed that may be a mixture of several different cañahua types. Depending on the variety or

varieties used, the plant takes between 95 - 150 days to grow and mature. Harvesting and post-harvesting processes such as threshing, sieving, airing, cleaning, and drying the seeds are time-consuming. However, quinoa, another Andean grain which has regained some popularity is also difficult to prepare and it does not have the advantage of cañahua whose seed coat contains only a low level of the bitter tasting saponins. This means it is quicker and cheaper to process cañahua into useable flour than it is to process quinoa.

Traditional use

In the high Andes, cañahua provides a reliable source of food and forage and also acts as a safety net when other crops fail. In the Department of Puno in southern Peru, cañahua is commonly grown alongside less hardy staple crops like potatoes and cereals. Although the resilient cañahua plant is primarily grown as a food crop, the calcium rich leaves are an important supplementary source of animal feed, especially in drought-prone areas where forage and feed is often inadequate.



Variability of cañahua seeds.

Culturally, cañahua grain has not been considered a substitute for potatoes or quinoa. Rather, it is valued as a supplement that enhances the taste, texture, and nutrition of other foods. In traditional food culture, the grain is most often converted into *cañiwako* flour that can be consumed with sugar, milk, and/or water, added to soups, or mixed with wheat flour to make bread, noodles, pastries, and snacks. *Cañiwako* flour and products with cañahua ingredients are marketed on a national scale in supermarkets, restaurants and street markets. The grain is also used to make a hot chocolate-type drink that is sold on the streets of cities such as Puno and Cuzco. Cañahua's role as a supplement does not mean that it is unimportant in Andean food culture, on the contrary its high nutritional value is well recognized.

Cañahua also has medical properties. Pulverized cañahua seeds dissolved in a water-vinegar mixture are used to treat typhoid fever, and toasted *cañiwako* is regarded as being an effective counter to altitude sickness and dysentery. Cañahua flour can be consumed by people who are allergic to gluten and who cannot eat products made with wheat, rye, barley or oats. In addition, the ash from its stalks and stems can be used as an insect repellent. Indigenous Bolivian and Peruvian highlanders burn

the residual biomass from threshed grain and use the ash produced to make *llipta*, a calcium-rich paste used by coca-leaf chewers.

Healthy food

Cañahua's high nutritional value together with its medicinal properties have contributed to its survival despite increasingly unfavourable socioeconomic circumstances. The grain is an important source of protein and has traditionally been a vital alternative source to meat and milk products in the rural areas of the high Andes. Its balanced composition of amino acids is similar to the composition of the casein milk protein and traditionally it is used in weaning mixtures. The grain also has high levels of dietary fibre, iron, unsaturated fats, and sugar.

Studies are beginning to show that the decrease in traditional Andean crop cultivation and use is having a negative health effect on rural communities in the region. Infants and children are no longer getting the nutrients provided by the traditional Andes diet, and changing food habits in general have led to an increase in obesity, diabetes, and arteriosclerosis amongst adults. High levels of anaemia (a blood disorder) due to iron deficiency have been found among women in the highland plains of Peru, a condition that could be cured if cañahua and Vitamin C - to help the body absorb the additional iron - were added to their diets.

Revitalization strategies

A secure future for cañahua diversity depends on its continued use. This in turn depends upon the recognition and affirmation of the crop's nutritional, economic, and cultural benefits. One essential component of cañahua "revitalization" is the promotion of its consumption and the development of a strategy that would support its cultivation. Educational campaigns that make urban and rural people aware of the importance of Andean food products need to be developed and implemented. Local institutions like mothers' clubs, communal dining centres, and local schools can play an important role in promoting crops like cañahua.

Changes are also necessary at policy level. The modification of national food policy in order to be more supportive of Andean crops is important. If government agencies guaranteed minimum prices to producers and regular price-controlled supplies to consumers, cañahua would have a better market chance. Also, international and nationally administered food aid programmes should base their activities on local food products and not on poor quality leftovers from developed countries. This would have a strengthening rather than a destabilizing effect on local production.

The decreased use of cañahua is in part due to limited access and supply. According to Macedo (2003), the production of Andean grains and tubers is insufficient to meet increasing urban demand and as a result consumers have turned to industrialized food products. This is particularly so in urban centres where indigenous people, who have recently migrated from the rural areas, may want to buy traditional products but are frustrated by inadequate and infrequent supplies, the poor selection and high prices. It can be concluded that any strategy for the conservation of cañahua genetic diversity must include mechanisms that ensure constant and affordable supplies.

Precautions

In spite of centuries of neglect, cañahua has maintained its functional identity as a tasty and nutritious supplementary

Photo: W. Rojas



Cañahua field in Bolivia.

Photo: W. Rojas

ingredient to many Andean dishes and drinks. Sadly, this identity is fading. Studies that locate the cultural factors that have led to decreased cultivation and consumption of cañahua are urgently needed. Future scientific research and commercial development on cañahua varieties must be done in culturally relevant and respectful ways. Intensive production and/or monocultures of cañahua would misrepresent its functional identity in Andean food culture. Regardless of how much

scientific, legal, and marketing improvements are made, cañahua will not flourish without the cultural support of its producers and users.

Recognition of cañahua as a neglected and underutilized crop is well overdue. However, any attempt to increase availability through commercialization that depends on the exploitation of only a few varieties is undesirable. This would have a negative effect on attempts to protect and use the full range of the plant's genetic diversity. It would be ironic if cañahua varieties that are so resilient to the natural elements should perish from neglect or too much favouritism.

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Genetic erosion of cañahua

Wilfredo Rojas, Milton Pinto and José Luis Soto

In Bolivia, cañahua is mainly grown around Lake Titicaca and in the high areas of Cochabamba. These regions are considered the centre of the crop's origin and diversity. However, the production area is so small that the crop is not even mentioned in the annual agricultural census of the country.

PROINPA, a foundation for promotion and research on Andean grains, based in Cochabamba, Bolivia, recently carried out a survey amongst 467 families in the Lake Titicaca area, with the purpose of studying the current state of the crop. Only 105 families (22% of the total) indicated that they grow cañahua. When asked to list the crops in terms of preference, cañahua was positioned at best in third place after potato and broad bean (*Vicia faba*) or oca tubers (*Oxalis tuberosa*) and at worse sixth. The following reasons were given for not growing more cañahua: lack of seeds, not enough land, harvesting difficulties and the lack of proper crop management technologies.

The survey also showed that on average, 84% of the crop yield is meant for own consumption, 8% is sold, 6% is kept for seed and 1% is exchanged. Big families as well as families headed by older people tend to grow more varieties and to

cultivate larger areas of cañahua. They also sell a higher proportion of the yield.

Only 20 different varieties of cañahua were being grown by the families surveyed and the number grown by individual families varied from one to three. Results showed that 85% of farmers only grew one variety which gives an indication of the extent to which genetic diversity in the region has been reduced. The most popular variety is grown by 22% of the families. However, there are thirteen varieties that are grown by four families or less. These can be considered critically endangered and immediate action is necessary to avoid their permanent loss.

In order to avoid the loss of this Andean grain, participatory studies to evaluate reasons for decline, farmers' preferences and the potential for its revival are required. It is also necessary to promote the use of the *Banco Nacional de Granos Andinos* in order to increase the use and diversity of cañahua varieties.

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Farmers evaluating quinoa varieties in field plots.

Growing and marketing Andean grains

José-Luis Soto, Wilfredo Rojas and Milton Pinto

Quinoa (*Chenopodium quinoa*) and cañahua (*Chenopodium pallidicaule*) are traditional grain crops in the high Andes and grow at altitudes of between 3000 - 4000 metres. They used to be the main source of nutrition for the indigenous Aymara and Quechua communities but during the last few centuries the area planted with these crops has declined dramatically. However, Andean grains still have a strategic value for people in Peru and Bolivia because of their high nutritional value. Their protein content for example is between 12 - 21% which is higher than wheat. Recently, the food industry has become interested in them because of growing consumer demand for products derived from these grains.

Bolivia is the main producer of quinoa and the area under quinoa cultivation is estimated to be 35,700 hectares. Approximately 65% is grown for own consumption and 35% is sold on the national and international markets. The area under cañahua cultivation is much smaller: between 1000 - 1500 hectares. About 85% of cañahua is grown for own consumption.

The Bolivian Foundation PROINPA is a research institution that promotes the cultivation of Andean grain crops. Its objective is to contribute to achieving food security by promoting the better conservation and use of different varieties of these crops. The foundation assists farmers obtain more benefits from quinoa and cañahua at two levels: domestic consumption and production for market.

Promising varieties

At present, farmers use a number of varieties. Many other varieties are stored at the *Banco Nacional de Granos Andinos* and are also available to farmers. In addition, PROINPA has its own improvement programme for Andean grains. It is important

that farmers are aware of all the different varieties available so they can make the most appropriate choice for their situation.

In 2002, PROINPA decided to carry out a participatory evaluation exercise with farmers on a number of the varieties in the national germplasm bank's collection, as well as with promising varieties from the PROINPA's crop breeding programme. The aim was to give researchers feedback on what criteria farmers use for selecting varieties and to let farmers see the different varieties available.

In the La Paz district of Bolivia, communities were selected for this exercise on the basis of their interest in growing quinoa and cañahua and their potential to produce these crops. Five communities participated in the evaluation of quinoa, and four communities in the evaluation of cañahua varieties. Farmer field schools were set up and demonstration plots were established with a number of varieties. A number of male and female farmers participating in the Farmer Field Schools were selected to carry out the evaluations. The farmers evaluated three features: the plant at flowering stage, the harvested grains and cooking properties.

At the flowering stage, researchers found that farmers' selection criteria related to:

- plant size (preferred sizes: 90 cm for quinoa and 30 cm for cañahua);
- uniform development;
- number of side branches (lower number preferred);
- characteristics of the flowering part (big and/or well-loaded inflorescence preferred);
- ease of harvesting (in the case of cañahua upright varieties preferred);
- time of maturity (early maturity preferred).

Farmers reported that plants with these characteristics could be expected to grow well and be less vulnerable to frost and hail.

It also appeared that farmers preferred sweet quinoa varieties. These contain much lower quantities of a substance called saponins, which give a bitter flavour. Saponins are removed by repeatedly washing the grains, and this work requires much less time in the case of sweet quinoa. However, farmers recognized that sweet varieties were more prone to attack by birds.

With regard to the evaluation of the quinoa grain, the farmers prefer large grain size and a white colour, arguing that large white grains were much in demand at communal fairs and fetched a higher price. Women farmers liked the coloured grains because they provide the dyes they use for colouring wool. In the case of cañahua, male as well as female farmers preferred light-coloured grains, because these were considered best for making ground and toasted cañahua flour called “pito”.

The cooking properties of different varieties were evaluated by preparing traditional quinoa dishes like “p’esque” (quinoa grains boiled in unsalted water and served with milk or cheese) and “quispiña” (a type of steamed bread). The farmers evaluated the cooking qualities of the grains and the flavour, colour and mildness of the dishes.

The selection of promising varieties through participatory evaluations was considered successful and it is planned to continue this in other communities in the upland plains of Bolivia.

Marketing

At present, quinoa and cañahua grains are sold at local markets. There the product is usually bought cheaply by informal middlemen, who sell it again for a profit. However, there is a growing demand for products made of quinoa and cañahua. The small agroindustry is demanding larger quantities of these grains, but often there is not enough good quality grain available. Frequently, the quinoa and cañahua offered by farmers contain

impurities - sometimes amounting to 12 - 15% of total weight - and supplies are irregular and small. In the words of a food manufacturer: “... It is very difficult to get good produce, because of the high degree of impurities like stones, which damage the machines. Because of the impurities, the weight of the clean product is low, which means that we hardly get any profits because of the high processing costs”.

PROINPA is trying to link the producers with the small but emerging agroindustrial sector in the region and to strengthen the production chain in order to increase benefits both to farmers and small-scale entrepreneurs. A project aimed at increasing the role of forgotten and underutilized species in food security and income generation of poor rural communities is being implemented with the support of the *International Plant Genetic Resources Institute* (IPGRI) and the *International Fund for Agricultural Development* (IFAD).

Food industry

In 2003, in order to achieve a direct link between small agro-industry and quinoa producers, PROINPA organized a visit by farmers in the Jalsuri community to a Bolivian company - the *Procesadora de Cereales Andina* - that processes Andean grains. Later, the company’s manager visited the community and saw how the different varieties - each with its own characteristics - were being grown in the field. During both visits there was an exchange of information about quinoa growing and processing. A round table discussion between the interested parties was organized in order to define the price of the quinoa sold, place and conditions of delivery, frequency of delivery and payments. This led to the signing of a contract between the *Jalsuri Irpa Chico*, the farmers’ cooperative, and *Procesadora de Cereales Andina*, in which the farmers committed themselves to increase the area of quinoa and to improve the quality of the product. *Procesadora de Cereales Andina* committed itself to buying all the produce the farmers could offer for a higher price than they would receive on the local market. PROINPA remains involved in this agreement because it offers technical assistance to the farmers to help them obtain a good quality final product.

So far 27 farmer families belonging to the Cooperative have sold high quality quinoa at prices that exceed the local market price by as much as 25% and the company is satisfied with a supply that helps it meet consumer demand for such items as quinoa flakes. This pilot experience was implemented with the active participation of farmers and processors. Future activities might focus on involving other actors in the production chain as well.



Farmers evaluate quinoa dishes.

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Fonio: a small grain with potential

Jean-François Cruz

Fonio (*Digitaria exilis*), a small cereal from West Africa, is much loved by farmers and consumers because of its many advantages. Fonio has a short growing season and is well adjusted to harsh environments. The cereal has excellent culinary and nutritional properties. The only drawback is that the grains are tiny and difficult to peel, which makes processing a tedious job. These difficulties have reduced the crop to a marginal cereal. However, efforts are now being made to develop equipment that will facilitate the processing of fonio.

Old and robust

Fonio is possibly the oldest indigenous cereal cultivated in West Africa. The domestication of fonio seems to go back 7000 years, but the first references to fonio as food date from the fourteenth century. The Dogons of Mali, an ancient people, refer to the fonio seed as “the germ of the world”. They believed that the whole universe emerged from the fonio seed – the smallest object known.

Nowadays, fonio still grows in farmers’ fields over a vast area extending from Senegal to Chad. Fonio is a staple food for many rural communities, especially for communities in the mountainous areas of the Fouta Djallon in Guinea. Farmers in Mali, Burkina Faso, Ivory Coast, Nigeria and Senegal also cultivate the small cereal. West African farmers mainly cultivate white fonio (*Digitaria exilis*), which is also called *fundi*, *findi*, *acha* or “hungry rice”. In Nigeria, farmers grow black fonio (*Digitaria iburua*) as well. In Guinea, farmers also occasionally plant the so-called “fonio with large seeds” (*Brachiaria deflexa*) but this is, in fact, a different species.

The production of fonio declined sharply in the 1960s but began to recover twenty years later. The increase in production can be attributed to larger areas being cultivated. Although average production per hectare remains relatively low, it has remained consistent at 600 - 700 kg/ha. At present fonio is grown on more than 380,000 ha and produces 250,000 tons of grain annually. Fonio supplies food to several million people during the most difficult months of the year when other food resources are scarce.

Fonio cropping cycles vary from 70 to 150 days depending on the variety. Varieties with a very short cycle (70 - 85 days) allow the farmers to harvest early and enable them to cover the critical “hunger” season before the major food crops can be harvested. Farmers generally cultivate fonio on light sandy or stony soils as the crop is not very demanding. The late varieties, in particular, are well adjusted to poor soils. This small grass, which reaches heights of 30 - 80 cm, is very robust and can resist periods of droughts and heavy rains.



Photo: Author

Farmer harvesting fonio.

Tasty and healthy

In West Africa fonio is considered to be the tastiest of all cereals. Serving fonio as a dish at festivals or important ceremonies is always a good choice because of its fine and delicate taste. As a popular proverb says “Fonio never embarrasses the cook”. Fonio is also known for its nutritional properties. Although the protein content of fonio is similar or slightly lower than that of other grains, it contains amino acids like methionine and cystine which are essential to human health. These are often deficient in today’s major cereals. As fonio is known to be easy to digest, it is traditionally recommended for children, old people who cannot digest other cereals, sick people and for people suffering from diabetes or stomach diseases. Local pharmacists also recommend fonio for people who want to lose weight.

Fonio, regarded as a minor cereal for a long time and referred to as the “cereal of the poor”, is attracting renewed interest in the urban areas of West Africa because of its cooking and nutritional qualities. Agricultural policies in the region are also changing in favour of traditional crops to try and decrease dependency on imported food products.

Difficult processing

In order to meet the needs of urban households, small enterprises, set up by artisans' or women's groups, have recently started to sell already-cleaned fonio in the markets. In Mali, Burkina Faso, Guinea and Senegal, small businesses are marketing pre-cooked fonio packed in plastic bags of 500 grams or one kilo. These products are distributed to groceries and supermarkets and are even exported to Europe and the United States. However, the price of fonio prepared in this way is high because the grain has to be prepared manually and this is a long process.

Processing fonio is a difficult and time-consuming task because of the extremely small size of the grain. One gram of fonio contains nearly 2000 grains and each egg-shaped grain is only about 1 - 1.5 mm long. After threshing, the grain is still surrounded by husks. This product is called "fonio paddy" or "raw fonio". Like rice, processing paddy into whitened fonio is done in two stages. The first stage, known as dehusking or peeling, involves removing the husks from the seed to obtain the dehusked grain. The second stage, known as whitening, aims to remove the bran (the pericarp and the germ) from the grain. Dehusking and whitening of the grain is done by hand and require four to five successive beatings using a pestle and a mortar alternated with as many winnowings. The productivity of this work is very low. It takes nearly one hour to peel just one or two kilos of fonio paddy. Moreover, in order to obtain a quality product, all dirt and sand must be eliminated. This means that the product should be washed several times which also adds to the amount of time and effort required for preparation. Thus, mechanizing the processing and the cleaning of fonio is essential both to reduce the painstaking work for women and to improve the quality and availability of the marketed product.

Mechanization

To make fonio more competitive on the market in terms of quality and price, it is necessary to improve grain processing techniques at small company and women's group level by modernizing existing and developing new equipment. To meet these needs, a regional project has been initiated that focuses on improving post-harvest technologies for fonio (1999 - 2004). The project is being carried out by CIRAD in collaboration with the national research institutes of Mali (IER) Guinea (IRAG) and Burkina Faso (IRSAT).

Before the project, there was little equipment available to process fonio and the equipment that did exist did not fully satisfy the users. It was, therefore, essential to improve and develop equipment that would make it possible to mechanize as much of the post-harvest operations as possible.

The CIRAD project carried out several technical studies aimed at improving equipment. These studies have so far led to an adaptation of a thresher and to the development of a dehusker - GMBF type Engelberg - that has an average capacity of 100 kilograms per hour. In addition, cleaning equipment has also been developed including a channel for winnowing, drum sieves and a machine to wash out sand.

Some of this equipment has been installed in small existing companies or enterprises operating in rural and urban areas, such as Bamako (Mali), Bobo Dioulasso (Burkina Faso) and Labé (Guinea). It has already helped users to process dozens of tons of fonio. Productivity has increased enormously and the quality of the product is high. An analysis of the cooking qualities of the fonio processed by the GMBF dehusker has been evaluated and found to be very satisfactory. The fonio processed with the machine had a better quality than traditionally whitened fonio: the germs had been removed, the product swells well when cooked and its consistency was smooth.



Photo: Author

A greatly enlarged photograph of one millimetre-long fonio paddy.

Training

But the project would not be complete without training and provision of adequate information to the various stakeholders involved, including manufacturers, those processing the crop, small business groups and the producers. The assistance of local manufacturers is necessary to ensure that the equipment developed can be constructed locally and this is being followed up. Together, these initiatives should make it possible to mechanize the processing of fonio and, in this way, contribute to the revival of this long neglected cereal.

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A branch of an *Uapaca* tree laden with the popular masuku fruit.

Masuku: food from the wild

Marcel Chimwala

In Malawi, the long dry period that follows the short rainy season (November - February) is a time when many farmers face severe food shortages. Like many other poor, rural communities in Southern Africa, they depend on a variety of wild products, including fruits from indigenous trees, to help them through the hunger months. Products from wild fruit trees are also an important part of the daily rural and urban diet. Not only are they common and cheap sources of food but they are also - as nutrition studies have shown - rich in the sugars, vitamins, minerals, vegetable oils and proteins necessary for a healthy and balanced diet.

However, in Malawi wild fruit trees, which are part of the region's *miombo* woodlands are disappearing very fast. Population growth and poverty have intensified the demand for land and, as a result, indigenous forest - a common resource under the control of local chiefs - is being cleared at an annual rate of 2.8% with little regard to its resources.

Eighty-five percent of Malawians live in the rural areas and 65% live below the poverty line. The recent crises in the tobacco industry and the loss of a crop that used to provide a cash income in the densely populated South has intensified levels of distress. It is against this background that Malawian communities - just like rural communities in neighbouring Zambia, Zimbabwe, Tanzania and Mozambique - are trying to domesticate and commercialize wild fruit. Working with ICRAF, local farmers are using their indigenous knowledge to complement scientific research in order to domesticate local species that are both popular sources of food and have market value.

Preferred fruits

The first step in this cooperation was for the communities to identify their "fruits of priority". In Malawi this turned out to be *masuku* (*Uapaca kirkiana*). The *masuku* tree is indigenous to this ecological zone and has many uses. The fruit can be eaten raw, made into jam, or used to produce a refreshing non-alcoholic drink as well as local wine, gin (*kachaso*) and beer (*ukana*). Other parts of the *masuku* tree such as the leaves, bark and roots are also widely used. For instance, its roots are used to cure dysentery and indigestion, its leaves to wrap and preserve foods like dried vegetables, and its wood to make domestic utensils, carvings, furniture and boxes.

Apart from *masuku*, other fruit trees identified as being important for homestead planting were *maula* or *mabola* plum

(*Parinari curatellifolia*), *mateme* or corky-bark monkey orange (*Strychnos cocculoides*) and *mfula* (*Sclerocarya birrea*).

Domestication

Over the last two years, local communities have collected 35,000 seedlings of wild trees. Some 3000 farmers have planted these seedlings and the initial results from farm orchards have shown that wild fruit trees can be grown under low-input management. As far as *masuku* is concerned, research carried out by ICRAF, indicates that the communities preferred trees that had a short maturing time and that gave fruit that was improved in size and taste. The communities are now applying their indigenous knowledge to select samples of fruit with these traits from the natural forest.

With technical assistance from the researchers, the communities are also developing vegetative propagation. Based on trials at the research station, the researchers have recommended grafting and air layering as suitable technologies for on-farm propagation and farmers are now experimenting with these technologies. The project is expected to produce clones and improved cultivars of *masuku* capable of giving fruit within three to five years.

Commercialization

It is also important that some of the economic potential of fruit trees can be realized. In areas such as Southern Malawi there is a strong demand for fruit and vegetables and market opportunities are good. Therefore, the project is also focusing on activities that will increase farmers' access to market information, stimulate product development, the identification of new markets, certification and labelling and encourage farmers to cooperate in assembling and marketing products collectively. For this reason farmers, assisted by ICRAF, are working on processing techniques that can increase the efficiency and quality of juice extraction, jam making, and the drying of *masuku* fruit to increase their shelf life and sales value.

Prospects for the whole project look bright and initial results show that improved marketing and processing that adds value to these wild fruits can improve the livelihoods of smallholder farmers in Malawi. Apart from the opportunities these activities offer for supplementing cash incomes, they also provide an important source of food for households whose emotional, financial and labour resources have been undermined by AIDS and the effects of labour migration.

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Home gardens: a cultural responsibility

Emily Oakley

Home gardens are reservoirs of agrobiodiversity in rural communities worldwide and, in many cultures it is women who maintain them. This everyday task is an important household activity and ensures that families get a nourishing diet suited to their tastes and cultural traditions. Women preserve agrobiodiversity through high-density plantings of underutilized species and their home gardens are often “experimental stations” for adapting indigenous and non-domesticated varieties. This rich diversity is important not only for household food security and economic stability, but also for the health of the agroecological system. Many studies from Asia, Africa, and Latin America conclude that women’s home gardens “provide early-maturing varieties that carry families over the hungry season till the main crops mature, contain reserve resources of plant genetic materials should the main crops fail, (and function) as conservation sites for special or preferred varieties, and as testing grounds for new varieties”.

Cultural legacy

Home gardens are a prominent feature of rural Bangladesh and are found in almost all village households. They are worked and managed exclusively by women. They are located within the walls of the family compound and function as fresh pantries from which women can harvest produce for the daily meal. Women have strong preferences for using traditional local varieties instead of modern high yielding commercial varieties in their home gardens. They consider local varieties to be uniquely adapted to local agroecological conditions, and feel that they represent a significant cultural legacy. By saving seed from home gardens and exchanging it with their neighbours, friends, and relatives they are able to maintain a considerable amount of agrobiodiversity.

In 2002, a study carried out in two villages in Bangladesh looked at the best way to promote the cultivation and conservation of species found in home gardens. Previous studies had concluded that women in Bangladesh prefer local varieties because they cook quickly and are an important source of vitamins. They also have a strong preference for the native varieties of fruit trees they manage in their gardens.

Women’s role

The villages studied - Bishnapur and Baushid - lie in the flood plain of West-Central Bangladesh approximately two hours from the capital Dhaka. Although Bishnapur is less remote and more independent agriculturally than Baushid, both villages have the same level of home garden production.

The study, which tried to find out how women’s preferences and the choices they made in their home gardens influenced the cultivation of various crops, surveyed 75 adult women. Their average age was 35 years and most had little formal education. Nearly all the women who participated in the study were economically vulnerable and their families suffered regularly from periods of food shortages.

Home gardens in Bangladesh are often overlooked as serious sources of food. In fact, they provide successful examples of how locally adapted varieties support food security, and have an important economic, dietary, cultural, and agroecological function. They also play a role in the financial security of rural households and help reduce dependence on vegetable and fruit from the local market. Women harvest from gardens to

supplement their rice supply. Over half the women interviewed also reported marketing garden produce when there was a seasonal surplus in order to increase their household income. Several of the women specialized in selling local varieties of fruit and vegetable seed to earn extra cash.

High-density diversity

Home gardens in Bishnapur and Baushid contain a high concentration of crop and variety diversity in remarkably small areas. Gardens are made on any ground available near the house, and often are no bigger than a few square meters. Some 60% of the women said their home gardens were less than 50 m² in size, but even so they were growing an average of 16 different crops and an astonishing number of fruit, vegetable, and spice species.

Women reported that they sowed a large number of crops per plot in order to minimize risk and maximize overall yield. In total, 25 different fruit crops, 29 vegetable crops, and 12 spice crops were cultivated in the two villages. Indigenous squashes, gourds, and greens were the most commonly grown vegetables, and local varieties of mangos, jackfruit, and papaya as well as guava, banana and grapefruit were popular in all households.

The crops grown required comparatively little room and roofs and fences were used as trellises to maximize vertical and horizontal space. Short-stature, annual vegetables occupy the lowest level, followed by shrub-like bi-annuals, such as taro. Bamboo frames support climbing vines such as squash, gourds, and beans and mixed fruit trees formed the top layer of the garden. The local varieties used by women gardeners have been selected for their ability to thrive under this type of intensive cultivation system. Although gardens were planted on marginal lands such as courtyards, the local varieties were highly productive, required few external inputs, and were able to survive the floods that regularly affect Bangladesh.

Women in Bishnapur and Baushid had a very sophisticated understanding of their agricultural systems and precise criteria for determining the varieties they use. When asked to list the most desirable characteristics of local home garden crops, their answers revealed not only a complex decision-making process but also the multiple uses for which they manage the different varieties. Because their needs are subsistence rather than commercially oriented, women emphasize taste, agroecological adaptation, culinary uses, and nutritional value. However, they also considered yield to be important and felt that local varieties performed well under home garden conditions.

Women liked local vegetable varieties because they mean something to them and are part of their culture and food traditions. Local varieties of gourds, for example, had a long growing season, could grow on rooftops, cook quickly and had fruit and leaves that were useful for a variety of purposes.

Women also preferred local varieties in home gardens because they were better adapted to local climate, soil, and disease conditions and could be grown without the fertilizers and pesticides needed for commercial varieties. In both Bishnapur and Baushid there were hardly any households that used pesticides in their home gardens and only 17% used chemical fertilizers. Women found that local varieties responded well to organic pest control measures, such as ashes, jute seed powder, and fermented rice water and thrived on organic fertilizers such as cow dung, compost, ashes, and courtyard sweepings.

It is often said that the reason why there are few high yielding varieties in home gardens is that women have not yet experimented with them. However, in Bishnapur and Baushid this was not the case. Seed for high yielding varieties was readily available yet women still preferred to rely on their local seed networks. In both villages, only 10% of women said they used one or more high yielding variety in their home gardens, although several women said they had tried them. The reasons for not continuing to grow them included not liking the taste or texture of the fruits and vegetables they produced; poor cooking qualities; the length of time and fuel they needed to cook and, in some cases, a very short growing season meant the crop could not be harvested gradually in accordance with household need.

Women's authority

Women are responsible for all the tasks associated with developing and maintaining the family's home garden, including land preparation, weeding, harvesting and saving seed. Their work in the home garden is seen as an extension of their domestic duties and is integrated into their daily routine. One woman in Bishnapur village described her work in her home garden like this:

"I decide what to plant in the home garden. I decide what vegetables have grown well last year and I plant those. I go to the home garden and see if there are good soil conditions for

planting seeds. I pick the fruits for harvesting. I manage the fruits for ripeness, checking the progress of each fruit every day to make sure I don't miss any. When we plant seeds I need to make sure the plants are coming up. I take care of seedlings. I pick and cook fruits and vegetables. If plants die, I replace them. I weed to give more space for the plants. I prepare the ground, air the soil and make sure it is well drained. When the soil is dry I plant seeds again."

Women of all educational levels, ages, and incomes cultivate home gardens. The art of home gardening has been passed down from generation to generation through oral tradition, observation and hands-on experience. At every stage of their lives women are involved in some aspect of home gardening and the fact that women are secluded in the home, in accordance with the traditions of Bangladesh, means they cooperate on home gardening tasks. This encourages the flow of information on crop selection, planting methods, and processing. In addition, young women obtain local varieties of seeds by inheriting them from their mothers or mothers-in-law. New brides often bring horticultural seeds from their home villages when they marry thus furthering the diffusion of varieties. The high rate of seed sharing within communities and among neighbouring villages further promotes crop genetic diversity.

Women maintain diversity

Although increased cultivation of high yielding varieties of rice in Bangladesh has led to an overall decrease in traditional field crops, such as local rice varieties, oilseeds, pulses, and millets, home gardens continue to be sanctuaries of agrobiodiversity. In both Bishnapur and Baushid, women expressed a commitment to preserving local varieties and regarded them as part of their cultural tradition and responsibility. Local varieties were an important part of the everyday diet and provided the special ingredients necessary for the dishes served at festivals. As one woman from Baushid put it "If I stop growing local vegetable varieties who will carry on the tradition?"

Lessons for practitioners

In answer to the question - How can women's preferences for local varieties be used to help promote their continued cultivation - it can be suggested that NGOs encourage informal learning networks through which older women can pass on knowledge about the cultivation of these varieties and that they promote the training of young women in seed management for local garden crops. NGOs could also start educational campaigns to encourage the use of local varieties and in this way strengthen the understanding that high yielding varieties are not the only option.

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A variety of seeds for the home garden.

Photo: Author



A mature umbo tree growing on the plains of North East Brazil.



Umbo fruits.

Native fruits: from hunger food to delicacy

Guillermo Gamarra-Rojas, Adriana Galvão Freire,
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Planalto da Borborema is a region in the State of Paraíba in North East Brazil. Most of the inhabitants live on small rural properties and they depend on selling farm produce, firewood, honey and native fruits for their livelihood. They rear cows, sheep and goats and cultivate crops with a short growing cycle such as beans, cereals and root crops. However, the daily diet tends to be deficient in essential nutrients, particularly those supplied by fruit and vegetables.

The Planalto da Borborema has three ecological sub-regions: the Brejo sub-region found at higher altitude is rather humid; the lower Cariri-Curimatau sub-region has a semi-arid climate; and Agreste - the transitional zone between the evergreen Brejo and the dry Cariri-Curimatau scrublands - has a milder, intermediate climate. All three regions, however, experience long periods of drought which puts the food security of local people at risk. At the same time, the daily diet tends to be deficient in essential nutrients, particularly those supplied by fruits and vegetables.

This context explains the strategic importance of the native fruits traditionally used by farmers. These fruits are well adapted to local environmental conditions, but today most of them are underutilized and local knowledge about their use and management is disappearing. They have also been neglected by research, and as a result little is known in scientific terms about fruit quality and productivity.

During the last ten years, a local development programme has been set up with organizations representing small-scale farmers to try to address some of the problems in the area. Most of these organizations are rural labour unions, united in the *Polo Sindical da Borborema*. The programme's objective is to develop sustainable local production systems based on agroecological principles, by generating, adapting and spreading new social and technical approaches.

In the period 2002 - 2003 a regional study of native fruit was carried out in seven municipalities covered by the *Polo Sindical da Borborema*, making use of the favourable social and organizational context and guided by participative approaches. The work was carried out with technical support from AS-PTA and APNE (*The Association for Plants of the North East*) and financial support from DFID, UK.

A collective effort was made to develop an action plan. First, the concept of native fruits was developed on the basis of the knowledge of the farmers. A meeting was then organized and several topics were discussed, including ways to increase knowledge and formulate research demands. A study group consisting of farmers, students, technicians and researchers was formed. Subsequently, semi-structured interviews and community meetings were organized in order to source, identify, characterize and rescue the knowledge on native fruits present in each one of the sub-regions.

Native fruits

Defining what constituted a native fruit resulted in a long debate among farmers. They concluded there were three categories. First, native fruits from the forest or "those species that are produced by nature itself" were identified as the nearest local concept to the technical term wild native fruits. The second category - naturalized native fruits - are species that have been introduced into the region and are now adapted to local conditions such as species of *Annona*, *Spondias* and varieties of banana and citrus. The third category was "non-native fruits" consisting of species and varieties that have been introduced recently into the area and require crop protection inputs. Non-native fruits can also be the result of plant breeding programmes based on local species, like the dwarf varieties of cashew (*Anacardium occidentale*), or the results of grafting or other techniques.

Farmers based their definitions on different levels of local adaptability and resilience. The native fruits from the forest were

considered to be the most resilient and non-native fruits the least resilient. The farmers realize that native fruits from the forest have a competitive advantage over species that have been introduced from outside the region and require high inputs before they can produce a crop in marginal environments.

Traditional values and new impulses

Farmers identified a total of 44 native fruits in the three regions, of which 29 were strongly preferred. Many of these fruits are found on family properties and require very little care. In nature they play an important ecological role because they supply food and shelter to wild animals. A number of species have become rare in some communities, for example the *ubaia* (*Eugenia uvalha*) and the *jatobá* (*Hymenaea courbaril*). This is partly the result of the wide-scale deforestation that occurred when large-scale cotton and sisal plantations were established in the area, and partly because they are being replaced by other fruits that are commercially more attractive. However, some native fruits are actually thriving in densely populated areas, such as *umbu* (*Spondias tuberosa*) in Cariri-Curimatau and *cajá* (*Spondias mombin*) in Agreste and Brejo. This is the result of local preferences and of the usefulness of the trees: they provide shade, timber, poles, live fences, firewood, medicine, food for bees and farm animals, and have a positive effect on the soil. Only one of the species identified by farmers (*Myrciaria cauliflora*) was useful for its fruit alone. Farmers prefer fruit bearing plants with multiple uses and they attach considerable value to multipurpose species.

There are also native fruits that are cultivated and carefully maintained in enclosed areas such as backyards and in small plots of prickly pear (*Opuntia ficus*). Some fruit species (*Spondias mombin* and *Brasilopuntia bahiensis*) are also used as living fences. In this way the domesticated fruits optimize the use of space, labour and other available resources, such as household waste water. These multi-functional practices and the care for fruit bearing plants have been promoted during group sessions and exchange visits, and are vital for maintaining the local biodiversity.

In areas that experience periodic water scarcity, fruit bearing and other scrubland plants are important during periods of extreme hunger. With the exception of *umbu*, these fruits are generally only eaten during very dry periods and in times of great need. However, the collective process of rebuilding knowledge about native fruits has led to a renewed interest in them. The *umbu* plant played an important part in this change of attitude. In Cariri-Curimatau, the delicious *umbu* fruit is an important source of food and is possibly the only fruit capable of generating significant income for families in the region. Recognizing its potential, a series of community and regional events and exchange visits took place, leading to a process of sharing knowledge on the exploitation, improvement, seedling production and conservation of *umbu*.

One of the most important results of this knowledge exchange was the development of new uses for fruits. Farmers started to think of recipes for candies, jellies, juices and fruit cakes using some local cactus species. In the more humid regions, there were attempts was made to make better use of fruits that are normally eaten fresh like cashew and *jenipapo* (*Genipa americana*).

The study and the exchange of experiences on the use and management of fruits, led to the spontaneous collection of seeds and the production and distribution of seedlings. This has enabled the reproduction of fruit species that were nearly extinct in some areas.

Marketing prospects

Many fruits grow spontaneously and, after receiving permission from the owner of the property on which they are growing anyone can pick them. While whole families are involved in collection, children do a lot of the work. However, plants that are cultivated or produce fruits that sell well can only be harvested by the owner.

Limited numbers of species and quantities of native fruits are marketed. *Spondias* and *Myrciaria* sp. have the highest market value, but the marketing of these fruits is difficult as they are collected in small volumes and there is a lack of market information. Usually middlemen collect the fruit from a community and sell it in local and regional markets. This often means that rural families have little financial benefits from these activities. However, farmers are now marketing their products directly at agroecological fairs, a process that adds value to these fruits.

Opportunities

The farmers identified factors that restrict the way local fruits are used at the moment. They want more information on qualitative and nutritional properties, processing and post-harvest management as well as more information on markets.

Spondias species, for example, produce fruits with a relatively high market value, but have only a small share in regional and national markets. The chemical composition and processing properties of the fruits are already known. However, it is necessary to adapt this knowledge to on-farm situation. *Brasilopuntia bahiensis*, a member of the cactus family common in Cariri-Curimatau, also has good development potential. The plant grows well on degraded soils, is widely available and has a long shelf life, high carotene content and good taste. However, its many thorns make it difficult to harvest. A study on its carotene composition is on-going. Much is also known about a related species, the prickly pear, that may prove useful. Other fruits, such as *Psidium araca*, may benefit from technologies already developed for the closely related guava (*Psidium guajava*).

A valuable experience

Gaining knowledge about the chemical and nutritional properties of the fruits, better ways of processing, propagation and multiplication, as well as developing distribution strategies for seedlings and the marketing of native fruits are valuable components of an action plan to make better use of them and preserve fruit bearing plants that would otherwise be underutilized or "lost".

This regional study of native fruit is now being extended to a wider geographical area. The recovery of local knowledge and its mobilization through the exchange of experiences are important elements in enhancing the vitality and securing the sustainability of small-scale family agriculture. Scientific research based on the needs of the local population play an important and complementary role in this process.

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Marugu: better than bread

Edward Mulaama

The Tiriki people, a subgroup of the Luhyia people of Western Kenya, live in an area bordered by Lake Victoria, Mount Elgon and the Nandi Escarpment. Tiriki sub-district has many hills and valleys and is divided into two relatively equal parts – the Hamisi and the Kaimosi divisions separated by the River Galgory. Most of the 430,000 people who live in the area practise mixed agriculture.

Harsh environment

Kaimosi Division has relatively fertile soils and farmers grow a variety of crops including millet, sorghum, bananas, maize, beans, and two cash crops: tea and coffee. There are plenty of grazing areas for cattle and the two local livestock markets are the most important in the Western province. Hamisi Division has rocky soils, is more hilly and soil erosion is a particularly serious problem. It is difficult to imagine how crops manage to take root in such a rocky area.

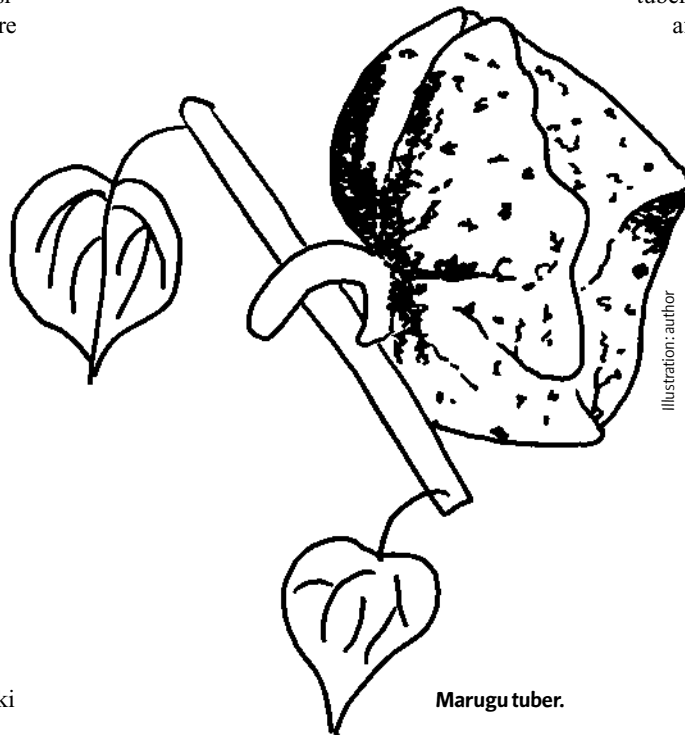
There are no industries in Hamisi and unemployment rates, especially amongst young people, continue to soar. Most men have left Tiriki and moved to the urban areas in search of jobs. They have left behind women-headed households who have to scrape a living from tiny farms. Malaria and typhoid claim thousands of lives in Tiriki every year.

A local resource

Dioscorea bulbifera, locally known among the Tiriki as *marugu*, a yam variety native to Western Kenya, is being revived to supplement the local diet. At an early age local children are taught to distinguish the edible *marugu* from the wild species which closely resembles *D. bulbifera* but which is highly toxic. The *marugu* may be wild in other parts of Africa but in this part of Kenya it has been domesticated. It is an angular heart-shaped, pinkish-white 'potato' that is usually cooked in a clay pot or roasted under glowing ashes. *Marugu* is allowed to cook or bake for at least one full hour and is considered ready when a thin thorn, stuck into the "potato", comes away clean. When cooked, the cover peels off easily leaving behind a whitish pink brownish fluffy potato-like yam. *Marugu* are usually served by themselves with cold water for lunch or with hot tea or coffee for breakfast. A meal of *marugu* is filling and a favourite dish for many after a heavy day's farm work.

Marugu is little known outside the Tiriki region but has a potential for wide use not only among the Tiriki but throughout the entire western part of Kenya. The tubers remain underground and sprout at the onsets of the first rains. This is a special and unique characteristic.

The Tiriki preserve their *marugu* for months and cook them when the need arises. *Marugu* are climbers and, like passion fruits, they need to be supported to grow. They are usually planted along fences or by the sides of streams, near banana or coffee stems or close to trees. *Marugu* are cultivated along with other food crops and so they do not require separate pieces of land. The farmer tends them at the same time as he looks after his main crops. Because of their ability to conserve water they can be planted in arid places. *Marugu* are perennials so that when the stem dies, the tuber remains in the soil and sprouts afresh when the rains return. This gives the farmer an economic advantage because he or she is able to save on labour and seed.



Marugu tuber.

Marugu are grown mainly by farmers who hold some cultural status in the community. These farmers get a sense of pride when they see people coming to their homes to ask for this special yam and are determined to protect its cultivation not only for economic reasons but because it also allows them to exert a special influence in the community.

Marugu's changing fortunes

The *marugu* offers new opportunities for trade and nutrition and provides another economic outlet for Tiriki people. Some *marugu* are packed in Western Kenya and dispatched to the urban areas where they are sold as an indigenous alternative to white bread for high prices. The Tiriki have actively begun to promote this crop and, with rising population and recurring drought and famine, the use of *Dioscorea bulbifera* as a food supplement is expected to rise in the near future.

The production of *marugu* declined originally because of foreign influence. As more young Kenyans became educated in the 1960s and 1970s, they learnt to eat wheat bread from the time they started boarding school and came to regard it as sophisticated and 'modern.' In the 1970s, Kenya's population was about 10 million but over the last 30 years it has increased considerably. Since the 1990s, however, the Kenyan economy has been in depression. The size of a loaf of bread has been

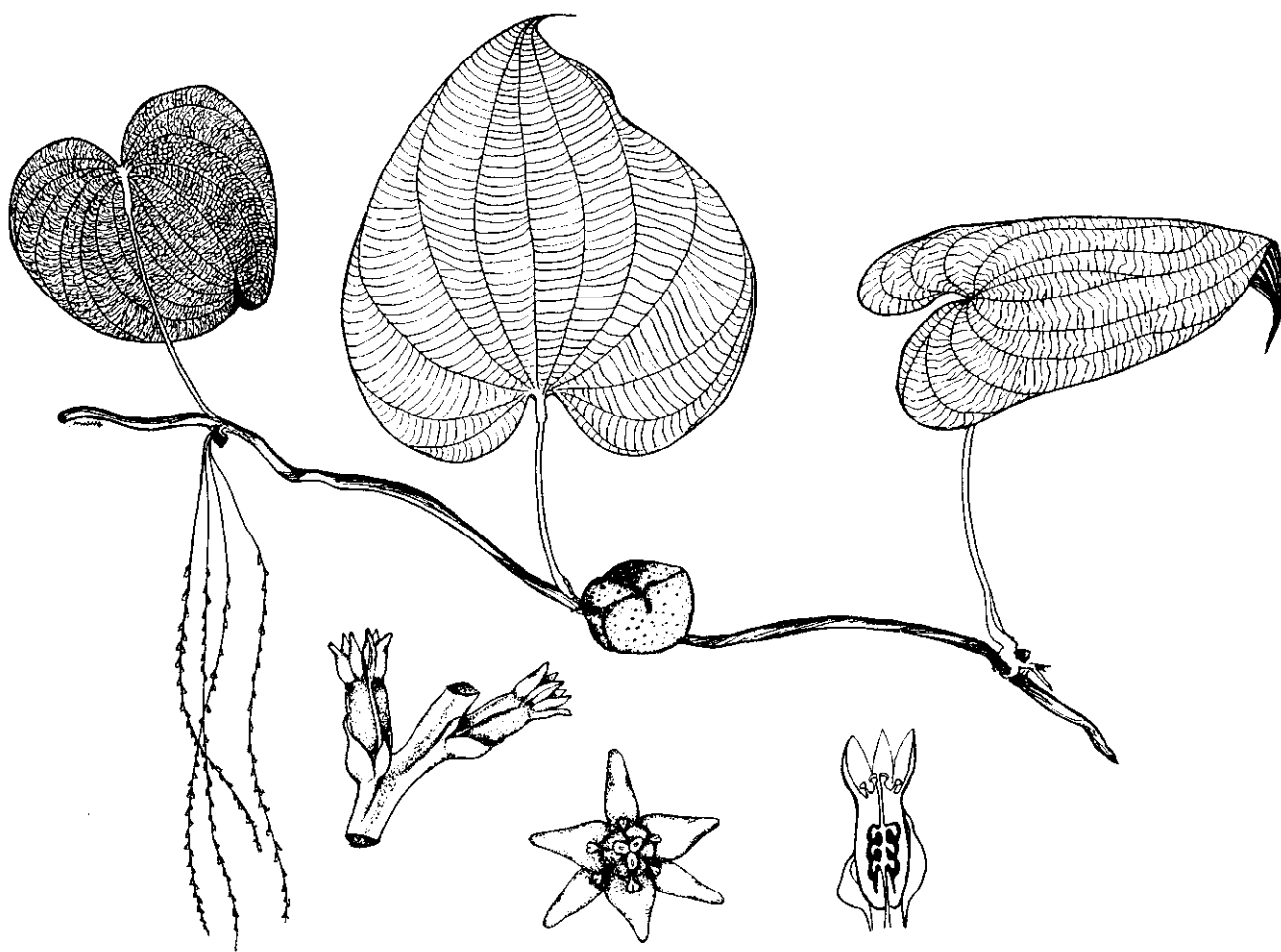


Illustration of marugu (*Dioscorea bulbifera*) adapted from: Tropical crops. J.W. Purseglove, 1979, Longman.

reduced from 500 grams to 400 grams and its price has rocketed to Ksh25 (US\$0.33). People living in the poorer areas such as the Tiriki, were amongst the first to drop this expensive item from their diet and look for local alternatives. Today, *marugu* is meeting their need. The Tiriki claim that a meal of *marugu* lasts longer in the stomach than wheat bread and shopkeepers in Ijevutulu, Ikamulembe and Imahanga villages are already blaming the rise of *marugu* for declining bread sales.

Marugu foods are being promoted in the main churches in Ijevutulu, Isigong'o, Ijamulongoji and Ijisasi. Churches in these areas are highly conservative. During their weekly services, they have periods for general announcements and it is during this time that farmers who grow *marugu* stand and announce to their congregations current prices and where *marugu* can be bought. This traditional form of communication saves farmers the expense of paying for advertisement and gets the message across to the right target group.

Milkmen also supply *marugu* to people as they move around the villages on their bicycles selling milk in the early morning dawn or just before dusk. Sometimes people are also informed about *marugu* during biweekly village meetings called to discuss local matters. It is clear that the revival and marketing of *marugu* in Tiriki is being done mainly through word of mouth and is very efficient.

Ezekiel Mutulia Shitiavai, a Tiriki farmer who lives in Bundolovo village in Kaimosi Division, plants and eats *marugu*

regularly. He explains that having a good meal of boiled *marugu* in the morning is a first step towards spiritual well-being. *Marugu* soothes the body. "If you visit a person", Shitiavai explains, "and they serve you with tea and *marugu*, then your visit is regarded a special occasion". He believes that efforts to encourage the sustainable use of *Dioscorea bulbifera* in Tiriki will lead to heightened use, widespread recognition and the preservation of this species. "The use of *marugu* is something for us to leave to posterity," he says.

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Women reintroducing neglected crops

Nazmul Haq

In African rural communities women in particular have a rich traditional knowledge of the value and properties of many minor local crops. They understand their nutritional value and know they are well adapted to the local agro-climate. These crops can be grown in kitchen gardens or on farmland with far fewer inputs than commercial varieties. In many households they are known as famine crops and, in some cases, they can be processed or sold directly to provide much needed cash for such essentials as school fees and health care.

This became clear when the *International Centre for Under-utilized Crops* at Southampton University was involved in a farmers' participatory survey in South Africa. The survey was part of a project to inventarise and reintroduce indigenous vegetable species suitable for cultivation in dry and semi-dry land areas in the North Transvaal and Eastern Cape. It was coordinated by the *South and East Africa Network for Underutilized Crops* (SEANUC).

The survey focused on how poor farming communities manage underutilized crops and on established and potential commodity chains from planting material to end-use. Later, practical experiences with these commodity chains were shared with the rural communities in Spitzkop in Northern Transvaal and Alice in the Eastern Cape. Whilst farmers participating in the survey identified several underutilized species, only three are discussed here: Livingstone potato (*Plectranthus esculenta*), cucurbits and *amaranthus*. Each case shows the depth of farmer knowledge and how keen they were to conserve these crops.

Knowledge

In both Spitzkop and Alice, women's knowledge of local plant species enables them to play an important role in the selection and management of seeds and planting material and the conservation of plant diversity. Their selection of edible plants is based on a wide range of criteria including palatability, quality, beliefs about health and nutrition, and commercial potential. However, the selection of crops and varieties involves more than a concern for



Photo: SEANUC

***Plectranthus esculenta*, popularly known as Livingstone potato.**

edibility and the passing on of botanical information and skills. Their understanding of local plants extends to chemical characteristics as well, especially those that affect processing, storage, preservation and the effectiveness of their medical properties. During the study it became clear that consumer demand and preference for taste and palatability influenced the way women decided which species and varieties to grow. For example, the green leaves of *amaranthus* are popular in Africa and farmers carefully selected a special type of *amaranthus* for the canning industry. In the same way cucurbit varieties were selected according to criteria such as market demand.

During the survey, seed for cucurbits and *amaranthus*, two of the target species, was collected from community gardens where it was being maintained alongside some major vegetable species. The women in these communities knew of the uses of these species from their grandparents and were multiplying and maintaining the varieties for their own needs.

Reintroduction

However, in the case of the third species studied - *plectranthus*, popularly known as Livingstone potato -, the situation was quite different. Although the communities knew that *plectranthus* tubers were nutritious - they contain high levels of Vitamin A, protein and iron - Irish potato had become so popular after its comparatively recent introduction that the Livingstone potato had been neglected. As a result there had been such a serious loss of planting material that the communities were no longer able to maintain the necessary diversity. The farmers realized this and were eager to get *plectranthus* reintroduced. The women of the community showed the most interest in this and the project was able to provide 14 accessions of *plectranthus* - collected from the northern region of South Africa - to women in two communities in the Spitzkop area. The women characterized, evaluated and selected two lines for further trial in their gardens and were given training in propagation and crop management.

Three years later a follow up survey found that the women's groups were still maintaining all the varieties they had been given in their communal gardens. The successful re-introduction of this species would not have been possible without the skills and knowledge of the women maintaining the communal gardens and the fact that they realized the nutritional value of the tuber and were keen to see it re-establish.



Cucurbits showing a wide range of diversity.

Photo: SEANUC

Production

As indicated above the farmers' participatory survey lead to the identification and selection of three species considered desirable by the communities for multiplication, distribution and planting – *plectranthus*, *amaranthus* and cucurbits. In working with the different varieties, women showed particular skill in the identification of characteristics such as drought, disease tolerance and the ability to withstand extremes of temperature and still perform well on marginal land. Above all women farmers gave priority to crops that could be grown in mixed farming systems. The project trained community members in participatory seed production and crop management as well as such operations as watering, control of diseases and pests (only few incidences observed) and harvesting. The communities found that the mixed cropping of these crops was profitable.

In Spitzkop, farming communities are relatively poor.

Plectranthus tubers were planted in small plots of 10 x 10 m between young eucalyptus trees in a mixed cropping system that included other vegetables such as *amaranthus* and cucurbits. They were also intercropped with maize on the household's farmland. Trained women community members managed the production of these crops with a very limited amount of supervision.

Plectranthus yields under community-managed mixed cropping systems were 60 tons/ha but lower when intercropped with maize.

Scaling-up

The SEANUC programme in the region started with two farming communities but after three years, as it prepared to withdraw from Spitzkop, some 120 farmers in 20 villages were cultivating *plectranthus*. The rapid uptake of the technology confirmed the success of the project and an extensive exchange of planting materials took place between farmers. The demand for tubers was also developing on the local market and between 2001 - 2002 farmers were getting up to Rand 5 (US\$1) per 250 g for their crop, higher than the market price for Irish potato. The possibility of earning an income from cultivating *plectranthus* encouraged young men who had access to land and who might otherwise have migrated out of the area to plant the crop.

In the Eastern Cape farmers selected five lines of *plectranthus* for their palatability and taste. Yields of 70 tons/ha were recorded when leaves were harvested at two weeks intervals over a period of six weeks. Community members started to sell the cooked leaves in small saucers to people travelling by bus and taxi for Rand 7 (US\$1.30).

Also in the Eastern Cape, 83 accessions of *Cucurbita maxima* and 4 lines of *Lagenaria* were collected, characterized and evaluated in community gardens. Two accessions of *Cucurbita maxima* were well accepted by the community because of their yield and palatability. These accessions were planted in a 50 m² field and fertilized with farmyard manure. The selected lines gave yields of 40.5 tons/ha and 30.6 tons/ha respectively. The women's community groups have included these two selected types in their household production systems and have started to market harvest surpluses.

Harvesting, post-harvesting and processing

The women in the communities involved in this project harvested, sorted, graded and arranged for the cucurbits and *amaranthus* crop to be transported to market. Although there was a cash demand for *plectranthus*, it was mostly exchanged between friends and neighbours.

In terms of planning similar activities, it should be noted that the price women received for cucurbits and *amaranthus* depended

on whether they took the vegetables to market themselves, or sold them through an intermediary. The advantages of the latter practice is, of course, that the women get their money all at once rather than in bits and pieces and they save on time and transport costs. However, it also means that they are not able to determine price according to supply and demand and, because they tend to sell their crop at irregular intervals to meet incidental expenses, they are in a weak position when it comes to negotiating price. A conclusion that might be drawn here is that marketing aspects need to be taken into consideration in such projects in order to ensure that the communities benefit as much as possible from the efforts they have made to re-establish and propagate underutilized but clearly popular species.



Photo: SEANUC

Farmers preparing land for mixed cropping.

Food and income

The experience of SEANUC in South Africa has shown that women continue to use and maintain the wealth of underutilized crops and that they show considerable interest and initiative especially when it comes to crop diversification activities in their kitchen or community gardens. Underutilized crops can be brought into production in many ways and can open up new possibilities for community participatory production as well as village level processing and marketing. SEANUC experience in South Africa is just one example of the way in which underutilized crops can be used to enhance food security, improve nutrition and contribute to the sustainable rural livelihoods.

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The Slow Food movement

Hielke van der Meulen

"Our enjoyment of food is based on an understanding of where and how it is grown, crafted and ripened. Slow Food campaigns to sustain quality agriculture, and to maintain the biodiversity of our food supply."

The *Slow Food* movement was founded in Italy in a spontaneous reaction to the opening of the first McDonalds restaurant in 1988. The founders, Carlo Petrini and Piero Sardo, were more shocked by what they regarded as the violation of the historic facade of the *Piazza di Spagna* in Rome, than by the arrival of the most high profile symbol of the fast food industry. This anecdote gets to the heart of the *Slow Food* movement: endowing food with cultural dignity.

Slow Food's first objective was to create awareness. *Osterie d'Italia*, their first publication, was a guide to local restaurants specializing in the type of traditional Italian food that was in danger of disappearing. *Slow Food* focused on the ingredients that gave these dishes their special character. "How can you enjoy a good *brassato al barolo*", it asked, "if real, classic *barolo* wine has become extinct and the right quality meat has disappeared?"

In 1996, *Slow Food* started an ambitious project called the *Ark of Taste* and began cataloguing and re-launching traditional Italian food products like *Lardo di Collonata* (lard), *Ventricina del Vastese* (salami), Sicilian *Ragusano* (cheese), and *Pan di Alta Mura* (bread). *Slow Food* volunteers started to set up guilds or "*presidia*" for each *Ark* product. These *presidia* brought together local craftsmen and producers working, or willing to work, in the traditional way. *Slow Food* helped by drawing up regulations for the *presidia* that guaranteed the authenticity of their product and assured customers that they were being produced in ecological and sustainable ways. Brochures were made and tastings and fairs held where producers and potential retailers could meet. *Slow Food* found that local and regional authorities were often willing to support these grass roots initiatives. There are now over 150 *presidia* in Italy - not just for processed foods, but increasingly for endangered breeds and crops like the red apples from Monti Sibillini, *Maremmana* cattle, *Noli* anchovies, and *Corno di Carmagnola* paprika.

In 2000, the *Ark of Taste* was introduced into other European countries and there are now also *presidia* in Japan, Peru, India,

Madagascar, Mexico and the USA. Two *presidia* have also been founded in the Netherlands: one for *Texelse Schapenkaas* (Texel sheep cheese) and one for *Boeren-Goudse Oplegkaas* (Aged Farmhouse Gouda cheese). The revival of traditional cheese making on the small island of Texel, for example, is helping to preserve traditional sheep breeding. Sheep have a specific ecological function on Texel and help to preserve the unique pasture vegetation and landscape that has developed on its sandy and saline soils. Similar close ties between food culture and biodiversity are found in many *presidia* products.

The *Ark of Taste* is making painstaking inventories of rare local breeds, vegetables and fruits but many old varieties are hard to trace and get back into cultivation. Therefore, there are *presidia* that focus on preserving a whole range of species, like the *Fruta Andina* in Peru and the *Criollo* maize varieties in Mexico. The aim of *Slow Food* is to use market mechanisms and consumer choice to protect rare species by selling them as cultural delicacies rather preserving them as botanical relics.

Another major new project to focus attention on the hidden heroes of the *Slow Food* movement is the *Award for Biodiversity*. Each year, over 600 journalists, scientists and professionals worldwide are asked to nominate persons or initiatives working to protect and promote agrobiodiversity. In 2001, the *Amal Cooperative* in Morocco won a special award for encouraging rural women to produce the exquisite Argan oil, thus safeguarding their livelihoods and the future of the local Argan tree. Another award winner was the New Zealander Graham Harris who has been revitalizing forgotten Maori potato varieties.

In 2004, an ambitious event will take place in Northern Italy. "*Terra Madre*" has invited thousands of farmers and artisan food-makers from all over the world to meet and discuss their problems and ideas. These range from how to produce quality mustard oil in India and market rare local vegetables to finding ways to get national authorities to give more support to *Slow Food* initiatives.

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The Ark of Taste is active all over the world.

Photo: Author

Describing useful plants

Jan Siemonsma

The number of higher plants in the world is estimated at 300,000 species. In the course of time, mankind has put to use about 40,000, either directly or indirectly. The majority of these plant species - 25,000 - grow in the tropics. While some have become major world crops, others are used only during famine. Some have received international attention, while others are only of local importance. There are overexploited plants and underutilized ones.

At present, information about useful plants in the tropics is scattered over many publications. Even though improved library databases and internet have made it easier to find information, this remains a problem especially in developing countries. The objective of PROSEA and PROTA is to make access easier by creating a system of 'information brokerage and knowledge repatriation' for countries in the South.

Plant Resources of South-East Asia (PROSEA)

What started in 1987 as a bilateral initiative between Indonesia and the Netherlands, gradually became a well-known regional partnership of seven institutions in seven countries, operating as a foundation under the acronym PROSEA. Over the past 16 years (1987 - 2003) an elaborate synthesis of existing information has been made of approximately 7000 useful plants from the region. The final product is a series of 24 books, each focusing on a commodity group and containing review articles describing the useful plants in a standardized way. Each species, although often multi-purpose, is described only once according to its main use although information on other uses is also provided in the same article. All this information is now being made available through a web database that is scheduled for completion by the end of 2005.

Table 1: The PROSEA Book Collection

Book	Year	Title
Prosea 1	1989	Pulses
Prosea 2	1991	Edible fruits and nuts
Prosea 3	1991	Dye and tannin-producing plants
Prosea 4	1992	Forages
Prosea 5 (1)	1993	Timber trees: Major commercial timbers
Prosea 5 (2)	1995	Timber trees: Minor commercial timbers
Prosea 5 (3)	1998	Timber trees: Lesser-known timbers
Prosea 6	1993	Rattans
Prosea 7	1995	Bamboos
Prosea 8	1993	Vegetables
Prosea 9	1996	Plants yielding non-seed carbohydrates
Prosea 10	1996	Cereals
Prosea 11	1997	Auxiliary plants
Prosea 12 (1)	1999	Medicinal plants 1
Prosea 12 (2)	2001	Medicinal plants 2
Prosea 12 (3)	2003	Medicinal plants 3
Prosea 13	1999	Spices
Prosea 14	2001	Vegetable oils and fats
Prosea 15 (1)	2001	Cryptogams: Algae
Prosea 15 (2)	2003	Cryptogams: Ferns and fern allies
Prosea 16	2000	Stimulants
Prosea 17	2003	Fibre plants
Prosea 18	2000	Plants producing exudates
Prosea 19	1999	Essential-oil plants

Branch with
fruits of *Spondias*
purpurea.
Example of
an illustration
in the PROSEA
books.



For more information on the book series, please visit www.prosea.nl. A low-price paperback edition is available for developing countries; it can be ordered from the PROSEA Network Office, P.O. Box 332, Bogor 16122, Indonesia. E-mail: info@proseanet.org. Additional information about the Web Database can be obtained from: www.proseanet.org.

Plant Resources of Tropical Africa (PROTA)

In 2000, the success of PROSEA led to a similar programme being set up for tropical Africa. The number of useful plants in tropical Africa is estimated to be around 7000, about the same as for Southeast Asia. The PROTA partnership includes eleven institutions in seven African, one Southeast Asian and three European countries. This time the 'knowledge system' will be directly built into a web database with free access, but the information will also be made available in a book and CD-Rom in English and French.

It is estimated that the implementation of the programme will take ten years (2003 - 2012). Currently, the first three Commodity groups are in preparation. About 100 manuscripts on vegetables are already accessible through the Web Database.

More information about this programme and access to the web database can be obtained from: www.prota.org.

The model publications, "*PROTA basic list of species and commodity grouping/PROTA liste de base des espèces et de leurs groupes d'usage*" (2002), and "*PROTA Precursor/PROTA Précurseur*" (2002), made during the preparatory phase are available from CTA, P.O. Box 380, 6700 AJ Wageningen, the Netherlands. E-mail: cta@cta.nl.

Conclusion

The PROSEA/PROTA 'knowledge synthesis' is a uniquely comprehensive review of the useful plants of the tropics and a rich source of information that can be used for research, education, extension, policy measures and industrial development. It brings the 'world literature', currently only available to a happy few, into the public domain with due respect to traditional knowledge and intellectual property rights. Above all, it is a contribution to raising awareness on the 'world heritage of useful plants of the tropics'.

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Prosea 12 (1)	1999	Medicinal plants 1
Prosea 12 (2)	2001	Medicinal plants 2
Prosea 12 (3)	2003	Medicinal plants 3
Prosea 13	1999	Spices
Prosea 14	2001	Vegetable oils and fats
Prosea 15 (1)	2001	Cryptogams: Algae
Prosea 15 (2)	2003	Cryptogams: Ferns and fern allies
Prosea 16	2000	Stimulants
Prosea 17	2003	Fibre plants
Prosea 18	2000	Plants producing exudates
Prosea 19	1999	Essential-oil plants

Branch with
fruits of *Spondias*
purpurea.
Example of
an illustration
in the PROSEA
books.



For more information on the book series, please visit www.prosea.nl. A low-price paperback edition is available for developing countries; it can be ordered from the PROSEA Network Office, P.O. Box 332, Bogor 16122, Indonesia. E-mail: info@proseanet.org. Additional information about the Web Database can be obtained from: www.proseanet.org.

Plant Resources of Tropical Africa (PROTA)

In 2000, the success of PROSEA led to a similar programme being set up for tropical Africa. The number of useful plants in tropical Africa is estimated to be around 7000, about the same as for Southeast Asia. The PROTA partnership includes eleven institutions in seven African, one Southeast Asian and three European countries. This time the 'knowledge system' will be directly built into a web database with free access, but the information will also be made available in a book and CD-Rom in English and French.

It is estimated that the implementation of the programme will take ten years (2003 - 2012). Currently, the first three Commodity groups are in preparation. About 100 manuscripts on vegetables are already accessible through the Web Database.

More information about this programme and access to the web database can be obtained from: www.prota.org.

The model publications, "*PROTA basic list of species and commodity grouping/PROTA liste de base des espèces et de leurs groupes d'usage*" (2002), and "*PROTA Precursor/PROTA Précurseur*" (2002), made during the preparatory phase are available from CTA, P.O. Box 380, 6700 AJ Wageningen, the Netherlands. E-mail: cta@cta.nl.

Conclusion

The PROSEA/PROTA 'knowledge synthesis' is a uniquely comprehensive review of the useful plants of the tropics and a rich source of information that can be used for research, education, extension, policy measures and industrial development. It brings the 'world literature', currently only available to a happy few, into the public domain with due respect to traditional knowledge and intellectual property rights. Above all, it is a contribution to raising awareness on the 'world heritage of useful plants of the tropics'.

Jan Siemonsma. PROTA Foundation, c/o Wageningen University, P.O.Box 341, 6700 AH Wageningen. E-mail: Jan.Siemsma@pros.dpw.wag-ur.nl

Lost crops of Africa. Vol. 1. Grains 1996. 383 p.

ISBN 0 309 04990 3. USD 28.95. Board on Science and Technology for International Development (BOSTID), Office of International Affairs, National Research Council (NRC), 2101 Constitution Avenue, N.W., Washington, D.C. 20418, USA. National Academy Press, 2101 Constitution Avenue NW, Washington, DC 20418, USA.

In contrast to what the title suggests, this book does not describe truly lost African cereals. It is the first volume in a series of books dealing with undervalued native African crops, which have been overlooked (in that sense "lost") by the mainstream of international science and people outside the local areas. The aim is to promote actions to explore and exploit the most promising African grains for increased production. These crops deserve attention for diversifying agriculture and creating economic opportunities. Many crops are described including African rice, finger millet, fonio, pearl millet, sorghum, tef, wild cereals and African oats, barley and wheat. Innovations for milling, storing, and processing are presented, as well as methods to reduce damage by birds, weeds and insects. The book also contains valuable appendices on research contacts and references. Following volumes in this still important series deal with cultivated fruits, wild fruits, vegetables, legumes, roots and tubers. (IHG)

The vegetable garden in the tropics

by Waaijenberg H. 2003. 72 p. ISBN 90 77073 50 7. AGROMISA, PO Box 41, 6700 AA Wageningen, The Netherlands. E-mail: agromisa@agromisa.org; www.agromisa.org (Agrodok 9). CTA. E-mail: cta@cta.nl The objective of this booklet is to serve as a general manual for those who practise or teach gardening in developing countries, in order to improve the living conditions of the inhabitants of these countries.



This seed is like ourselves: a case study from Rajasthan, India, on the social aspects of biodiversity and farmers' management of pearl millet seed by Christinck A.

2002. 190 p. ISBN 3 8236 1381 2. EUR 25.60. (Kommunikation und Beratung, Sozialwissenschaftliche Schriften zur Landnutzung und ländlichen Entwicklung 47). Margraf Verlag, Postfach 1205, 97985 Weikersheim, Germany. E-mail: info@margraf-verlag.de This book is based on field studies carried out in the semi-arid state of Rajasthan, India. Pearl millet is the staple crop in this area, and the "adoption" of modern crop varieties has so far been limited. Many farmers produce their own seed, and use traditional landraces and modern varieties as complementary options, or as breeding material for their own crop improvement strategies. A traditional system for seed distribution has ensured the survival of various landraces. However, the availability of modern varieties that suit the needs of farmers with better land resources, have modified farmers' practices and their pearl millet seeds. This process of change also has consequences for seed and food security, human health and nutrition, and social relations within the villages. This work therefore contributes to the actual debate on the conservation of genetic resources, seed systems and participatory plant breeding, and more generally, the reorientation of international agricultural research.

Managing plant genetic diversity by Engels J.M.M., Rao V.R.,

Brown A.H.D., Jackson M.T. (eds.). 2002. 487 p. ISBN 0 8519 522 5. IPGRI. CABI Publishing, Wallingford, Oxon OX10 8DE, UK.

E-mail: cabi-nao@cabi.org; www.cabi.org

This book addresses key scientific and technical aspects of the wise and effective management of plant genetic resources

now and in the future. Over 40 chapters deal with a broad range of topics, including technologies for *ex-situ* conservation, deploying and managing genetic diversity in agroecosystems, conservation of wild species, exploring underutilized species, application of genomic sciences, bioinformatics, and economic and policy knowledge. The content is largely based on papers presented at a conference on managing plant genetic diversity in 2000, organized by the International Plant Genetic Resources Institute (IPGRI).

Neglected crops: 1492 from a different perspective

by Hernando Bermejo J.E., León J. (eds.). 1994. 341 p. ISBN 92 5 103217 3. FAO, Rome. (Plant Production and Protection Series No. 26). Purdue University. www.hort.purdue.edu/newcrop/1492/1492.html

This book contains a study of 65 crops, mostly of American origin, which for social agronomic or biological reasons have lost their importance over the last 500 years. They are plant species that once played a fundamental role in the agriculture and food supply of indigenous peoples and local communities. Their neglect was in many cases the result of the deliberate suppression of self-sufficient ways of life which characterized traditional cultures. Though the publication itself is not very recent, the chapters of this still important document are available in full text from the website of the Center for New Crops and Plant Products from Purdue University. (WR)

Women and plants: gender relations in biodiversity management and conservation by Howard P.L. (ed). 2003.

298 p. ISBN 1 84277 157 4. GTZ, IDRC. ZED Books, 7 Cynthia Street, London N1 9JF, UK. E-mail: zed@zedbooks.demon.co.uk

This collection of largely unpublished in-depth studies, drawn from all over the world, aims to increase our understanding of the importance of women and gender relations in plant biodiversity management and conservation. The contributors demonstrate how crucial women are to plant genetic resource management and conservation at household, village and community levels; and how gender relations have a strong influence on the way in which local people understand, manage and conserve biodiversity. Continued access to plant biodiversity is crucial to rural women's status and welfare, and their motivations are therefore a principal driving force countering processes of genetic erosion.



The New Crop Compendium CD-ROM by Jules Janick and

Anna Whipkey (eds.). 1998. ISBN 0 931682 70 3. FAO, Rome. Centre for New Crops and Plant Products. 1165 Hort. Bldg, Purdue University, West Lafayette, IN 47907, USA. www.hort.purdue.edu/newcrop

The New Crop Compendium CD-ROM is a searchable resource of new crop information. It contains the entire text and figures from the proceedings of the three National New Crop Symposia: J. Janick and J.E. Simon (eds.). 1990. *Advances in New Crops*. Timber Press, Portland, Oregon; J. Janick and J.E. Simon (eds.). 1993. *New Crops*. Wiley, New York; and J. Janick (ed.). 1996. *Progress in New Crops*. ASHS Press, Alexandria, Virginia. This valuable source of information on new, specialty, neglected, and underutilized crops was developed for scientists, growers, marketers, processors, and extension personnel. It can be ordered from the Purdue University NewCROP website. The Proceedings of the fifth Symposium 'New Crops and New Uses: Strength in Diversity' (Hardback, 599 p. ISBN 0-970756-5-5), held in Atlanta, Georgia in 2001 has also been published and can be ordered from ASHS Press, 113 South West Street, Suite 200, Alexandria, VA 22314-2851 USA. Fax: 703-836-2024. E-mail: ashspress@ashs.org

Correction for TRIOPS – Tropical Scientific Books Distribution

<http://www.triops.de/>

In the last issue we published the wrong web address for TRIOPS. This is the right link.

People and Plants Initiative

<http://www.rbgekew.org.uk/peopleplants/>

This website acts as a gateway to selected useful information about ethnobotany, with links to other online information courtesy of the Royal Botanic Gardens, Kew. The People and Plants handbook and working papers are available from this website. The papers in this series provide information on case studies in ethnobotany, usually relating to fieldwork projects undertaken by People and Plants researchers and local experts.



This CD Rom contains all articles published in the ILEIA Newsletter and the LEISA Magazine during the period 1984 – 2003. If you would like to order more copies, please contact ILEIA.

GRAIN Growing Diversity

<http://www.grain.org/gd/>

The Growing Diversity project is an initiative for sharing and discussion. It involves local organizations working on biodiversity management in its broadest sense, which includes those involved in agriculture, forests, aquatic resources and indeed all life that sustains people. This website in English, French and Spanish provides the results and commitments produced by the international workshop on the local management of agricultural biodiversity in 2002.

Danida Forest Seed Centre (DFSC)

<http://www.dfsc.dk/>

DFSC has been engaged in the development and transfer of know-how in management of tree genetic resources. DFSC seeks to contribute to improve the benefits of growing trees for the well-being of people in developing countries.

This site gives an overview of training and extension resources on tree seed, highlights the best, gives links to electronic versions that can be copied, and makes suggestions for creating new resources. This interesting site also provides a seed bank for trees.

International Centre for Underutilised Crops (ICUC), University of Southampton

<http://www.civil.soton.ac.uk/icuc/>

ICUC is an autonomous, non-profit, scientific research and training centre. The Centre was established to address ways of increasing the use of underutilized crops for food, medicinal and industrial products, and also for environmental improvement. This site provides access to all publications of ICUC in full text format, as well as names and details of species, some germplasm catalogues and links to other networks.

Underutilized Tropical Fruits in Asia Network (UTFANET)

<http://www.civil.soton.ac.uk/icuc/utfanet/>

Asia, the centre of tropical fruit diversity, is fortunate to benefit from the vast potential of tropical fruits. Fruits have nutritional and economic benefits. Fruit trees also have environmental importance. The objective of UTFANET is to develop an effective network, which facilitates collaborative partnerships among countries in the region for biodiversity conservation, efficient use of genetic resources, expertise, and technologies.

The Inland and Foreign Trading Co.

<http://www.iftco.com.sg/>

The Inland and Foreign Trading Co. harvests, processes and markets legume cover crop, pasture, lawn, medicinal, shrub and tree seeds. Their main markets are in subtropical and to tropical countries. The seeds are packed in double jute bags of 50 kilos. Address: Block 1090, 04-04/05 Lower Delta Road, Singapore 169201; iftco@pacific.net.sg

International Plant Genetic Resources Institute (IPGRI)

<http://www.ipgri.cgiar.org/>

This website draws attention to those species of plants which have been neglected in a varying degree by researchers or have been underutilized economically.

IPGRI's vision: "Through the collective, concerted action of farmers, forest dwellers, pastoralists, scientists, development workers and political leaders, the full potential of the Earth's plant genetic diversity will be harnessed to eradicate poverty, achieve food security and protect the environment for the benefit of present and future generations". This site provides many publications on different crop species ordered systematically, and a lot of links to regional networks. Also, a Training Calendar for 2004 is available.

NewCROP: the New Crop Resource Online Program

<http://www.hort.purdue.edu/newcrop/>

This is the website of the Center for New Crops & Plant Products, at Purdue University. Online since 1995, NewCROP is an information-rich site related to crop plants. It is a project of the Purdue University Center for New Crops and Plant Products and is associated with the New Crop Diversification project and the Jefferson Institute. NewCROP provides windows to new and specialty crop profiles.

The International Food Policy Research Institute (IFPRI)

<http://www.ifpri.org/>

The mission of the International Food Policy Research Institute is to identify and analyze policies for sustainably meeting the food needs of the developing world. Research at IFPRI concentrates on economic growth and poverty alleviation in low-income countries, improvement of the well-being of poor people, and sound management of the natural resource base that supports agriculture. Through its policy analyses, IFPRI directly supports developing-country policymakers, non-governmental organizations (NGOs), and civil society in their efforts to help the poor.

GFU: Global Facilitation Unit for Underutilized Species

<http://www.underutilized-species.org/>

The Global Facilitation Unit for Underutilized Species offers this website as a tool to enhance information and knowledge exchange in the field of underutilized and neglected species, amongst experts and organizations working on underutilized species as well as groups or individuals in need of information on the topic. The kind of information accessible through this portal ranges from details of specific crops, events of interest, important topics related to underutilized species, to relevant publications. Soon it will provide a database of experts and ongoing activities on underutilized species. Besides making knowledge available, the site also intends to offer a platform for communication among interested parties.

The International Journal of Agricultural Sustainability (IJAS)

<http://www.channelviewpublications.com/>

This first issue of "the International Journal of Agricultural Sustainability" (IJAS), edited by Professor Jules Pretty (University of Essex), is meant to play a role in furthering the debate on what is and is not sustainable in current farming practices and food systems, as well as helping to define the future of these systems. The website provides abstracts of the papers in the first issue, as well as details of how to subscribe. This journal is not for free.

TANSO-TARO Network for Southeast Asia and Oceania

<http://www.cirad.fr/presentation/programmes/cult-alim/projets/rootcrops.htm>

The underutilized root crops of Southeast Asia and the Pacific region have much potential in terms of processed and fresh products. These crops are consistent with maintaining fragile ecosystems and have a potentially high output per hectare compared with other vegetables, particularly on marginal land. They are often well adapted to local agro-climatic conditions and to small farm production. In addition, they play a major role in the food security of this region. The objective of the network is to enhance the competitive position of taro in cropping systems of Southeast Asia and the Pacific.

ASEAN Regional Centre for Biodiversity Conservation

<http://www.arcbc.org/>

The ASEAN Regional Centre for Biodiversity Conservation (ARCBC) serves as the central focus for networking and institutional linkage among ASEAN Member Countries and between ASEAN and European Union partner organizations to enhance the capacity of ASEAN in promoting biodiversity conservation.

The Australian New Crops Web site

<http://www.newcrops.uq.edu.au/index.html>

This website seeks to improve the communications network among new crops workers in Australia. It provides links to information on potential crop species and new crop development.

Plant Genetic Resources Newsletter

<http://www.ipgri.cgiar.org/pgnewsletter/last.asp>

This is a Newsletter Web portal, with contents and full text articles of this publication of IPGRI and FAO. For each article, a summary is available in English, French and Spanish.

Science and Development Network

<http://www.scidev.net/events/>

A list of forthcoming events around the globe related to science, technology and the developing world are provided on this website, for example:

- **Ethnobiology, social change and displacement**
Canterbury, UK. 13 - 17 June 2004.

E-mail: ice2004@kent.ac.uk

This congress will look at how ethnobiological knowledge is transformed under conditions of rapid social and technical change, through globalization, and in particular how it adapts in situations of socio-ecological change.

- **Globalization and Food Systems: scientific workshop and science-policy forum**

Nicoya, Costa Rica. 24 October - 6 November 2004. E-mail: i2004-geci@dir.iai.int

Focus will be given to the interactions between processes of globalization and global environmental change, and the implications of these interactions for food systems and food security. Funding is available for up to 25 applicants.

- **Third IUCN World Conservation Congress**
Bangkok, Thailand. 17 - 25 November 2004.

E-mail: ursula.hiltbrunner@iucn.org

During the Forum, IUCN members, partners and interested stakeholders will debate options that safeguard the ecosystems upon which future prosperity depends.

Southern Africa New Crop Research Association (SANCRA)

<http://www.sancra.co.za/>

The mission of SANCRA is to promote the development of potentially novel crops and products derived from them with the aim of enhancing the socio-economic status of all Southern Africa's people. The website offers a newsletter and a conference agenda.

Issue 20.4, December 2004

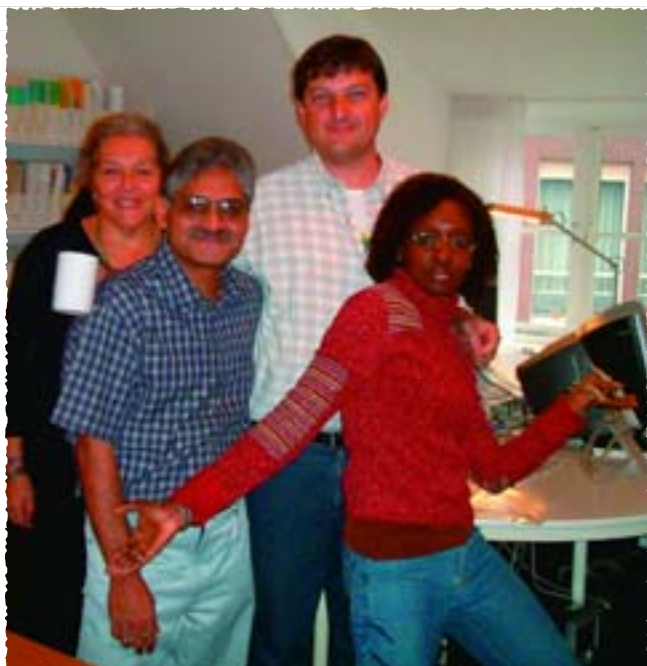
Ecoagriculture

Agroecosystems rely on natural processes and biodiversity to produce food, fodder, fuel, construction materials and medicines. However, ecosystem services such as decomposition of organic matter and nutrient cycling, pest and disease regulation, pollination and seed dispersal, maintenance of soil and water quality, microclimate regulation and the provision of habitats for wildlife, are often taken for granted. In industrialized agriculture, many ecosystem services have been replaced by external inputs and people have forgotten that agricultural systems are ecosystems too. Agriculture is therefore often held responsible for environmental degradation, and yet continued food production is essential to our survival.

"Ecoagriculture" is a new term being used to emphasize the importance of managing agricultural landscapes as functioning ecosystems that simultaneously achieve the goals of agricultural production and biodiversity conservation, while maintaining ecosystem services. This issue is a collaboration with the Ecoagriculture Partners, including Future Harvest and IUCN, and will draw on some of the material presented at an international Ecoagriculture conference in September 2004.

Deadline for contributions is the 1st of September 2004.

You are invited to contribute to this issue with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided. ILEIA offers to pay on request Euro 75.00 per article published in LEISA Magazine.



IEM participants, from left to right: Teresa Gianella Estrems, K.V.S. Prasad, Paulo Petersen and Awa Faly Ba.

Sourcing and documenting LEISA and the difficulties of identifying and developing articles on practical field experiences, useful to farmers and rural communities, remain high on the agenda. Editors agree they need to share information from their own networks more effectively – something that requires time, commitment and planning. During the IEM 2004, strategies to involve readers, authors and organizations more closely in the development of the content of the magazines were discussed. In India, for example, the *LEISA India* team, in response to requests from its network, has started a *Documentation and Communication Programme* aimed at increasing the capacity of organizations working with LEISA to document their experiences more effectively. Materials generated during these workshops will be shared with colleague editors and partner organizations. Other initiatives to source and document information are taking place in Latin America (using web-based methodologies and case studies), and in Africa (working with agricultural journalists and agricultural information services).

Plans to strengthen and monitor the quality and impact of the LEISA magazines have also been made. These include special sections in the magazine for readers' opinions and field experiences (global edition), focus groups to get feed back on content and relevance (West Africa), regular e-mail contact to stimulate comment and criticism (Latin America) and developing further activities with members of the LEISA network (India). Regular readers' surveys have also been scheduled. Latest developments at the LEISA magazines include the publication of a Portuguese language LEISA magazine in June 2004, and the launching of a new website that will provide easy access to all the LEISA magazines and link visitors quickly to other sources of LEISA information.

For more information on LEISA magazines contact the respective team (see colophon) or visit our website www.ileia.org

International Editors Meeting 2004

The editors who arrived in the middle of the Dutch winter for their annual international editors meeting (IEM) got a warm welcome from ILEIA's staff at the new office in the centre of Amersfoort. The IEM meeting is a major event in the editors' calendar and provides them with an opportunity to reaffirm the common identity of their magazines - *LEISA Revista de agroecología* (Latin America), *LEISA India*, *Salam* (Indonesia), *AGRIDAPE* (West Africa) and *LEISA Magazine* (global edition) - and coordinate strategies to intensify the promotion, documentation and dissemination of information on LEISA.

Issue 20.3, September 2004

Post-harvest management

Traditionally, major attention is given to increasing crop and livestock production in the field in order to improve farm incomes and food availability. Post-harvest handling and storage arrangements have often been neglected. As a result, worldwide post-harvest losses of agricultural produce are estimated at 30%. Taking better care and making better use of produce can enhance farm incomes, food availability and quality in a cost-effective way. Improved harvesting and packing techniques, better means of transport to the farm or markets, improved methods of processing and proper storage all contribute to this. In addition, extended post-harvest storage may add value to produce when it is sold, as market prices may be higher in certain periods.

Readers are invited to contribute their practical experiences on how proper post-harvest management of grains, fruits, vegetables, livestock products and other rural produce has led to increased benefits for farmers. Experiences related to efficient and low-cost ways of storage, processing and transport are welcome.

Deadline for contributions is the 1st of June 2004.

You are invited to contribute to this issue with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided. ILEIA offers to pay on request Euro 75.00 per article published in LEISA Magazine.