



GFAR

GLOBAL FORUM ON AGRICULTURAL RESEARCH
FORUM MONDIAL DE LA RECHERCHE AGRICOLE
FORO GLOBAL DE INVESTIGACION AGROPECUARIA

The role of underutilized plant species in the 21st Century¹

Preamble

This document has been prepared by IPGRI upon the request of the GFAR Steering Committee at its Beijing Meeting on May 1999.

The paper discusses possible approaches to promote partnerships in the area of underutilized species/minor crops. IPGRI has several years of experience in this domain, involving a variety of stakeholders, sharing efforts in addressing the better conservation and use of these species across regions and focusing on issues ranging from domestication, market potential to documentation and networking.

It is clear that a blend of old and new approaches is needed to achieve the sustainable promotion of these less-used crops in order to contribute to economic development, well being of people as well as maintenance of genetic diversity and its associated local knowledge. A better understanding of socio-economic mechanisms that hinder the greater deployment of these crops of local significance is fundamental to strengthen their role in poverty alleviation.

It is recognised that most underutilized crops are of local or regional importance and therefore it is most appropriate to foster partnerships at this level. Several mechanisms (including the GFAR SC) exist to ensure that lessons learned in one region can also benefit other regions. The strengthening of the links among international stakeholders involved in the promotion of underutilized species is indeed strategic to allow best use of existing capacities and promote synergism across regions.

Introduction

In human history, **40-100,000** plant species have been regularly used for food, fibres, industrial, cultural and medicinal purposes. At least **7,000** cultivated species are in use today around the world. Over the last five hundred years, with increased contacts between disparate populations and the development of a global trading system, **30** or so crop species have become intensively and widely used and are now the basis of much of the world's agriculture. These commodity crops have been the focus of attention of markets and scientific research world-wide. The fate of the vast majority of the remaining agro-biodiversity has been quite different: some species have been replaced or fallen into disuse, while others have remained important in their centres of origin or secondary centres of diversity, but largely ignored by commerce and science.

The focus on a few widely used species has helped to sustain the explosion in human population over the last two hundred and fifty years, but it has narrowed down dramatically the number of species upon which global food security and in general economic agricultural pursues depends. With over half of humanity's caloric and protein needs being met by three

¹ The concept note has been prepared by S. Padulosi and E. Frison of IPGRI for the GFAR October 1999 Meeting in Washington D.C., USA. This note is meant to cover specifically underutilized plant species (wild and cultivated), although issues being addressed in the text may be relevant to some extent also to other agricultural sub-sectors.

crops, maize, wheat and rice, humankind faces a highly vulnerable situation and an urgent action to promote crop diversification is needed.

There is an increasing endorsement at national and international level of the important role in sustainable farming systems and human well-being of less-used crops and species. Such attention stems out from developments over the last decade that have contributed to change the perception of people regarding the importance of such species and raised the issue on how best to pursue the promotion of underutilized species. *Inter alia* these developments include:

- **Agrobiodiversity in agricultural development:** both the Convention on Biological Diversity (1992, Annex I) and the FAO IV Technical Conference on Plant Genetic Resources (1996, Action 12 of GPA) have contributed to further significantly the work on PGR and raise the need to enhance their sustainable conservation through use. The poor representation of agrobiodiversity in *ex situ* collections and the widespread genetic erosion encountered by less-used species raise today serious concerns for an effective utilisation of PGR (FAO State of the World Report on PGR).
- **Environmental changes and ecosystem stability:** climate changes, degradation of land and water resources have led to a greater appreciation of those species better adapted to stress and difficult environments where they play a strategic role in maintaining a diversity rich and hence more stable environment. The use of many of these species is at the moment restricted to niches where they are maintained by poor farming communities in fragile ecosystems, including those areas affected by salinization and desertification.
- **Food security and nutrition:** many underutilized species are nutritionally rich and adapted to low input agriculture. They complement significantly the diet based on few staple crops by providing important vitamins and minerals. The further neglect and genetic erosion of these species can have immediate consequences on the nutritional status and food security around the world.
- **Increased attention to indigenous knowledge:** underutilized species hold a great genetic diversity and a vast heritage of indigenous knowledge. The new emphasis given to indigenous knowledge is creating new favourable conditions for the enhancement of these species largely maintained today by local communities.
- **New tools for using biodiversity:** the availability of newly developed tools to assess genetic diversity in plant species, its distribution and uses (s.a. GIS and molecular markers) along with innovative ways to improve productivity constraints (s.a. gene transfer techniques) is opening-up new opportunities for the better deployment of agrobiodiversity.
- **New market opportunities:** 1) availability of new biotechnological tools to transform useful plant species into diverse products from plastics to surgical tissues or to extend shelf life of perishable crops represent important factors that enhance commercialisation and strengthen marketing systems of those underutilized crops. 2) The movement of people across countries and regions provides opportunities for strengthening markets of underutilized crops in which immigrants identify their own culture and traditions; 3) Tourism represents increasingly an important source for supporting local *filières* built around underutilized species; 4) high standard of living in industrialised countries is generating demands for more natural food and environmental friendly products, and this demand can be met also by underutilized species.

Enhancing use of underutilized species

All the above mentioned developments are bringing about an increased attention to underutilized species which can be translated into activities to generate additional income to poor farmers and forest dwellers in less favoured environments around the world. *In order to meet this goal it is important to take into consideration some specific points:*

- **Many underutilized species have multiple uses and do not belong to any one specific category of crops** (food, medicinal, ornamental, etc..). The key to unlock their true

potential rests in our ability to harness their multiple uses, and traditional, single-use enhancement approaches are not the best way to achieve their full valorisation. The analyses of social and economic useful traits present in underutilized species should therefore receive appropriate attention and be thoroughly addressed. Local mechanisms that support the deployment of useful diversity should be strengthened. “House hold filieres” (largely run by women) built in rural and forest areas typically around multiple uses of the same crop, should be strengthened or established anew if no longer present. These chains, linking farmers up to final end-users, play a critical role in securing revenues to rural communities and thus fuelling the very mechanism that will maintain the diversity of these species in the field.

- **The potential of some underutilized species to become commodity crops should not be underestimated.** The development of an underutilized species into a commodity is generally perceived as a too ambitious goal in its promotion process. A commodity does not have to be necessarily a global commodity (as in the case of kiwi, *Actinidia sinensis*). If adequate investment in R&D (including marketing and commercialisation) is deployed, efforts are likely to raise economic returns for these species at national, regional or international level. This is the case for instance of hulled wheat (*Triticum monococcum*, *T. dicoccum*) which thanks to processing technologies (allowing the use of flour for making biscuits and pasta) and marketing strategies (emphasising its low input cultivating practices) have revived dramatically its cultivation in Italy and raised interest in countries as distant as Australia. Similarly, the spicy vegetable rocket (*Eruca sativa* and *Diplotaxis* species) so popular at local level across the whole Mediterranean, is improving its level of use in Italy, thanks to research efforts in recent years in the improvement of agricultural practices and its commercialisation (better packaging systems have allowed access into new markets outside the traditional areas of distribution). Roselle (*Hibiscus sabdariffa*) known for centuries in Sub Sahara Africa became eventually a well established beverage in Europe thanks to simple marketing strategies; okra (*Abelmoscus esculentus*), a traditional African vegetable, is now accepted in most markets around the world (yet this was achieved without greatest investments, but rather on the basis of consumers’ interest studies and commercialisation strategies); the demand for high quality natural resins and gums contained in the seeds of the carob tree (*Ceratonia siliqua*, a multipurpose species from the Mediterranean region) is generating significant market demands for the pods of this tree and is contributing sensibly to the rediscovering of this valuable species.
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- **Some underutilized species are essentially geared to the market, while others are important for subsistence farming.** The species which are geared to the market will generate cash income and therefore can call on external inputs. For these species, while public investment is justified in the initial stages of development, it can be expected that the private sector will take over the funding of research and development in the medium to long term. For those underutilized species which are important for subsistence farming and therefore will not generate cash income, it is not realistic to expect an access to external inputs. For these species, research and development activities will also have to be funded from the public sector. It is recognized though, that some species which are important for subsistence farming may have a market potential, and may be developed into market oriented crops, in which case they may gain access to external inputs, and later to investments from the private sector.

Strategic domains in the promotion of underutilized species

Participatory Research

Underutilized species constitute a category defined by their social value and status. For this reason people and farmers play an important role in reversing their decline in use and arresting their genetic erosion. Farmers and forest dwellers are the source of information for revealing the potentials of these species, their distribution and local use. Multi-disciplinary research is therefore fundamental for an effective conservation and use of these species and

scientists and policy makers should closely work together to translate their full potential into greater food security and development. Participatory research should be actively fostered among primary and secondary stakeholders. The Agenda of these shared efforts should address *inter alia*:

- analyses of constraints and development of strategic work plans for enhancing seed/germplasm selection and supply, production, processing, commercialisation, marketing (*greater cooperation between private sector and extension workers*);
- characterisation and evaluation work using descriptor lists and farmers' criteria (*closer cooperation between informal associations /NGO and international and national research organisations*)
- development / strengthening the seed supply systems (*closer participation of farmers in government-lead efforts*)
- participatory plant breeding and selection activities (*bridging the gap between farmers' needs and breeders' objectives*)

Ensure the availability of genetic diversity

According to IPGRI² the conservation (both *ex situ* and *in situ*) of the genetic diversity of underutilized species is extremely poor: more than 80% of these “minor species” conserved in gene banks around the world (ca 5,000 species as a whole) are represented by just 1 to 10 accessions. This is not a sufficient base upon which characterise, develop or restore the genetic resource base of these species which may turn out to be very important for food security, income generation and environmental health. This fact indicates furthermore that the vast bulk of the genetic resources of underutilized species is in the hands of users and local communities. A successful and sustainable use of underutilized species rely on both the provision of diversity for current uses and its maintenance for future deployment. In view of the local specificity of underutilized species such two-fold objective requires however a conservation and development approach rather distinctive from that applied to other crops. Collections held in isolation from the main users are vulnerable to being lost or not maintained, as the crop may be unimportant to the country holding the genetic resources. At the same time, should the genetic resources increase in value as a result of prospecting, research, and new market opportunities, it may be more difficult to ensure that the resulting benefits are distributed to the farmers who maintained and developed the genetic diversity in the form of land races. In order to encourage the continuation of these activities germplasm should be able to flow from farmer to PGR programs and back.

For these reasons, the link between ex situ collections and in situ users of genetic diversity is fundamental for underutilized species. Research should be therefore directed towards the establishment and/ or strengthening of existing community-based efforts and integrate them with ex situ national capacities.

Document and disseminate information

Documentation and information play a crucial role in the enhancement of the use of underutilized crops. The most immediate step in the field of documentation is to take stock of available information on current activities and produce information and publications that provide guidance, options, techniques and approaches for national programmes and other partners whose awareness of the importance of these species has been raised. Relevant activities falling in this domain of action include:

- development of ecogeographic databases on target species;
- development of use-oriented and nutritional database to asses social impact of these species over the territory;
- dissemination to users of information on improved varieties and agronomic requirements for enhancing productivity;

² Padulosi, S. (1999)

- development of tools (newsletters, internet web pages, etc..) for disseminating relevant information to stakeholders (including list of experts, initiatives carried out on target species and thematic issues etc..) and facilitate links among them.

Processing and value-added activities

A common feature to many underutilized species is the poor storing ability of the harvested plant products which limit shelf life and hence commercialisation in space and time. Crop improvement activities addressing the storability of these species should be therefore accompanied by parallel efforts aiming at the development of simple and low-cost processing methods. Research on taste, flavour and appearance of both fresh and processed product will contribute to create add value to underutilized species and generate greater benefits to local communities (*this domain represents one of the most important areas of cooperation among the private sector, the government and local farmers' associations*).

Marketing

The development of new markets in order to reach as wide user community as possible including –but not exclusively- traditional growing areas- is another strategic domain that would create new sources of revenues to the local people. User definition, promotion campaign, market niche and price studies, presentation of final product are among those important fields of research largely unexplored for underutilized species. The establishment of *filieres* to link all actors from the local producers to the final end-users represents a major bottle-neck in the marketing process. This is very much true for underutilized species which in spite of the good acceptance by local people lack yet an organised system that would consolidate their existing market niches and permit access to new ones. (*the enhancement of local market systems and the developing of more effective commercialisation mechanisms rests in the ability to achieve close partnership between local communities and private enterprises under a coordinated use-driven framework*).

Fostering synergism at national, regional and international level

Over the last 20 years or so, networking has proven to be a successful tool for sharing research efforts in the area of plant genetic resources. Close cooperation at national and international level among workers (from both formal and informal sector) has lead to greater and more effective deployment of crops' diversity around the world. Although these efforts have traditionally focused on major crops, various initiatives, s.a. the one supported by the Italian Government on Underutilized Mediterranean Species (UMS), the Network on Underutilized Fruits in Asia (UTFANET), the African Leafy Vegetables Network and the Bambara Groundnut Genetic Resources Network (BAMNET) have demonstrated the efficacy of this approach also for those so called “minor crops”. *The networking of scientists around underutilized species may be most effectively carried out within the context of regional projects where scientists of National Plant Genetic Resources Programmes can play a lead research role and share experiences on species of common interest. A role for international partners in such networking efforts is paramount. The pursuing of joint initiatives among international organisations already involved in activities dealing with underutilized species (s.a. FAO, CHIEAM, ICUC, and CGIAR Centres) is crucial for maximising the benefits of all involved stakeholders.*

Legal and policy frameworks and public awareness

The enhancement of uses of underutilized and neglected species finds in many cases a major constraint in the legal and policy frameworks. The sharing of experiences among countries in the way progress could be achieved to improve such frameworks represents another important area to address for an effective promotion of underutilized species. An important role in this endeavour is played by public awareness which should be directed at all levels. *Cooperation among national and international organisations for developing adequate tools to reach target audience from students, policy makers and user at large, should be encouraged and supported.*

Criteria in prioritising underutilized species³

Under the overarching goals of food security, poverty elimination and environmental sustainability, underutilized species should be selected on the basis of their capacity to best address such challenges:

- **Food security:** Attention should be paid to both quantity and quality of food. Underutilized species offer untapped potentials to contribute to fight malnutrition. Their enhanced use can bring about better nutrition (vitamin C in the fruit of the Barbados cherry -*Malpighia glabra*- is more than ten times higher than in the kiwi fruit -notably very rich in this micro nutrient; nutritional value of the Himalayan chenopod grains, *Chenopodium* spp., is superior to that of most major cereals). Emphasis should thus be given to those species having comparative advantages in providing better food, being affordable by the poor and more available both in time and space.
- **Poverty elimination:** Multiple uses offer greater opportunities to raise income of local people by diversifying valuable plant products. The greater the number of uses, the greater the chances to strengthen local markets and contribute to improve well being of people. In terms of numbers, the recorded 3,000 vascular species of economic importance⁴ are part of a much larger diversity basket, largely unexplored by R&D. As for figures on income generation, it is estimated that the use of minor forest products in India employs as a whole more than 10 million people per year.
- **Environmental sustainability:** Underutilized species have recognised ability to grow in marginal areas. Selection criteria should thus take into consideration their comparative advantages in halting soil erosion, contribute to land rehabilitation, ability to withstand difficult soils (excess of salt, lack of water, etc..), contribute to maintain balanced ecosystems and ability to tolerate heat, cold and other abiotic stresses.

³ Additional information on this aspect can be found in the Proceedings of the International Workshop on “Priority Setting for Underutilized & Neglected Plant Species of the Mediterranean region”, held in Aleppo, Syria on Feb. 1998, published by IPGRI.

⁴ Terrell, 1977

Operationalizing a GFAR agenda on underutilized species

Two of the basic principles of GFAR should of course be fully taken into account in deciding how to operationalize the GFAR agenda in this area. These are the principles of:

- **Subsidiarity:** Activities should be implemented at the lowest possible level at which they can be efficiently executed. In the case of underutilized species, this will often be at the regional or subregional level.

and

- **Additionality:** initiatives should only be promoted when there is a clearly perceived added value of working together at a subregional, regional or global level.

A mechanism should be set up by the GFAR to facilitate the emergence of collaborative initiatives on underutilized species at the regional or subregional level.

Next steps

- Identification of interest in different species and setting of priorities at regional level. This will be done by both looking at past experiences and by reviewing the inputs from the various stakeholders in response to the call for proposals on new partnership initiatives.
- Identification of stakeholders who might be involved in participating in the implementation of initiatives on the priority species.
- Identification of opportunities to implement the initiatives and to move ahead.