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Making the most of wild and relict species - experiences and lessons

Abstract

Today’s narrow agricultural basket is a major concern for the future of humanity. Calls by the FAO for World leaders to devote greater attention to agricultural diversification have so far received very limited response (Swaminathan 2005). Crop choices made during the Neolithic Age still represent today the basis of our global food production systems (Janick 2001). Through its focus on the provision of calories to meet the demands of a burgeoning population, the Green Revolution has neglected the need for minerals, vitamins, micronutrients and other functional properties from food crops, particularly in developing countries. A shift of paradigm of agricultural efforts is advocated through the launching of an “Evergreen Revolution” which would address nutritional and health concerns through a more effective and sustainable use of agricultural biodiversity (Swaminathan 2006). Such an objective would rely heavily on crop genetic resources and on an array of species, variously called neglected or underutilized (Padulosi & Hoeschle-Zeledon 2004), till now largely sidelined by research and development efforts. In this paper, we present examples from a typical underutilized crop, hulled wheats (einkorn, emmer and spelt), which have returned to the limelight in Italy in recent years and that of a multi-purpose species, sumac (Rhus coriaria L.), today a relict crop in Italy, but still very popular in the Middle East. Lessons learned from studying these species are proposed along with suggestions for the sustainable promotion of species of similar significance and conditions.

Introduction
From the beginning of the practice of agriculture around 10,000 years ago in the Fertile Crescent and other regions of the world (Zohary & Hopf 1993, Balter 2007), farmers and then scientists have selected crops and varieties with specific traits in order to satisfy a diverse range of human needs, including food and nutritional security, tasty meals, medicinal remedies, fibre for clothing, fodder for feeding livestock and also meeting social, cultural, religious and aesthetic desires (Heywood 2007). Along with these, other factors have also shaped crop production systems around the world. These include the ability of crops to adapt to specific agro-ecological conditions and their capacity to help farmers to seize emerging economic opportunities arising from new trends, market and uses for crop genetic diversity and its products. Such factors still play a profound role today (albeit in different ways than in the past) influencing crop choices and determining continuing change in the preferences of species and varieties grown in the field (Jarvis & Hodgkin 2000). The
history of agriculture is characterized by the establishment in various locations and at var-
ious times, of crops which have become “major” while others have continued to be culti-
vated only locally, and have survived until today in a marginalized state (Janick 2001). Some of these crops have disappeared to the extent of becoming true “relicts”.

Today, few crops dominate international trade, only around 30 staple crops feed the world, and only three—rice, wheat and maize—provide more than half of the world’s food supply despite the fact that over 30,000 plant species are edible and about 7,000 have been or still are cultivated to some extent for food (FAO 1996a). At a national level, these few staple foods are supplemented by a range of other food crops (Prescott-Allen & Prescott-Allen 1990, FAO 1996b). The dependence on this relatively small number of food crops raises serious concerns about the sustainability of feeding the world in the future and feeding it well (Swaminathan 2005, Frison 2005, Raschke & Cheema 2007). The alarming loss of agro-biodiversity at the onset of the Green Revolution led to the genetic resources movement, and in 1974, to the establishment of the International Board for Plant Genetic Resources (IBPGR), today known as Bioversity International (Pistorius 1997), the largest international agency dedicated to the conservation and sustainable use of agro-biodiversity (Bioversity 2006). Thanks to the efforts made by national and international agencies to rescue crop diversity, today some 6 million accessions of germplasm are being maintained in more than 1,300 ex situ gene collections (Fowler & Hodgkin 2004). Many other species, variously described as neglected or underutilized have been left out of these “safety nets” and survive only in limited populations thanks to in situ/on farm conservation activities (Padulosi & al. 2002b).

More recent trends, including urbanization and increased purchasing power among certain segments of the population in both developed and developing countries, are significantly contributing to raise the demand for food diversity, including new specialty crops, high value and natural/biological products (Heywood 1999a, Senauer 2001, Senauer & Goetz 2003).

Emmer: Resurgence of a Roman staple in Italy

The history of emmer and its uses.- A recent example of a relict crop that is enjoying renewed interest among farmers and consumers in several parts of Europe, particularly in Italy, is that of hulled wheat. In Italy this crop goes by the generic name of farro, but in reality this one name covers three different species: einkorn (Triticum monococcum), emmer (T. dicoccon) and spelt (T. spelta). The name farro was originally used only for emmer, but now is used indiscriminately for all types of hulled wheat. These are amongst the most ancient cereal crops of the Mediterranean Region (Perrino & Hammer 1982). The cultivation of einkorn and emmer started in the Fertile Crescent about 10,000 years ago where it has continued to be grown (Helmqvist 1955; Harlan 1981; Zohary & Hopf 1993, Nesbitt & Samuel 1996). After Julius Caesar’s invasion of Egypt in 30 B.C., emmer was introduced to Italy, where it was referred to as the ‘Pharaoh’s wheat’ (hence ‘farro’) and gained popularity in Italian cuisine. The nutritious grain became a staple at every level of Roman society, sustaining the Roman Legions and is said even giving rise to the Italian word for flour farina. Because of their adaptation to colder climates, einkorn and spelt
spread across the Alps and northern Europe (D’Antuono 1989). Their decline began at different times ranging from 3,000 BC in Eastern Turkey to the 20th Century in Southern Germany and Switzerland (Nesbitt & Samuel 1996). Various hypotheses have been suggested as to the reasons for the decline of hulled wheat species, including economic changes, dietary changes and the introduction of new cereals.

Though there are few detailed studies that provide rigorous analyses of these changing crop patterns in different epochs, we can say that based on our understanding of the decline of spelt during the last 100 years, the two major factors involved in such a process seemed to be mainly economic pressure for higher productivity which led to the selection of free-threshing wheat, which is more responsive to increased inputs; and changes in eating habits as rural populations became more attracted to industrialized food markets (seeing hulled wheat as food of the rural and poor areas). Whatever the reasons, hulled wheats were progressively replaced by free-threshing wheat (T. aestivum) and continued to exist only in isolated and remote areas in the Italian Appenines or the Central Anatolian region of Turkey (Karagöz 1996). The cultivation of hulled wheat in Italy, for example, survived only in marginal mountainous areas and there primarily as a fodder crop (D’Antuono & Bravi 1996). Its use as a human food remained established only in the local traditions of two small production areas (Garfagnana and Valnerina in Central Italy) but it was not until the 1980s that such uses became documented and studied by scholars (Perrino & Hammer 1982, Perrino & Hammer 1984). According to Di Napoli & Marino (2001), emmer cultivation in Italy had been reduced to a few thousand square meters in the 1970s. Around the same time, spelt was introduced for commercial purposes to Italy from Germany (D’Antuono & Bravi 1996). Today, the area under hulled wheat production in Italy is predominantly emmer and is estimated at around 2,000-2,500 ha with yields of up to 3.5 t/ha (Troccoli & Codianni 2005; Buerli 2006).

Hulled wheats are processed into a range of modern and convenient products including pasta, biscuits, bread, porridge, gruel, a soup ingredient, cracked wheat or beer (Stallknecht & al. 1996). Today, hulled wheats are no longer considered the food of the poor as they were in the past. They have become an exclusive, fashionable food for which concerned consumers are prepared to pay a premium price (Heller & Padulosi 1996).

Hulled wheat has spread from the traditional growing areas to new sites due to the ability of the crop to adapt to marginal land while providing reliable yields, something modern wheat varieties fail to do. In these new sites, both traditional landraces and new varieties resulting from small breeding programmes are cultivated (Padulosi & al. 1996) and compete successfully on the market with the produce from traditional areas. The success of hulled wheats in Italy has contributed to the improved conservation of their genetic resources, which are under threat; einkorn, considered a true relict crop in this country, is now maintained in the ex situ gene bank in Bari together with local populations of emmer. According to the System-wide Information Network for Genetic Resources (SINGER), in October 2007 the world’s genebanks contained 8,956 accessions of hulled wheats, made up of 1,502 accessions of emmer, 3,777 of einkorn and 3,677 of spelt. The largest collection of hulled wheats is held in Switzerland (2,392 accessions). The commercial success of this crop is, however, putting the traditional areas cultivated with these species under great pressure. Emmer, which has been typically produced by relatively poor, small-scale farmers in mountainous regions, is now...
being grown by richer farmers attracted by the high price of the crop, who cultivate it outside its area of popular cultivation. At the same time, market needs favour the cultivation of fields planted with selected varieties in the name of standardized cultivating practices and product uniformity. Emmer fields, traditionally a mix of different landraces, are becoming therefore increasingly uniform and poor in genetic diversity.

Marketing of emmer in Italy and beyond.- The increasing interest shown towards an old crop like emmer is associated with an observed growing attention paid by the public towards old traditions and the search for naturalness (D’Antuono & Bravi 1996). Until a few decades ago, emmer was consumed only by the rural communities who cultivated it. In the 1980s, health-conscious people and gourmets in the cities started to demand emmer. For the last few years now, emmer products have been readily available in traditional Italian food shops and even in modern supermarkets. Between 1998 and 2000 the market in Italy grew by a remarkable 15% per year and at the same time farm-gate prices for the raw material increased by 30% a year. This increase is due largely to the direct marketing of emmer by farmers within the agro-tourism circle, a form of holidays spent on farms where home-grown agricultural food products are served and also sold to tourists (Buerli 2006). From there, consumption has spread to other groups and even other countries, including the United States and Canada (Buerli 2006). Specific marketing strategies such as certified organic production or certification of the geographic origin (Vazzana 1996) have added to the success of emmer products on the market.

An enabling environment for increased emmer consumption.- The success of farro in Italy would not have been possible without the support of the research community and policy makers. Alerted by the loss of hulled wheats and their genetic erosion, Bioversity International launched a Hulled Wheat Genetic Resources Network, an outcome of the first international workshop on hulled wheats held in 1995.

The Network’s activities contributed to raising the awareness of both growers and scientists about the increasing genetic erosion of hulled wheats taking place in Italy and that led to a number of ex situ and in situ/on farm conservation activities along with greater collaboration on research activities dealing with characterization, breeding, agronomic improvement, value addition and the sustainable marketing of this crop.

Among the latest research initiatives promoted on hulled wheats in Italy is that of the National Institute for Agro-Economy (INEA) of the Italian Ministry of Agriculture, dealing with a multi-year programme on agri-food chains in the framework of broader intervention on the sustainable re-qualification of urban and rural areas of the Campania Region (Regione Campania 2004). The project includes, inter alia, interventions on cereals and hulled wheats, aiming at increasing the adoption of emmer varieties suitable for organic production and the development of transformation technologies to obtain novel food products. The Italian Research Centre for Plant Improvement (CERMIS), in collaboration with other national research institutes, contributes also to maintaining the genetic material of emmer and carrying out crop improvement, adaptation and morpho-physiological studies. This work is financially supported by the Region of Marche (CERMIS s.a.). Among the various Local Municipalities across Italy, which are very active in the promotion of emmer and its products, is that of Monteleone, a small city in the Umbria Region, where the culinary farro tradition is still very strong and popular and where the crop is being used as instrument of development and promotion of the hinterland (Porfiri & al. 1998).
These activities have contributed to raising dramatically the visibility of hulled wheats and market demand for it, and for emmer in particular, from consumers in the areas of production as well as at the national level.

A different story in Turkey

Current production.- Emmer continued to be cultivated as a relict crop also in Turkey. Here its production decreased radically from the beginning of the last century, due to the introduction of other wheat types and other cereals such as rice and maize. Today, the area under cultivation is limited to a small zone in the central and western part of the Black Sea Region in Kastamonu and Sinop Provinces. In these areas, the geographic altitude changes very rapidly from sea level to 2000 m a.s.l. within less than 15 km and the areas are considered to be harsh with varying conditions. As in most other countries, farmers in remote mountainous areas belong to the poorest part of the population. In the case of Turkey, 10% of the heads of the farm households that grow emmer are illiterate. Emmer is grown there as pure or mixed stands (with wheat) often on land resulting from deforestation due to overexploitation of forest trees, which is unsuitable for growing other crops as it is at a high altitude. Other small growing areas are found in Anatolia. The total area under emmer cultivation is estimated at 6000 ha with average yields of 1.5 t/ha. It is predicted that this area will be further reduced because of the high labour demand for emmer cultivation, harvesting and processing with no or low levels of mechanization. Growers are typically small-scale subsistence farmers. In average, they dedicate about 1.5 ha to emmer, which is about 25% of their total arable land. All production is rain-fed. It seems that the only reason why emmer is still grown in these areas, despite the low yields, is its high adaptability to poor soils and harsh environments without requiring much external input. For the type of farmers inhabiting these areas, cultivation of other cereals and improved varieties is not an alternative as these would require high inputs to produce reasonable yields (Giuliani & al. 2009). In the absence of a formal seed market, farmers use their own grains as seed for the following season or exchange seed with other farmers (70% of the producers). Knowledge about emmer cultivation is transmitted from generation to generation. No formal training or extension services are available.

The emmer market in Turkey.- Emmer once was a popular grain for human consumption, in particular for bread making. Today, emmer is mainly grown for animal feed (three quarters of the total production) as livestock is more important in these areas than agriculture. Farmers harvest the grain and crack it before feeding it to the animals. Sometimes, the crop is also left in the field and the animals are allowed to graze on it. It is rarely used to make bread, but sometimes to make bulgur, which is a parboiled, sun-dried, de-husked and cracked product used in traditional soups, nowadays mainly made using wheat. People who still eat emmer bulgur consider it tastier and healthier than the wheat version. About 25% of the production is designated for human consumption, either for domestic use (farmers) or/and for sale as bulgur (farmers-traders). In Sinop province, farmers grow emmer only for their own consumption. Therefore no value chains exist. In Kastamonou Province, production is also offered on the villagers’ market in Kastamonu town, mainly during the month of September, immediately after harvest. Availability of emmer to the consumer is hence also limited to this month. The value chain is as simple as that of emmer in Italy, though much less organized. Farmers are not organized and the chain lacks horizontal and vertical integration.
The overall environment for emmer.-Agricultural policy in Turkey strongly supports the production of wheat as a staple food. Premiums are paid to farmers who use certified seeds. There are no released emmer varieties in Turkey, hence no availability of certified seeds. Emmer growers therefore cannot benefit from these government incentives. Since 2002, a “Direct Income Support” scheme is in place. Under this scheme, farmers can apply for cash support depending on the amount of land they own (Turkish New Lira 120/ha). However, this incentive does not seem to be attractive to all farmers. Applications for this support have to be filed in person at the Agricultural Provincial Directorates, which are not easy to reach for the remote emmer farmers. With their small land holdings they would also receive only a meagre amount. According to Giuliani & al. (2007), in one particular area surveyed in Kastamonu Province, the number of applicants decreased by 20% within a period of six years. This could also be an indication that the poorest farmers with very small land holdings, who are the emmer producers, had left the area and abandoned agriculture.

Since the introduction of modern wheat varieties and the increasing urbanization in Turkey, emmer is considered poor people’s food. However, there seems to be a new attitude in the major cities towards healthy food, preferably from organic production. This is reflected in the choice of certified organic whole wheat pasta and bulgur available in supermarkets and shops in wealthier areas of the cities (Giuliani & al. 2009). This new trend and the existence of certifying bodies are an opportunity for the revival of emmer production and consumption in the country.

Tanner’s Sumac: A relict multipurpose crop and its fortunes

Sumac (*Rhus coriaria* L.) is a shrub of the *Anacardiaceae* family distributed around the Mediterranean Sea. One of 250 species of the genus *Rhus* occurring in temperate and tropical regions worldwide, *R. coriaria* L. is thought to have originated in the north of Iraq (Aoudat & Barkodah 1979) and today is present in Sicily, Western Asia, parts of the Arabian Peninsula and Central Asia (Polunin & Huxley 1987). The word sumac traces its origins back to the Aramaic language, referring to the red colour of its berries, while in Modern Hebrew it means spice. The species name *coriaria* refers to the use of the plant by the tanning industry (from the Latin corium meaning leather). These two different main uses of the crop (spice and tanning) have contributed to the continued use of the plant since Roman times. However, while the use as spice is today still much practiced in the Middle East, its use as tanning agent is no longer common due to technological innovations developed by the leather industry, which have substituted sumac products. In addition to these two uses, sumac has been popular in the local pharmacopeia thanks to the astringent characteristic of its tannins which act as a traditional remedy for dysentery. Use of sumac as anti-tumour, haemostat and for mouth gargle is also reported (Duke & al. 2003) and infusions made from sumac fruits are used widely to treat stomach upsets and ulcers of the mucous membranes (Turker & Usta 2006). Sumac leaves and fruits have demonstrated properties as anti-bacterial substances (especially for harmful bacteria in the intestine) (Lauk & al. 1998; Fazeli & al. 2004; Rayne & Mazza 2007)
Tanning leather industry and sumac.- The use of sumac as a tanning agent for leather dates back to Roman times. It is believed to have been introduced to Sicily by the Arabs during the 10th Century (Cari 2006) via Turkey where R. cotinus L. and R. coriaria L. were popular in Turkish markets for dying leather and woollen clothes (Türkmen & al. 2004).

Apart from R. coriaria L. (tanner’s sumac), tannin is also extracted from the leaves of other species of sumac such as the American sumacs R. copallina (dwarf sumac), R. glabra L. (smooth sumac) and R. typhina L. (lemonade sumac). The tannin from sumac has been much appreciated in the past for its ability to produce gentle tanning of white or light-coloured, soft and supple leathers and because of the fact that the leather treated with sumac has great resistance to ageing, it does not darken upon exposure to light and is less likely to decay than leather processed by other tannins. In Italy, the cultivation of sumac (known as sommacco or corinna in Italian) was popular particularly in Sicily where it was also used for the dying of yellow clothes and sacks known as “coffa” from the Arabic cuffa (Ferreira & al 2004) and nowadays many commercial materials are made from plant material, like “RETAN BLK-M”, a mixture of tannins obtained from R. cotinus L. (smoke tree) and R. coriaria L. (SCRD.net 2008) The use of sumac in the tanning industry has nevertheless dramatically decreased over recent decades in view of the development of less expensive tannins.

Sumac, the irresistible spice of Middle Eastern cuisine.- Sumac is an essential spice in Middle Eastern cuisine. It is mentioned in the writing of Dioscorides 2000 years ago, along with a reference to its medicinal properties (Arndt 1988). The spice is obtained from grinding the whole panicle and the dust obtained is used to flavour a vast array of dishes. Its tart, tangy, sour flavour contributed to the popularity of the spice. Because of its lemon-like flavour, sumac was used for centuries by the Romans before the introduction of lemons by the Arabs, which took place in Sicily around 1000 AD along with the introduction of mulberry and sour orange (Cari 2006).

This spice is used to delicately enhance the flavours of foods. It is an excellent substitute for salt and for that reason it is recommended to those suffering from hypertension. It is used as a condiment in everyday cuisine in Syria, Lebanon, Iran, Iraq, Israel, Greece, Turkey and other countries in the Middle East and Central Asia. It is used directly on rice, salads, barbecued meat, mixed with freshly cut onions as an appetizer. Ground sumac fruit is the main component of very popular spice-mix in the Middle East called “zahtar” (made of sesame seeds, thyme, marjoram, ground sumac, fennel seeds and salt). Zahtar and olive oil spread over freshly baked bread are a common Middle Eastern breakfast.

Historical records of the cultivation of sumac in Italy are numerous: in the 18th Century, its cultivation in Mondello (Sicily) is documented as a very profitable agricultural activity (Lo Cascio 2000-2001, Regione Siciliana s.a.), and there are also records of cultivation in the areas near Trapani (Accardi 2004). In those days, sumac spice was a major commodity exported along with sulphur, wine, wheat, tuna fish and manna sugar (a sugary sap obtained from the bark of Fraxinus ornus). Its popularity led also to the development of a cultivation manual (Inzegna 1874). A century later sumac was still an important crop in Sicily, but by the mid 20th Century it was no longer so. In the Parliamentary session of 31 January 1961 a group of Italian politicians called on the Government to give greater attention to the cultivation of sumac and other local crops as a means of strengthening the Italian GDP (Repubblica Italiana 1961).
Today, sumac spice is grown in Italy much less than in the past, only in limited areas of Sicily such as Vizzini and Militello near Catania, and Messagno and Borgetto near Palermo, where it is part of the local production systems along with cereals, prickly pears and local vegetables (Provincia di Catania s.a.). Efforts to reintroduce the cultivation of sumac as a spice have continued, albeit with limited success, over the last 20 years (Di Fazio 1983). Lately, sumac’s soil conservation properties have also been exploited for its reintroduction to Italy in anti-erosion forestation projects in the region of Tuscany (Regione Toscana 2000).

Reclit vs. popularity.- The case of sumac is interesting from the viewpoint of a crop faced with a dual destiny. The replacement of sumac with other products by the tannin industry has determined its dramatic decline, to the extent of becoming a relict crop in Europe and other North Mediterranean countries. On the other hand, the same species in the South Mediterranean-West Asian area does remain a highly popular spice and its use continues to be strongly embedded in local culinary traditions. That has led to a continued use of *Rhus coriaria* L., but interestingly enough without an impact on the level of research required to strengthen the sustainable conservation and use of this species.

One of the countries where sumac is today mostly used as a spice is Syria. In this country the majority of production is obtained from wild stands and there are no organized cultivated fields of sumac. Domestication, selection and crop improvement of sumac do not exist, and knowledge of cultivation practices, multiplication and conservation of the genetic diversity of its wild populations is very scarce. The same can be said for most of the countries in the Near East where sumac spice is very popular, including Turkey, where the production of this non wood forest product was estimated at 62 tonnes in 1999, entirely harvested from wild stands (Özuğurlu & Düzgün 2003). It is interesting to notice that until a few years ago, sumac was so commonly found that it was used to adulterate the more expensive herb oregano in Turkey (today this practice is no longer possible due to more rigorous food safety measures present in the country).

Genetic diversity of sumac and cultivation practices.- An eco-geographic survey project was carried out in Syria during the period 2004-2006 (Al-Haj Ibrahim 2007). The research aimed at shedding light on the eco-geographic distribution of sumac, characterizing the diversity of economic traits in its wild populations and documenting local uses and the economic role of sumac in local livelihoods. The study showed that sumac shrubs are highly adapted to a different range of ecological conditions and identified a typical value chain of sumac in Syria related to both uses as a tanning agent and a spice.

In order to understand better the genetic diversity of sumac, a comprehensive morphological characterization based on over eighty characters (10 growth characters, over 70 shoot system characters and several phenological observation characters) was performed. The study revealed that sumac in Syria can be grouped under 2 major taxa, each including other minor taxonomic entities. The ethnobotanic survey indicated also that the majority of people interviewed commonly harvested sumac for home consumption as a spice and at the same time harvested a large amount of fruit clusters for commercial purposes. Uses in traditional medicine, industrial applications, and environmental purposes were also mentioned by the respondents. Among the propagation methods, root cutting had comparative advantages over other methods (such as stem cutting, air layering, budding and grafting) as long as it is executed at the appropriate time and using suitable techniques (Al-Haj Ibrahim 2007).
What can we learn?

Literature is rich in examples of crops which were once well known and extensively cultivated and that have fallen into disuse for one or more reasons (Zohary & Hopf 1993). Similar reasons are also behind the non-domestication and absence of cultivation of other plants that are gathered directly from the wild and which therefore may not strictly speaking be called ‘crops’ (Heywood 1999b).

The reasons behind the abandon and neglect of domesticated species are numerous, including the following:
- Agronomic: e.g. due to the lack of improved genetic material, uneven maturity or low yield potential (e.g. the decrease in cultivation of lupin and grass pea, which can be reversed through breeding of new varieties containing lower levels of alkaloids and so which do not cause lathyrism)
- Technological: e.g. due to lack of efficient cultivation methods, lack of processing technologies, low potential for mechanization of production and processing, low shelf life of harvested produce, lack of recognized quality standards (e.g. the decrease in the cultivation of quinoa and little millet which can be reversed through development of technology to remove the labour intensive processing)
- Cultural and social: e.g. due to the introduction of modern crops, urbanization, changing of traditional food trends, loss of indigenous knowledge;
- Economic: e.g. due to low economic returns from cultivation, low competitiveness with new introduced crops, labour intensive cultivation and processing, limited uses;
- Political: e.g. due to the presence of subsidies for competitive cash crops, lack of focus in national development strategies.

The process of declining attention on a certain crop can be gradual or take place over a short period of time. When the reduced attention is not accompanied by the documentation or transmission of indigenous knowledge related to the use of that crop, it falls into a state of abandon and eventually become a relict crop, growing only in a few populations in some home gardens. Future prospects of such crops may well include their complete extinction. This is the case of the vegetable garden rampion *Campanula rapunculus* reported as extinct in the 1820s (Mabberley 1997) or the Hausa bean *Kerstingella geocarpa*, a highly neglected crops described as occurring in the Guinean/Sudanian Woodland (Central-West African States) (Dalziel 1937, Verdocurt 1982), but currently found growing only in few populations.

One particular group of crops is that of medicinal species, for which the knowledge needed for continuing the appreciation and use of the plants, requires more attention than that given today (Padulosi & al. 2002a). The fact that 80% of the world’s population relies still today for their primary health care on traditional medicine and herbal remedies (WHO 2002), makes the loss of medicinal plants (which is among the greatest in absolute numerical terms), one of the worst problems affecting biodiversity and its sustainable use.

On the other hand, as the case of emmer in Italy demonstrates changes in food habits and lifestyle can lead to the rediscovery of a crop previously fallen into abandon and neglect. The emmer case in Italy clearly shows that this process is demand-driven and not initiated by the producers. The producers react on a specific demand from a particular powerful consumer group (health conscious, trendy people prepared to pay premium prices for specialty
products). From this group the trend is steadily passing on to the “normal” consumers thus getting the crop out of the niche status. The role of the national and international media cannot be over-stressed. In addition to the private processors, they give the crop and the products made from it, wide publicity in newspapers, special journals and magazines. Emmer products received a further push as they were picked up by renowned restaurants all over the country, giving them a prestigious image. However, the producers would not have engaged in expanded emmer production without the strategic engagement of researchers and the private sector, as the inherent disadvantages of the crop remained unchanged. The technological support from the processors to farmers and their enthusiasm in the development of new products and processing technologies represent the driving forces in satisfying growing consumer demand and overcoming production constraints. Research has contributed with programmes on the conservation of landraces, the development of improved varieties and looking at agronomic problems. Support from the policy level is given through providing internationally recognized certification schemes such as Protected Geographic Indication and organic production. Producers who qualify for these labels benefit from higher returns from their production. Policy also supports the involvement of farmers in tourist activities and sales of agricultural produce on farm. This contributes to a higher awareness by consumers of traditional products. A combination of all these factors led to the resurgence of emmer in Italy and to its growing production and consumption.

In Turkey, the reasons for the decline in emmer production and consumption were the same as in Italy. However, there are no clear signs yet to allow the forecast of a change in the current situation. Turkey lacks the driving forces behind a potential change – strong consumer demand. This demand can only be stimulated by a reversal of the low image that emmer products currently have. This is where the role of the media and health and education policy-makers is crucial. Unless the available information about the dietary advantages of emmer compared to other grains is diffused by inclusion into the basic education, university curricula, health programmes and in the mass media, consumers will not demand it. There is also a lack of innovativeness among the private companies producing cereal based foods. They need to start experimenting with new products that include emmer.

With regard to the sumac situation, the fact this crop has been used by people in several ways, has been in itself a sort of insurance policy for its continued existence. In particular, its use as a spice has ensured that the crop did not fall into oblivion after the drop in its use by the leather industry in the 20th century.

A number of general lessons could be drawn from these examples, and other cases reported in the literature, on the “fall and (possible) rise” of agricultural crops:

Diversity of uses: The more diverse the spectrum of uses of a species, the higher the likelihood of surviving changes in agricultural policies, life styles, dietary trends. Diversity in uses, just like genetic diversity, is key to the continued survival of crops. This is closely linked to the following lessons, viz.

Cultural erosion: The widespread erosion of local traditions and knowledge is the root cause of the loss of hundreds of species worldwide. Such a loss can be stemmed through proper interventions such as appropriate, timely documentation of indigenous knowledge, empowerment of local communities to increase their self-esteem and recognition of their own identity and culture which is safeguarded also through the continued use of local crops and species.
Conservation of genetic diversity: Ups and downs in the popularity of a crop are a common feature in crop usage patterns over time. The ultimate appreciation of a crop by people is the result of several factors such as the utility of the crop in satisfying specific needs, the convenience provided by the crop compared to other crops and products, fashion trends, cultural and historical background of people, etc. The loss of both genetic diversity and indigenous knowledge should be prevented through strategic interventions using *ex situ* and *in situ* conservation methods;

Getting the evidence: The various values of crops (economic, nutritional, medicinal, cultural etc) call for greater attention by research and development. Detailed studies to provide scientific and empirical evidence and to document information about the crops would allow better advocacy for the conservation and sustainable use of biodiversity, particularly neglected and underutilized species, and hence contribute to their valorization over time.

Role of users: Contrary to the past, nowadays, consumers play a more active and pivotal role in defining the level of use or neglect of agricultural biodiversity. They can contribute through the initiation of new trends in consumption or following or not trends promoted by industry and/or media. Conservation efforts led by R&D should be better linked to consumers and that raises the issue of how effective we are in conveying our messages on the benefits from biodiversity to consumers. More effective public awareness campaigns are therefore needed, including those targeting younger generations. Greater linkages between R&D and Fair Trade or other movements sensitive to sustainable use of biodiversity should be promoted;

Enabling policies: National and international policies have so far aimed at the protection mainly of crop varieties that are uniform, distinct and stable (in line with the requirements needed to fulfill plant breeders’ rights). Legal protection of wild, neglected, underutilized or relict species, typically represented by landraces and ecotypes, is very limited and should receive greater attention. The suggestion, for instance, of expanding the list of species in Annex I of the International FAO Treaty for PGRFA during the anticipated review of this list to include such species would be an important step in that direction and should be further promoted and supported.

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