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Opportunities for farm seed conservation, breeding and production

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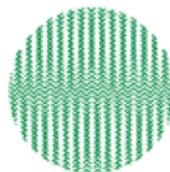
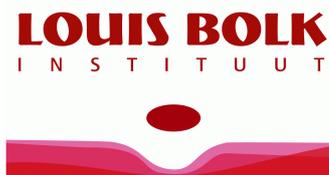


Breeding initiatives of seeds of landraces, amateur varieties and conservation varieties

An inventory and Case Studies

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INRA





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One of the objectives of the Farm Seed Opportunities (FSO) project (www.farmseed.net) is to develop on farm breeding methodologies for the conservation and development of landraces, amateur and conservation varieties. The starting point for the development of these methodologies are the already existing experiences of farmers, small scale seed producers and researchers. To be able to draw on the expertise of these practitioners, we have selected five breeding initiatives for in depth case-studies. Prior to the selection of the five cases we carried out an inventory of all known initiatives within the European Economic Area. Results are presented in this report.

This study has been carried out to fulfil Task 2.1. of Workpackage 2 of Farm Seed Opportunities.

DELIMITATIONS OF THE FIELD OF STUDY

There are many and different types of persons and organisations (companies, NGOs, research institutes) involved in breeding, maintenance and seed multiplication of agricultural crops. This particular study concerns breeding initiatives of landraces, amateur and conservation varieties. However, the terms “breeding” “landraces”, “amateur varieties” and “conservation varieties” are open to multiple interpretations. Therefore, we will first present the definitions for the earlier mentioned terms that we used to carry out this study.

In another workpackage (task1.1) of the FSO project, studies bring complementary aspects of the definitions of the concept of landraces, conservation varieties and amateur varieties and these will be discussed from different point of views in different countries and/or regions. As this task started at the same time as the present study, results were not available yet, when we started to set up this research.

Landraces, amateur and conservation varieties

For the term *Landrace* we use the definition proposed by Villa et al. (2005): “*A landrace is a dynamic population(s) of a cultivated plant that has historical origin, distinct identity and lacks formal crop improvement, as well as often being genetically diverse, locally adapted and associated with traditional farming systems*”.

The term “amateur varieties” originates from French legislation and refers to varieties that are not used for commercial agricultural production, i.e. varieties that are only grown for private use by for example hobby gardeners.

The term “*conservation varieties*” was first introduced in the EU drafts of the proposed directive EU98/95 “providing for certain derogations for acceptance of agricultural landraces and varieties which are naturally adapted to the local and regional conditions and threatened by genetic erosion and for marketing of seed and seed potatoes of those landraces and varieties”. According to the text of this directive conservation varieties are: *landraces and varieties which are naturally adapted to the local and regional conditions and threatened by genetic erosion*. So, “conservation varieties” include both landraces and amateur varieties, provided that these are locally adapted and threatened to disappear.

To improve readability in the rest of this document we will only use the term “landraces” and consider that these also include “amateur varieties and conservation varieties”

Breeding

The activity of plant breeding aims at provoking genetic changes in a crop in order to enhance crop performance for yield, quality and or other desirable traits. These genetic changes can be achieved by deliberate selection of certain plant types and by selection pressure from the growing environment. For species cultivated for their seeds, usually plant types that are better adapted to the environment produce more seeds than plants that are not adapted and hence after several growing seasons the composition of the population will be shifted towards the more adapted plant types. For vegetables, the seed production performance is often opposite to the quality traits selection. In this study we consider both deliberate selection as intentionally growing a diverse population in a certain environment, with the aim to adapt the population to the environment, as breeding.

Breeding initiatives of landraces

These include private persons, institutes and companies that use landraces, amateur or conservation varieties as a starting point to create improved varieties that are adapted to local cropping systems by either:

- Allowing such a variety to evolve with the local cropping system through natural selection and, optionally, in combination with mass selection
- Using landraces merely as crossing parents in a breeding programme to develop new varieties

The previous two points distinguish the breeding initiatives in this study from both main stream plant breeders. The latter aim at taking advantage of the latest gains in plant breeding and therefore are reluctant to include older varieties in their crossing schemes. If they do recur to landraces, they will cross these with their modern varieties.

Further delimitations

The study limits itself to initiatives that breed agricultural field and vegetable crops for human consumption and so does not include initiatives on fruits, herbs, forage, ornamental and forestry crops. Furthermore, we are only interested in breeding initiatives that are oriented towards commercial crop producers and hence excludes initiatives that only breed for hobby gardeners.

METHODOLOGY

The study consisted of the following steps:

1. Inventory of existing initiatives that are involved in breeding and seed multiplication of landraces

This consisted of a review of literature and resources on the internet. Besides that, all members of the FSO project were asked to include the initiatives in their respective countries in the inventory. Furthermore the authors contacted key resource persons from different European regions that do not belong to the FSO project to ask for the initiatives in their country and neighbouring countries. These included persons from Sweden, Latvia, Czech Republic, Hungary and Rumania.

In this phase we did not restrict ourselves to breeding only, but considered all initiatives that are involved in seeds of landraces. This allowed us to get an overview of all possible activities related to these varieties

2. Selection of five cases of in depth case-studies

In order to select cases that cover the whole range of diversity of existing breeding initiatives, the inventory was analysed and initiatives were grouped according to type of activities and crops. This allowed for selecting cases from the categories that were relevant for this study.

3. Conducting of case-studies

The case studies were carried out by either interviewing persons involved directly or asking these to answer written questions by e-mail. As a basis for both the direct interviews and the e-mail correspondence a question list was developed (see Appendix).

Furthermore information was obtained by review of (grey) literature and information on the internet.



2. Inventory of initiatives on seeds of landraces

The inventory resulted in a list of 68 initiatives in 17 European countries (Table 1). Most likely there are more initiatives that were not included in this inventory. This is because many seed initiatives are local, and farmer driven and the information these spread usually remains local and in the national language. So, it is difficult to obtain this information. Furthermore, there are relatively few Eastern European countries included. This may be partly due to difficulties to get access to information in local languages, but also because contacts with key informants from four Eastern European countries made clear that there are relatively few seed initiatives in this region. This is due to the system of collective agriculture during the communist era and its transition afterwards. Because of this history, the farmers of today in many parts of this region did not only loose the knowledge to multiply and breed seeds, but also the experience of managing their own farm.

The primary objective of this exercise was to get an overview of the diversity of organisations and individuals that are involved in seed multiplication and breeding of landraces and their main activities. And in this we most likely succeeded. Despite the diversity, there are also similarities between initiatives. Based on their activities we distinguish the following groups:

- **“Seed Savers”**. Private initiatives to collect and conserve old local varieties *in situ* and promote its use, mostly by hobby gardeners but also for commercial growers. Examples are Garden Organic/Heritage Seed Library (UK); Irish Seed Savers; Pro Species Rara (Switzerland).
- **Initiatives to promote *in situ* conservation of landraces** by farmers, mostly by national and local governmental bodies, national parks. Examples are programmes of the Ministries of Agriculture of Finland and Greece; Municipalities such as the Kaiserstühler Garten in Eichstetten (Germany); the regional nature Parc du Queyras (France).
- **Producers of regional varieties** (and products derived of these). This are mostly farmers, who often collaborate with processors (e.g. bakers), who grow a certain variety that originated in their region and which they market as a speciality. Examples are Consorzio della Solina (Italy), Opperdoezer Ronde potato growers (Netherlands).
- **Seed producers**. These are either
 - small private companies, specialised in seed production of old and special OP varieties such as Reinsaat (Austria), Semailles (Belgium), Biau Germe (France), Bingenheimer Saatgut AG (Germany) or
 - farmer (groups), who both produce food and seeds and most are also active in political lobbying, such as Dreschflegel and Karsten Ellenberg (Germany).
- **Farmer Breeders**. These are farmers who improve local varieties, sometimes in collaboration with researchers and extensionists. Examples are PAIS (France), Vaso project (Portugal), onion and cabbage farmers in the Netherlands.
- **(Biodynamic) breeders of landraces and old varieties**. These are private “non profit” initiatives run by persons, mostly with an academic background (degree in plant

breeding), who aim at both improving landraces and old varieties. They aim at maintaining genetic diversity within their varieties. Mostly they both work with common crops as well as with “old” or rare crops (emmer, einkorn, spelt etc.). Most of them are also active in developing ways to market regional and special products. Examples are Allkorn (Sweden), Cereal Breeding Research Darzau and Kultursaat (Germany)

- **Supporting institutions.** Institutes and Foundations that provide either financial or technical support to one or more of the groups above. These often accompany this support with political lobbying. Examples are Zukunftstiftung Landwirtschaft (Germany), AIAB (Italy), Red de Semillas (Spain), Louis Bolk Institute (Netherlands)

It is important to note that there are no strict boundaries between these groups. Many initiatives could be categorized in more than one group. For example “farmer breeders” are often also commercial producers of regional varieties.

Table 1: Inventory of Seed Initiatives

COUNTRY AND ORGANISATION	KIND OF ORGANISATION	CROPS	SHORT DESCRIPTION OF ACTIVITIES	WEBSITE
AUSTRIA				
Arche Noah	NGO/Association	Different crops	Conservation, exchange, extension, marketing of rare varieties	www.arche-noah.at
Reinsaat	Seed company	Vegetables, herbs, flowers	Seed multiplication and selling of seeds	www.reinsaat.co.at
BELGIUM				
Semailles	Seed company	Vegetables, herbs, flowers	Seed multiplication and selling of seeds	www.semaille.com
DENMARK				
Agrologica	Consultancy	Cereals	Conservation and breeding of landraces	www.agrologica.dk
Frøsamlerne	Association	Vegetables	Conservation and exchange	www.froesamlerne.dk
FINLAND				
MTT-Agri Food Research	Ministry of Agriculture	Different crops	Financially support farmers who grow landraces	
FRANCE				
AGRIBIO 04 - Producteurs bio des Alpes de Haute-Provence	Farmer association	Wheat	Conservation, multiplication, extension	www.civampaca.org
ARDEAR Rhone-Alpes	Farmer association	Wheat, Maize	Collection of farmer varieties	
Association des Producteurs de Végétaux du Queyras	Farmer association	Wheat	Conservation and seed multiplication	
Association Kokopelli	NGO/Association	Vegetables	Conservation, exchange, extension, lobbying	www.kokopelli.asso.fr
Biau Germe	Farmer association	Different crops	Sale of old vegetable seed varieties, flowers	www.biaugerme.com
Bio d'Aquitaine	Association	Maize		
BIOCIVAM 11	Farmer association	Vegetables, durum wheat	Seed multiplication, farmer breeding, extension	
CETAB - Centre d'Etude et Terre d'Accueil des Blés	Association	Wheat	Conservation, exchange, farmer breeding, extension	
Association Croqueurs de Carottes	Association	Carrots	Conservation, lobbying	

Germinance	Seed company	Vegetables, flowers	Seed multiplication and selling of seeds	
Graines del País Kaol Kozh	Seed company Farmer association	different crops Brassicas	Seed multiplication and selling of seeds Conservation, multiplication and breeding of landraces	www.interbiobretagne.asso.fr
MAB 16 - Maison des Agriculteurs Biologiques de Charente	Association	Wheat, pulses, sunflower	Seed Multiplication	
Parc naturel régional du Queyras	National parc	Wheat	Conservation and seed multiplication	charte.pnr-queyras.fr/
Payzons ferme	Farmer association	Potatoes	Multiplication and selling of seed potatoes	
Plateforme Agrobiologique d'Inter Bio Bretagne à Suscinio (PAIS)	Association	Vegetables	Seed Multiplication and breeding	www.interbiobretagne.asso.fr
Potager d'un Curieux	Seed company	Vegetables, flowers	Seed multiplication and selling of seeds	
Savoirs de Terroirs	Association	Potato, squash	Conservation, exchange and extension	savoirdeterroirs.free.fr
Syndicat de Promotion de la Touselle	Association	Cereals, fodder crops	Multiplication, exchange, promotion of use	
Triptoleme	Association	Cereals, herbs	Multiplication, exchange, extension	tripto@laposte.net
GERMANY				
Bauernhof Karsten Ellenberg	Farmer breeder	Potato	maintains, breeds and sells old potato varieties	www.kartoffelvielfalt.de
Bingenheimer Saatgut AG	Seed company of farmers	Vegetables	Multiplication and selling of seeds (breeding through independent organisation Kultursaat)	www.oekoseeds.de
Cereal Breeding Research Darzau	Research institute/ association	Cereals	Breeding, development of cereal products	www.darzau.de
Dreschflegel	Farmer association/NGO	Different crops	Conservation, exchange, breeding, multiplication and selling, extension, lobbying	www.dreschflegel-saatgut.de
J. und C. Graf Keyserlingk Institut	Research institute/ association	Cereals	Conservation, breeding, development and promotion regional products	www.saatgut-forschung.de
Kaiserstühler Garten	Seed savers and	Vegetables	Maintain and improve regional varieties,	www.kaiserstuehler-

	breeders		extension, promotion of regional products	saatgut.de
Kultursaat e.V. VEN	Association NGO/Association	Vegetables Different crops	Breeding Conservation, exchange, breeding, extension, lobbying	www.kultursaat.org www.nutzpflanzenvielfalt.de
Verein für Pflanzenzucht Hof Grub VERN	Research farm/ association NGO/Association	Cereals Different crops	Breeding Conservation, exchange, extension, promote cultivation by farmers and regional products	www.hofgrub.de www.vern.de
Zukunftsstiftung Landwirtschaft	Foundation	Different crops	Financially support breeding initiatives, lobbying	www.zs-l.de
GREECE				
Aegilops Ministry of Agriculture	NGO Ministry	Cereals Different crops	Promoting use of heritage varieties Supporting farmers who want to grow regional varieties	www.aegilops.gr
HUNGARY				
MTA-Genebank	Research institute	Cereals	Conservation, breeding, supporting farmers who want to grow landraces	www.mgki.hu
IRELAND				
Irish Seed Saver Association	NGO/Association	Different crops	Conservation, exchange, extension	www.irishseedsavers.ie
ITALY				
Agri90 sca	Farmer association	Maize	Conservation, extension, promotion regional products	
Arcoiris	Seed company	Different crops	Seed multiplication and selling	www.arcoiris.it
Associazione Italiana Agricoltura Biologica	NGO/Association	Vegetables	Research, lobbying	www.aiab.it
Azienda Agricola Stuard	Research institute/ association	Different crops	Conservation, extension, promotion regional products	www.stuard.it
Civiltà contadina	NGO/Association	Vegetables, cereals	Conservation, exchange, lobbying	www.civiltacontadina.it
Consorzio della Quarantina	NGO/Association	Vegetables, potatoes, cereals	Conservation, exchange, extension, promote cultivation by farmers and regional products	www.quarantina.it

Consorzio Solina d'Abruzzo	NGO/Association + regional research institution	Wheat	Conservation and marketing of the variety Solina	www.arssa.abruzzo.it
Cooperativa Agricola La Fiorita	Farmer association	Cereals and vegetables	Conservation, extension, promotion regional products	
Coordinamento Toscano produttori biologici	NGO/Association	Cereals	Conservation, exchange, multiplication, extension, lobbying and production of bread from local varieties	www.ctpb.it
Istituto di Genetica e Sperimentazione Agraria "N. Strampelli"	Research institute/ association	Cereals	Conservation, exchange, extension, promote cultivation by farmers and regional products	www.biodiversitaveneto.it
Oriana Porfiri	researcher/farmer	Cereals	Conservation and exchange, conservation of old varieties	
Rete Semi Rurali	NGO/Association		Support to local association and facilitate sharing of information	www.semirurali.net
S'armidda	NGO/Association	Different crops	Regional association (Sardinia) supporting farmers who want to grow regional varieties	
NETHERLANDS				
De Bolster	Seed company	Vegetables, herbs, flowers	Seed multiplication and selling, breeding	www.bolster.nl
It Griene Nest	Association/Farm	Regional plant and animal varieties	Conservation, extension, promotion regional products	www.grienenest.nl
Louis Bolk Institute	Research institute	Different crops	Technical Support farmer breeders	www.louisbolk.nl
Opperdoezer Ronde farmers	Farmer Group	Potato	Group of farmers that multiply, cultivate and market an old variety	
Stichting Zaadgoed	Foundation	Different crops	Financial Support farmer breeders, lobbying	www.zaadgoed.nl
Vreeken's Zaden	Seed company	Vegetables, herbs, flowers	Seed multiplication and selling	www.vreeken.nl/
PORTUGAL				
VASO	Researcher/farmer	Maize	Participatory plant breeding with local maize varieties	

SPAIN				
Red de Semillas	Association	Different crops	Bring together the various local projects in Spain and provide instruments for carrying out activities in the field of preservation and utilisation of agricultural biodiversity.	www.redandaluzadesemillas.org
SWEDEN				
Allkorn	Association/researcher and farmers	Cereals	Multiplication, breeding, exchange, promotion	www.allkorn.se
Sesam association	Association	Vegetables	Conservation and exchange	www.foreningensesam.se
SWITZERLAND				
Pro Species Rara	NGO/Association	Different crops and animals	Conservation, exchange, extension, marketing of rare varieties	www.prospecierara.ch
Sativa Rheinau	Seed company	Vegetables, herbs, flowers	Seed multiplication and selling	www.sativa-rheinau.ch
UNITED KINGDOM				
Garden Organic/Heritage Seed Library	NGO/Association	Different crops	Conservation, exchange, extension	www.gardenorganic.org.uk



Based on the inventory in the previous chapter and internal discussions with all members of the Farm Seed Opportunities project five cases were selected for more in depth studies. The cases that are described on the following pages are

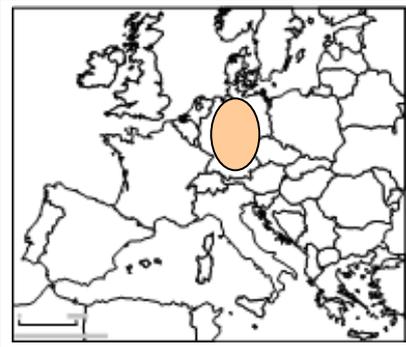
- Kultursaar, farmer vegetable breeders in Germany
- Plateforme Agrobiologique d'Inter Bio Bretagne à Suscinio (PAIS), farmer vegetable breeders in France
- Syndicat de Promotion de la Touselle, farmer breeders and producers of regional wheat varieties in France
- Consorzio Solina d'Abruzzo, producers and processors of a regional wheat variety in Italy
- Allkorn, an initiative of a cereal Biodynamic breeder and farmers in Sweden

The cases were chosen in such a way that these covered different types of initiatives crops and countries.

Description of the existing breeding initiatives in Europe on landraces, conservation varieties and amateur varieties

Kultursaat

Vegetables– Germany



The Initiative

In 1985 a number of biodynamic vegetable producers, who were involved in multiplication and breeding of open pollinated varieties, set up the “Initiativkreis für Gemüsesaatgut aus biologisch-dynamischen Anbau” (The Initiativecircle for vegetable seeds from biodynamic farming). Within this informal platform they exchanged experiences and discussed issues related to organic seed multiplication and breeding. During the years they realised that, to avoid conflicts between the time dedicated to professional vegetable production and time dedicated to breeding, the vegetable producers needed some economic compensation for their breeder activities. To promote their breeding work, raise funds and coordinate their breeding activities, members of the “Initiativkreis” established the (non-profit) association Kultursaat in 1994.

At present eighteen breeders are working for Kultursaat. These breeders are located all over Germany, one breeder is situated in the Netherlands and two others are based in the north of Switzerland. Together they cover all major vegetable crops, such as e.g. carrot, cabbage, lettuce, tomato, sweet pepper, pumpkin, cucumber, onion, leek, beans and beetroot. The crop choice of each breeder depends on his individual interests and affinity with the crop. But Kultursaat also actively stimulates gardeners to pick up breeding of crops that are not included in its activities yet.

The breeders are financed through Kultursaat for their breeding activities. To apply for funding, each breeder has to submit a project proposal once a year that is evaluated by the executive board, a committee that consists of five of the members, mainly breeders themselves. The association also handles the official procedures for the registration and application for breeders’ rights of new varieties. When breeders’ rights are granted, the individual breeders transfer these rights to the Kultursaat association. Another important activity is the exchange of knowledge and experiences between breeders. This is realised by bi-annual meetings. Furthermore, new breeders are personally coached by more experienced members and the more experienced breeders also can ask for personal coaching by one of the other members. In 2007 Kultursaat also started a genebank for the collection and *in situ* maintenance of open pollinated varieties (co-funded project by the German Federal programme for organic farming).

Besides practical breeding and seed multiplication, the members are also active in developing new plant evaluation and breeding methods that are inspired by anthroposophy, such as peripheral effects (e.g. biodynamic preparations, planetary configuration, sound) on appearance of plants and breeding and picture forming methods (e.g. copper chloride crystallization) to evaluate quality.

For seed production and marketing the “Initiativkreis” has established an independent seed company: it started in 1989 under the name “Allerleirauh” and developed in 2001 in Bingenheimer Saatgut AG. This company contracts organic farmers to multiply the varieties that were bred by the breeders of Kultursaat and other open pollinated vegetable varieties that are interesting for organic farmers. The majority of the

approximately hundred seed growers are also member of the "Initiativkreis".

Bingenheimer Saatgut AG is owned by shareholders, but shares are not freely negotiable. The shares are only issued to named persons or institutes that are known by the others ("vinkulierte Namensaktien"). Among the shareholders are the Kultursaat breeders and seed producers. Bingenheimer Saatgut AG pays licence fees to Kultursaat association for the multiplication of the varieties of which Kultursaat has obtained property rights.

The income through licence fees has increased over the last years, but main funding comes from private foundations. One of the important donors is the Zukunftsstiftung Landwirtschaft, a private fund that has been established specifically for long term support of organic seed and breeding initiatives. In recent years they also are supported through projects of the German government and agreements with organic retailers.

Membership of Kultursaat is open to anybody who pays the membership fee. In 2007 in total 248 persons were members; besides the 18 breeders also producers, hobbygardeners, traders and consumers. The organization employs three persons and is lead by an executive board that consists of a delegation of the members.

Organic vegetable production

All breeders are involved in biodynamic farming, but the varieties are aimed at all organic growers in Western Europe and so they do not exclusively target a specific cropping system. They do aim at varieties that are adapted to specific regions and agro-ecological conditions. This is realized by having the network of 18 breeding projects in different regions with different climates and soils.

All breeders are either commercial organic vegetable producers themselves or have their breeding on a commercial biodynamic farm. When breeders do not manage the commercial vegetable production themselves, the commercial farmer also takes part in the evaluation of the selections. This is to make sure that varieties are developed within the agricultural practice and will comply with the requirements of organic farmers. The types of farms the breeders work vary from less than 5 ha to over 100 ha.

Although they do not target a specific organic cropping system, they aim at developing varieties with superior sensory (particularly taste) and nutritional quality. Therefore the varieties are specifically suitable for farmers and market channels with a special interest in the production of high quality food.

Motivation for involvement in breeding

The initiative started out of concern with the disappearance of open pollinated vegetable varieties as well as the lab-based techniques that are used in modern plant breeding. Commercial seed companies are replacing open pollinated varieties by hybrids that cannot be multiplied by the farmers and gardeners themselves. Nowadays, open pollinated varieties of the major vegetable crops are scarce. Furthermore, a number of techniques, such as protoplast fusion to obtain Cytoplasmic Male Sterility, that are used in modern plant breeding are not in accordance with the principles of organic farming. Therefore a number of organic vegetable producers decided to maintain and multiply open pollinated varieties that were interesting for organic farming and this evolved in also improving the varieties by breeding.

Another important aspect is that members of Kultursaat consider breeding and varieties as a part of our cultural heritage and they consider the maintenance of this heritage as a task of mankind.

Breeding and seed multiplication

The most important aim is to develop “new” varieties that contribute to human nutrition. For Kultursaat a vegetable should contribute to the consumers’ physical well being and spiritual development. As these aspects of food quality are difficult to identify by measuring the contents of nutritious substances (e.g. vitamins, proteins), they apply holistic methods to determine quality such as the earlier mentioned picture forming methods. A good taste is a vital indicator for nutritional quality and this receives the major emphasis in all breeding programmes. Furthermore, in Kultursaat’s quality concept, a distinctive ripening phase and a harmonious balance between vegetative growth and ripening of the product is important to obtain. Besides this, breeders also look at adaptation to organic growing conditions (good rooting ability, efficient in uptake of soil nutrients, tolerance to diseases and abiotic stresses).

Starting point for the breeding are open pollinated varieties that were available on the commercial market, collected from organic producers and obtained through genebanks. Currently, they are also setting up their own genebank. This is because commercial open pollinated varieties are rapidly disappearing. They find it important that varieties are maintained *in situ*, so that these can co-evolve with agriculture. In genebanks seed maintenance is isolated from practical agriculture and done in small plots instead of (“authentic” and) broad fields that are common in practice.

They distinguish maintenance breeding and “new” breeding (“Neu-Züchtung”). Maintenance breeding is aimed at conserving the open pollinated varieties true to type. If open pollinated varieties are not maintained with care these degenerate and become less productive and loose quality. For maintenance breeding plants that are typical for the variety, are selected.

For breeding *new* varieties the methodology depends on the crop and its reproductive system (cross pollinator, self pollinator). In all crops, but especially in the cross pollinating crops (cabbages, carrots) they have obtained major success by positive mass selection, with a strong focus on taste. Also important for the success is the fact that they work at commercial farms, where open pollinated varieties are grown in large fields. So, as a result there are many plants to select from and this increases the chance of finding new plant types with positive traits, within an existing variety.

In self pollinating crops, such as tomato, diversity within open pollinated varieties is much smaller. One option they have successfully pursued is to sow hybrids and select among the off spring. They also make deliberate crosses to create variation to select from.

Varieties are registered through the regular official procedures at the German Bundessortenamt (as a rule) or any corresponding agency.

Achievements and Future Challenges

The success of initiative can be measured by the number of varieties they have produced: in 2007 42 varieties of 16 different vegetable crops were officially registered and applications for the registration of 10 more varieties were in progress.

To promote the use of the varieties and increase income for breeding, together with seed company Bingenheimer Saatgut AG and retailers they are developing the marketing concept: “Vegetables with Character” (“Gemüse mit Charakter”). Most Kultursaat varieties have a distinctive and better taste than conventional varieties. However, so far in Western Europe, vegetable consumers are not aware of the name of the variety. For ten of their varieties they have developed promotion material, which includes posters, flyers with information on the variety and a description of its specific taste and labels for the crates. The varieties are grown by 50 producers and sold in Germany through 12 organic retailers. Generally producers receive a better price from retailers. Processors such as vegetable juice producers use Kultursaat varieties because of the superior taste and merchandise their products using the varieties’ names. Main obstacle is that production of seeds and vegetables lags behind consumer demand. In 2005 the concept has gained an award at the yearly international organic trade fair Biofach (in Neurenberg,

Germany).

Contact

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Further information

Website

www.kultursaat.org

www.oekoseeds.de

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Description of the existing breeding initiatives in Europe on landraces, conservation varieties and amateur varieties

Plateforme Agrobiologique d'Inter Bio Bretagne à Suscinio (PAIS)

Vegetables– France



The Initiative

Plateforme Agrobiologique d'Inter Bio Bretagne à Suscinio (PAIS) is a network of organic vegetable producers, traders and scientists. The members of PAIS are involved in the evaluation, breeding and multiplication of traditional open pollinated varieties of vegetables that were originally cultivated in Brittany. They started with different species of Brassicas: cabbage, cauliflower and broccoli. Now their activities also include fennel, tomato, carrot, parsnip, leek, shallot and lettuces. This case study mainly deals with the breeding of cauliflower, as this is one of the crops with which they started and hence have the longest experience.

PAIS was established in 2000 through the initiative of farmers and traders, who are member of the regional organic organisation Inter Bio Bretagne (IBB). They started an experimental centre with fields and greenhouses at the farm of the agricultural school, Lycée agricole de Suscinio.

The following members participate in PAIS:

Farmer Organisations:

- Association des Producteurs de Fruits et Légumes Biologiques de Bretagne
- Armorique Maraîchère

Traders:

- Biomas
- Pronatura
- Poder

Scientific partners:

- INRA
- GRAB Avignon
- Lycée Agricole de Suscinio - Ploujean - Morlaix

The organisation employs one full time field technician and the agricultural school contributes with field labour at the experimental station. Currently PAIS is financed through IBB, Inter Bio Bretagne. The researchers belong to their own organisation and their activity were partly performed at PAIS.

Organic cauliflower production in Brittany

The farmers involved are specialised organic vegetable growers and are situated in a fertile region with intensive year round vegetable production. They produce both for the local and export market. Their region is favoured by mild winters. This feature enables them to produce cauliflowers during the end of the winter period and early spring, when there is little or no fresh production in other regions in Europe. So, this makes the cultivation of winter cauliflower especially important and profitable for them.

Cauliflowers are planted during August and July and are harvested from September to June. Each variety produces harvestable heads during one month, so they grow many

varieties with different maturity periods. The early maturing varieties are called “autumn cauliflower” and the varieties that are harvested later in the season “winter cauliflowers”.

Another important aspect of the region is that about 30 years ago farmers still produced vegetable seeds. The production of seeds disappeared with the replacement of open pollinated varieties by hybrids. However, older farmers have not completely lost the knowledge of seed production.

Motivation for involvement in breeding

The farmers’ interest in traditional open pollinated varieties and in starting their own breeding is motivated by the fact that they find that most modern conventional seed companies only breed varieties that are not acceptable for organic farmers. First of all most of the companies only produce F1-hybrid cauliflowers. For the production of these hybrids, breeders mainly use Cytoplasmic Male Sterility (CMS). The most commonly used CMS-system is not derived from the cauliflower (*Brassica oleracea*) itself, but from radish (*Raphanus sativus*). The so-called “Ogura”-cytoplasm has been introduced in the crop by protoplast fusion, that is a form of genetic modification of the mitochondria. Moreover the “Ogura”-cytoplasm is patented. Both Genetically Modified Organisms and patents on life are not accepted by the organic sector. Secondly, most modern Brassica varieties are not adapted to the organic growing system as these were bred under high input conditions. So, since the conventional seed companies do not provide the varieties they need, the farmers decided to take seed production and selection of varieties in their own hands.

Besides this, farmers also manifest a strong desire not to become dependent on the modern seed sector that over the last decades has become more dominated by only a few large multinational companies. Furthermore, cultivation of local varieties also fits in their strong sense of regional pride.

The initiative was further triggered by a revision of the EU directive on organic farming (EU2092/91), that was aimed at increasing the use of organically multiplied seeds. Discussions on the obligatory use of organically multiplied seeds and a new regulation for organic seeds started around 1995. Only few conventional seed companies were prepared to provide organic seeds and therefore the farmers decided to set up organic seed multiplication themselves. For this purpose they needed open pollinated varieties that were not protected by breeders’ rights.

Breeding and seed multiplication

The initial aim was to evaluate genetic resources from genebanks, to organise an organic variety breeding and seed production. When farmers evaluated traditional cauliflower varieties of the region, conserved in the INRA genebank, they became aware that these were interesting for direct commercial production. A number of farmers adopted local varieties that originated in their area, and started to improve these by selection.

The genetic resources of winter cauliflower came from the collection of the genebank of INRA. This genebank possesses a large (220) collection of local varieties of Brittany of winter cauliflower. This is because winter cauliflower has been a traditional crop in Brittany for one century. The cultivation of autumn cauliflower is from more recent times and varieties of the region originate from seed companies. To increase diversity for autumn cauliflower also genetic resources from other genebanks (UK, Netherlands, Switzerland) were evaluated.

Before distribution to the farmers, new genetic resources are first evaluated at the experimental station at the agricultural school. The varieties are jointly evaluated by researchers, farmers and traders. In this initial stage they evaluate the cauliflower for adaptation to the region and the organic cropping system. Besides the quality of the head, farmers are also specifically interested in cauliflower varieties that produce heads in the winter and spring season, because it is the period of production of the traditional Roscoff type. Currently there are less commercial varieties that are suited to the Spring

growing season. The participation of the traders is important to establish the market potential of the new crop. Also an important feature of this breeding programme is that they look for cauliflowers with characteristic colours (e.g. purple) and shape ("romanesco") and thus can be marketed as specialities.

From this central evaluation field at the PAIS, farmers choose the varieties they want to try at their own farm. To further improve these, they apply mass selection, with technical assistance of PAIS or the scientists at the beginning. They aim at better quality and not necessarily homogeneity. Farmers' requirements for homogeneity and quality depend on their marketing system (directly to local consumers or through traders and for export) and hence are different for each farmer.

For coloured cauliflower scientists have created new diversity by intercrossing different populations. This is because the original genetic resources needed improvement for various traits (mainly quality of the curd and leaf shape), before they would become interesting for commercial farming. The first generations (2 to 4) are grown and selected (mass or pedigree selection) at the experimental station. Future generations will be distributed among farmers for further selection.

Seed multiplication takes place through cuttings of the plant stems that are replanted for flowering. Seed production of the varieties that the farmers have chosen for commercial production and the breeding populations are carried out by the farmers with assistance of the field technician. An exception is the early maturing autumn cauliflower varieties. These are multiplied by the field technician. This is because the preparation of the cuttings requires attention during a period of the year in which farmers are very busy. Also, traditionally seed production of this maturity class has been troublesome, because of unfavourable weather conditions during the flowering and seed setting period.

Achievements and Future Challenges

From the genetic resources farmers have identified a number of traditional varieties that were originally from their own region, that were directly suitable for organic commercial production or only needed minor selection effort to make these suitable.

Farmers need to exchange their seed from their production mainly because one farmer can not breed all the varieties he needs. The period of production is about 9 months long and to cover this period at least 6 to 10 varieties, with different maturity dates, are required. Brassicas are cross pollinators and hence the multiplication of many different varieties needs special care. They have decided that having an association for this, will be more efficient in the current legal context. Furthermore, in this way they can share machinery and equipment. For this purpose they have recently created the association "Kaol Kozh". This association will also deal with the legal issues of the seeds and breeding initiatives and the financial revenues.

This case of vegetable breeding by PAIS is an example of collaboration between farmers and scientists. The role of the scientists and the field technician is making available knowledge on traditional varieties, breeding and seed multiplication, through field visits, workshops and publications. Besides that they also are important in obtaining access to genetic resources of the genebanks. The collaboration with the scientists gave the farmers direct access to the traditional varieties that are stored in the gene bank. This is important because in France it is usually not easy for farmers to obtain seeds directly from the genebank.

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Description of the existing breeding initiatives in Europe on landraces, conservation varieties and amateur varieties

Syndicat de Promotion Touselle

Wheat, France



The Initiative

“Touselle” is a group of wheat varieties that were traditionally grown in the South of France (Languedoc, Provence) and are characterised by being soft wheat varieties which are appreciated for its baking quality, mature early and give relatively good yields under marginal conditions. The grains can be either white or red and ears can have awns or be awnless. Touselle wheat is adapted to the South of France. The first known written reference to this name dates back to 1042. After the First World War Touselle varieties were replaced by modern varieties.

To promote the cultivation of Touselle varieties and its use in breadmaking in 2005 the “Syndicat de Promotion de la Touselle” was founded. This association consists mainly of organic farmers but also a miller and baker. Besides Touselle wheat, they also started collection and breeding of traditional Mediterranean fodder crops. In 2007 it had 54 members. Driving force behind the initiative is the agronomist and organic farmer Henri Ferté, who started to grow Touselle varieties in 1997.

The association is member of the farmers network Réseau Semences Paysanne (RSP). RSP unites different French farmer groups that are involved in breeding, conservation and development of the cultivated biodiversity. . The RSP members that are active in wheat and breadmaking are subdivided in six regional groups. They exchange seeds within and between regions and organise meetings to discuss breeding and bread making.

The production and processing of Touselle wheats

Generally, the farmers involved have a small organic farm, but type of farm varies from mixed (animal and crop production) to specialisation in cereal production only. The producers involved are organic farmers. The wheat is adapted to poor soils. Under such conditions the yield is about 2 to 2,5 tons per hectare.

The wheat is processed by the miller who is member of the association. It is mainly used for bread production. This is done by the farmers themselves on their own farm, but also a number of organic bakers are interested to use flour of Touselle. Furthermore, consumers also buy flour for home baking.

Motivation for multiplying and breeding Touselles

The primary motivation is to re-introduce these traditional varieties that are part of the cultural heritage of the French Mediterranean region. Furthermore, unlike modern varieties, Touselles are specifically adapted to low input organic cropping systems in the South of France and have an exceptional baking quality.

Breeding and multiplication

Henri Ferté started to experiment with Touselle varieties in 1997. He obtained small seed samples of four varieties from the genebank of INRA-Clermont-Ferrand: “la Touselle Anone”, “la Blanche de Provence”, “la Blanche Barbue” and “la Rouge”. He multiplied these four varieties as a mixture in a small plot in his back garden and after two seasons he had enough seeds to sow a bigger field of 1 hectare. In this period he also studied how to manage the cultivation (sowing date, seed density, etc.) of these varieties.

In 2004, he began to exchange seeds with other organic wheat farmers. In the beginning he sold seeds, but then was faced with legal problems because these varieties are not registered in an official Variety Catalogue. According to EU seed directives, in the European Economic Area only seeds of officially registered varieties may be sold or exchanged between farmers. This was solved by setting up the association “Syndicat de Promotion de la Touselle”, that aims is to exchange the seeds. New members who receive seed agree to return two times the same quantity of seeds to the association after harvest.

At the farm of Henri Ferté the association established an experimental field to evaluate “new” strains of Touselle. They received four additional Touselle varieties from the INRA genebank and also are collecting seeds from old farmers who still grow Touselle varieties. These farmers mainly are found in mountainous regions. Besides growing mixtures of Touselles, they also maintain all varieties as “pure” lines for further studies.

The other farmers of the association maintain and multiply the Touselle varieties as “pure” lines at their own farm. The farmers apply mass selection. They also select for off-types by observing plants within their fields or within smaller plots, and identifying new or different phenotypes that might be of interest to them. New plant types might have appeared by mutation or by natural crosses between plants within the same variety or between plants from neighbouring fields or plots. Then, the farmers harvest the spikes of these specific new types, they grow the seeds separately to develop new populations or varieties. Some farmers also grow their varieties in different pedo-climatic conditions, either stressing conditions to select for more resistant plants, or they move the varieties in different environments (such as in mountains) from one year to the other to “restore” robustness.

Achievements and Future Challenges

The initiative grew from a private activity of one person to an association of more than 50 members. The members are re-introducing Touselle varieties at their farms. Through participation in regional meetings and the participation in the national farmers network Réseau Semences Paysanne knowledge on the Touselle varieties is spreading. This resulted in setting up another farmer group in the Arriège District.

The “Syndicat de Promotion de la Touselle”, wants to re-create a link between farmers, miller and bakers. Therefore they organise exchange meetings between the these groups. At the moment, bakers are starting to use Touselle flour and are experimenting with blends to improve the baking quality.

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Further information

Website

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Description of the existing breeding initiatives in Europe on landraces, conservation varieties and amateur varieties

Consorzio Solina d'Abruzzo

Wheat, Italy



The Initiative

The Consorzio Solina d'Abruzzo was established in September 2006 to conserve and market the ancient wheat (*Triticum aestivum*) variety Solina. The flour of Solina has an exceptionally good taste and quality and is used for bread and fresh artisanal home made pasta. To compensate the relatively low yield, the Consortium aims at selling the flour at a price that is twice the price of ordinary flour. This is only possible when quality and provenance can be guaranteed. The fact that the production of Solina needs to be controlled and cannot be left to in the hands of the free market was an important reason to formalise the initiative. Furthermore the legal structure also allows at getting access to apply for projects to support the marketing.

The initiative started in 1997 as a programme of ARSSA (Agenzia Regionale per i Servizi di Sviluppo Agricolo), the agricultural extension and research institute of the regional government of Abruzzo. This programme aimed at the collection, characterisation and evaluation of different traditional crop species in the Abruzzo Region. ARSSA found many cereals still cultivated by farmers: common wheat and emmer were the most common, but also some landraces of durum wheat, rye and barley were still cultivated. The variety Solina d'Abruzzo was chosen as the more important landrace for the project, because of the farmers' interest in this particular variety. Additional traditional landraces that are grown are Ruscia (a Sicilian landraces of durum wheat cultivated since more than 50 years in the region) and a spelt ecotype of Central Italy (*Triticum dicoccum*). The aim of the consortium is to enlarge the cultivation of local varieties with the technical support of ARSSA.

The consortium consists of about 12 famers of the provinces Aquila, Pescara and Chieti and the public organisation ARSSA.

The production and processing of Solina wheat

At present Solina is still used by many rural families in mountainous regions of the three provinces Aquila, Pescara and Chieti to produce their own bread and pasta. The history of Solina in the areas is testified by many documents and proverbs; for example notary deeds of the first half of the 16th century record the trade of "grano solino" and a book of 1793 speaks of "Il pane a Popoli esce dal grano solino" ("the bread in Popoli is made by Solina wheat").

Solina is a winter wheat, which has to be sown in September or in the first half of October, has a big ear with good protein content. The variety is well adapted to poor soils with an excellent resistance to cold that occurs at high altitudes. In these marginal areas, where it is grown, it has a low but stable yield of about 2 tons/ha. The low yield is compensated by the exceptional good taste and aroma of its flour.

Farmers in the Consortium are almost all organic (11) and they cultivate overall 500 ha of wheat. They have also leguminous in rotation with cereals and their farms are mainly located in national or regional parks.

The Consortium uses two small organic mills, one uses traditional milling stones and the other is a more modern roller-mill. At the moment the production of flour is dedicated to own consumption and direct selling to consumers at the local markets. They are still in the process of trying to convince bakers to use Solina flour.

Motivation for maintaining Solina

This variety has a huge cultural value. It's part of the culture of mountain rural areas, as testified by many proverbs. The flour produces bread with a characteristic and highly appreciated colour, taste and smell.

Furthermore Solina is maintained because of its ability of growing in cold areas with snow during the winter (more than 1,400 mt).

Maintenance and multiplication

Within the Region there are a number of "ecotypes" of Solina that differ in flowering time and other physiological characteristics. ARSSA has listed fifteen diverse populations, which are all conserved by the Institution. Four of these fifteen are actually grown by the farmers of the Consortium

Each farmer of the Consortium harvest his own seeds from his wheat production field. If they have multiple fields with Solina, they choose the best field for saving seeds. After harvest seeds are mechanically cleaned and seeds are kept in cool and dry stores, usually mixed with some smelling grasses.

Maintenance breeding is done by ARSSA. The collected seed samples were also "contaminated" with seeds of other varieties and species and ARSSA also is eliminating these seeds from the seed stocks. Consortium members who need seeds can obtain these from ARSSA. The institute has its own research field and also farmers growing seeds on behalf of ARSSA.

Achievements and Future Challenges

There is a strong demand of Solina seeds from farmers outside the Consortium. However, at present the Consortium is still in the process of establishing their own market to be able to promote and sustain the cultivation of this particular variety. Therefore at the moment they only provide seeds to Consortium.

One of the major challenges is to find bakers that are able to use and valorise their flour. However, the use of Solina flour would also require an adaptation of the modern baking process and not many bakers are prepared to do so. The Consortium is working with other regional initiatives organised by ARSSA, for example the project "Pane nei Parchi" that aims at improving the traditional bread production from Solina flour. Besides that, they are increasing the marketing possibilities by diversifying their products (e.g. biscuits, dried pasta's). Furthermore they also are looking for financing to establish their own mill and bakery.

Another problem at the moment is that seeds are often mixed with other cereals seeds, like e.g. barley. At present they are purifying their seed stocks. In the future they would like to improve the seed cleaning machinery.

In the next years the Consortium has planned to start cultivating local varieties of other crops like legumes, vegetables and fruit trees.

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Description of the existing breeding initiatives in Europe on landraces, conservation varieties and amateur varieties

Allkorn

Cereals, Sweden



The Initiative

Allkorn is involved in breeding and multiplication of traditional varieties of all cereals that were traditionally grown in Sweden such as: winter and spring wheat, spelt, emmer, einkorn, rye, spring barley and oats. The initiative is looking for varieties with high nutritional quality and adaptation to local climate and (organic) cropping conditions. Furthermore it supports farmers with the marketing of their products. Through its website (www.allkorn.se) consumers are linked with local producers.

The initiative started in 1995 as a research project on old Scandinavian landraces at the Swedish Agricultural University (SLU) in Alnarp. To support farmers who want to grow these varieties in 2003 the Allkorn association was set up. The main breeding is still concentrated at the organic experimental farm of SLU in Alnarp. Since the beginning also a limited number of farmers are involved in breeding at their own farm.

The association has about 120 members of which some 50 are organic farmers that grow traditional varieties.

The cultivation and processing of traditional varieties

Mainly organic farmers participate in this project. In Sweden organic farms are mostly situated on less fertile soils and in the Northern regions of the countries the percentage of organic farms is higher than in the south. The participating farms vary from big with several 100 hectares to small with only a few hectares. Farmers which are interested to produce cereals for consumption often do not have animals on the farm and the crop rotation is dominated by cereals, preceded by grass –clover

The cereal yields of old varieties are often lower than for modern varieties (3-4 tons/ha) but the market value is significantly higher. Most farmers experience that the growing of the varieties is quite easy because they compete very good with weeds and the weaker straw is seldom a problem because most farmers do not fertilise with mineral nitrogen.

The cereals are processed by local millers with roller mills. The products are packed for consumers and distributed to local or regional shops and also sold to bakers. The bakers that are interested, usually apply traditional baking methods with long fermentation periods and sour dough. New bakeries with stone ovens have been constructed in three different regions and they have become very popular especially for tourists. To bake the old varieties with old baking methods (sour dough) and in a stone oven gives an extra added value to the bread.

Motivation to multiply and breed traditional Scandinavian cereal varieties

Farmers are interested in traditional and older (bred before 1960) varieties because these possess special qualities (taste, nutritional value), that can not be found in modern varieties and are more adapted to their cropping systems. For autumn sown crops winterhardiness is an important trait for adaptation to the local Nordic climate. Furthermore, organic farmers prefer tall varieties, because these are better in suppressing weeds. Also, tall varieties are less susceptible to ear diseases, as many pathogens stem from the soil and have more difficulties to reach the ears when these are higher above the ground. Besides that microclimate around the ears is usually less humid and so less favourable for fungi in tall plants.

Especially crops like barley and oats contain health improving substances such as Beta-glucan (a fiber that has a positive effect against intestinal cancer) and plant pigments (anti-oxidants). When grains are used for direct human consumption, hullless variants of these species are interesting, because these can be marketed without having to process the seeds.

Breeding and multiplication

Main breeding activities are carried out by a researcher of SLU in Alnarp. Since the beginning of the project seeds are distributed to farmers. A few of these farmers also do some selection.

The varieties in the breeding programme were obtained from the Nordic Gene Bank. Both traditional Swedish varieties and cultivars that were bred by Scandinavian seed companies between 1900 and 1960 were included. Furthermore, the researcher has collected varieties from farmers that still grow traditional varieties.

The researcher is member of the Association of Bio-Dynamic Breeders (ABDP) and applies breeding methods that were developed by Bio-Dynamic breeders. For maintenance he is selecting for individual ears that are typical for the variety. To obtain new varieties he selects for "off-types" with interesting traits such as tallness, disease resistance, colour, harmonious form, etc. All selections are sown according to the ear bed method. In this method ten ears of each selection are sown in separate lines and in the line seeds are placed in the same order as the original sequence of the kernels in the ear. The researcher is looking for diversity that is already available within the varieties. He does not make crosses to create new diversity. He also does not see a need for crossing, because he finds sufficient diversity within the varieties that already exist in the Gene Bank. First priority is to screen all material in the Gene Banks..

Farmers can choose 10-15 varieties from lists on the website for evaluation on their own fields. The list contains pictures of the variety and a description. They receive 1 kg. of seeds of each variety. From this set of varieties, each farmer selects a few varieties for further multiplication on his own field. Varieties are sown as a pure stand, but they are also sown as mixtures to enhance disease resistance and yield stability.

A few farmers start to make their own selection within these varieties by picking the healthiest and best looking plants and also picking out off types. The majority of the farmers do not actively select, but they do report that the varieties are changing after two years of multiplication on their farm. So, in this case the environment is doing the selection.

Not all farmers are interested in evaluating varieties at their own farm. The small quantity of seed that is available per variety requires special care with sowing and harvesting and is not always possible with the regular machinery available at a farm. The farmers that do not want to sow their own evaluation trials, can observe the varieties during field days at regional demonstration trials at various locations in Sweden.

Seed multiplication is done by SLU on organic fields in Alnarp and Uppsala and since 2000 at experimental farms in other regions (Halland, Gotland and Bohuslän). After

obtaining seeds, farmers multiply the seeds on their own farm for several generations. Also farmer groups have been and still are formed for seed multiplication. However, farmers would prefer that experimental farms produce certified seeds for them because sometimes they encounter problems with seed health (*Tilletia caries*).

Achievements and future challenges

Many varieties from the programme have been taken into production in the regions, where they originally came from. In organic fields with less fertile soils these varieties often have the same or even better yield than modern varieties and always a better protein content and weedcompetitiveness. Besides that, some varieties are valued for their special and nice colours. Good winterhardiness allowed farmers in the North of Sweden, who stopped growing wintercereals 20 years ago, to grow these cereals again.

Good taste and aroma of the varieties are important for the farmers, because it enables them to get a higher price. Also the cultural history is used in the marketing concept The nomination of two varieties for the Swedish Ark of taste of Slow Food will further support the marketing.

Local bakers are involved in the assessment of baking quality and taste. Traditional varieties usually have a higher gluten content, which is positive for baking quality. However, gluten is also usually weaker in traditional varieties. This makes these varieties suited for more traditional baking processes, but not for industrial baking. Allkorn also teaches consumers old baking methods.

A regional farmer group has been set up in Västergötland (www.wastgotarna.se) and new groups are being formed in other Swedish regions to facilitate marketing, processing and seed productions.

A threat to this project is that the EU seed regulations do not permit the distribution among farmers of the seeds of the varieties. As it is not legal to distribute the seeds, the farmers must make contracts within the regional groups, but it is very difficult to distribute the seed to interested new farmers. Also, due to the regulations seed multiplication is not certified. The production of certified seeds would improve seed quality.

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4. Discussion and Conclusions

Motivation for maintaining and breeding landraces

In the previous chapter we have presented five case studies of breeding and multiplication initiatives of landraces of different crops and regions in Europe. Despite the differences, these also have many aspects in common. For four of the five initiatives one of the important reasons for growing and improving landraces is the superior food quality and taste, that has been lost in the modern varieties. All initiatives use the quality of the varieties to develop marketing strategies to increase the profitability of their crops.

The cereal cases concern regions with marginal soils and/or difficult climatological conditions. The cases show that especially under less favourable growing conditions landraces can compete and even outperform modern varieties. In the case of Sweden, for example, farmers who had stopped growing winter wheat because modern varieties did not survive the Nordic winter are now growing landraces that do survive the period of frosts. So, landraces offer new opportunities to farmers in marginal areas as these allow them to cope with environmental stress and to compensate lower yields with a higher product price for quality.

The cultural value of landraces is stressed by a number of initiatives. The German vegetable growers emphasized this aspect in the choice of the name of their association: Kultursaat. For the French and Italian farmers the fact that the varieties are part of their cultural heritage, also contributes to strengthen their own regional identity.

A number of farmers involved also are highly concerned with the ongoing concentration in the private seed sector. The yearly mergers of existing companies make farmers increasingly dependent on only a few seed companies. Simultaneously, in most cross pollinating (vegetable) crops the industry has replaced open pollinated varieties by hybrids. As hybrids can not be multiplied by the farmers themselves, this has increased their dependence on the seed companies. Especially organic farmers were confronted with this dependency, when the organic movement in the 1990s wanted to limit the practice of derogations for the use of non organically multiplied seeds. Most conventional seed companies are reluctant to also provide organically multiplied seeds, because of the limited acreage of organic production. Also, the possible release of genetically modified seeds, triggered a more general discussion on the compatibility of breeding techniques with the organic principles. The necessity to safeguard the supply of organic seeds, together with the inappropriateness of number technologies for organic farming, motivated the organic sector to become involved in seed multiplication and breeding of landraces and older varieties. This probably explains why most of the breeding initiatives in Europe have their roots in organic agriculture.

Summarising we have learned that old landraces contribute to:

- a better adaptation compared to modern varieties in regions with marginal soil or unfavourable climate conditions (yield stability, food quality and taste);
- strengthening the region specific identity;
- less dependency on a limit number of seed companies involved in organic seed production, to safeguard the supply of organic seed
 - by broadening the assortment;

- replacing hybrids by open pollinated varieties;
- providing alternatives to cultivars with undesirable breeding techniques such as genetic modification and protoplast fusion.

Breeding landraces

Despite the superior food quality of landraces, the majority of the initiatives also see a need to improve the landraces for agronomic performance or use these as a base population to generate new varieties. This is because the landraces, that were taken out of production for many decades, did not have the opportunity to co-evolve with the current agricultural system and changes in climate.

The farmers involved in the initiatives with the self pollinating cereal crops, mainly multiply the varieties at their own locations, sometimes in combination with mass selection. They experience that the varieties change due to selection pressure of the environment.

In the cross pollinating vegetable crops more strict maintenance breeding is required to keep a variety in good shape. Furthermore, in a commercial farm seeds are not the end product for crops like cabbage and lettuce. Farmers have to make an extra effort to keep these in the field until seed production. This does not only require knowledge and experience, but also sufficient time to dedicate to seed production and breeding. The farmers of PAIS receive technical assistance for this and already in an early stage decided to set up an organisation to deal with the organisation of seed multiplication and processing. In the example of Kultursaat producers decided to set up separate organisations for maintenance breeding and breeding of new varieties and also experienced the need for financial support to compensate their time dedicated to breeding. In the case of PAIS and Allkorn part of the more time consuming breeding activities are carried out by professional scientists.

From the studied cases it becomes clear that most farmers do not resort to crossing varieties to create new diversity. The cross pollinating varieties continuously produce new plant types and this gives good opportunities to select new varieties from landraces and open pollinated varieties, without making crosses. In the self pollinating crops, such as wheat and tomato, the possibility to find new types is much smaller. In the case of tomato Kultursaat breeders therefore do make crosses. In the wheat case of Allkorn the breeder involved still finds sufficient diversity within the landraces to select new varieties.

Summarising we have learned that many initiatives involved in maintaining old landraces:

- experience a need to improve the agronomic performance of landraces;
- allow improvement in self pollinating cereal crops by mass selection and natural evolution due to environmental selection pressure;
- benefit from organisational, financial and knowledge assistance in maintaining and improving cross pollinating vegetable crops without making new manual crossings.

The future of maintenance and breeding of landraces

From the cases it becomes clear that the initiatives provide the society the possibility to obtain food products with qualities and tastes that are not present in mainstream modern varieties. Furthermore, the production landraces offers farmers and processors in marginal areas where agriculture is usually not profitable, new opportunities for a more profitable marketing of their produce.

The majority of old varieties are not available on the market anymore. If in the past these were saved by genebanks, these could be made available to farmers again. To obtain such seeds farmers should be organised in e.g. an association or seek an alliance with an institute (as for example in the case of PAIS and Allkorn), because genebanks do not directly give out seeds to individual farmers, but only to so called *bona fide* users. Even

then, due to restricted financial resources, genebanks only make available limited numbers of seeds. It usually takes one or two cropping seasons to obtain sufficient quantities to sow a field of reasonable size. This is one of the reasons why e.g. Kultursaat has decided to set up its own genebank.

Once farmers have obtained landraces, the current seed legislation in the European Economic Area limits the possibility of upscaling the initiatives to a larger group of farmers, because the legislation prohibits the farmers to exchange or sell seeds of these landraces to other colleagues. Finding solutions for these problems will be the aim of further studies that will be carried out within the Farm Seed Opportunities project.

Summarising we learned that the initiatives

- provide society food products with exceptional qualities and taste;
- provide farmers and processors in marginal regions new market opportunities;
- need to organise themselves to be able to obtain genetic resources from the genebanks, and to obtain a sufficient number of seeds per accession;
- Urgently need adapted legislation to be able to upscale their work and exchange or sell seeds to colleagues.



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Appendix: Check list of questions for the case-studies

Introduction

- What are their activities, in general and more specifically related to seeds
- What is their history: when did they start and how did they start
- What is the aim of the initiative, what motivates them to do what, they are doing?
- For whom are they breeding or multiplying seeds?

Description of the organization of the initiative

- Kind of organisation (e.g. individual farmer, farmer cooperative, NGO, private company, research institute, network of different organization (if so, specify etc.)
- How big is the organization, how many people are involved
- Who is doing the breeding, maintenance and multiplication (how many persons, educational/professional background)
- Do they collaborate with other actors in the seed breeding and production chain and in what way.

Description of breeding, maintenance and seed multiplication

- What crops do they work on
- What are the varieties they use for breeding or multiplication (names and types e.g. landraces, improved varieties of seed companies)
- Where (from whom) do/did they get seeds for their breeding and seed multiplication

If applicable:

- How do they breed/improve their varieties:
 - What is the aim of their selection: what plant traits do they want to improve
 - Do they make crosses or are they improving diverse populations
 - Are they actively selecting plants or is selection done by the environment
 - What selection methodologies do they use (e.g. positive or negative mass selection, selection of individual plants, pedigree selection, etc.)
- What are their main successes and problems with breeding
 - What do they see as their main achievements
 - What problems do they encounter
 - What would they like to improve in their work the coming years, what are their future aims
- How do they maintain and multiply their varieties

- Do they follow specific procedures (e.g. choice of location, selection in the field, seed processing) and describe
- What are their main successes and problems with maintenance and seed multiplication
 - What do they see as their main achievements
 - What problems do they encounter
 - What would they like to improve in their work the coming years, what are their future aims
- (How) are seeds and varieties made available to (other) farmers
 - e.g. Informal exchange or selling directly or selling through other organizations
 - are varieties officially registered and seeds certified
 - what problems do they encounter in making their seeds/varieties available to others