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28. Farm Seed Opportunities: a Project to Promote Landrace Use and Renew Biodiversity

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28.1 Introduction

Farm Seed Opportunities (FSO), a specific targeted research project in the FP6 European programme (2007-2009), was conceived to support the implementation of seed regulations on conservation varieties (directive 98/95/EC and new directive 2008/62/EC for agricultural species). For this purpose, FSO has been developing coherent definitions of the different kinds of varieties cultivated in farm fields following a survey and evaluation of practices at the national level. Even though the project aims mainly at responding to the needs of European policy makers, it will also significantly contribute to the recognition of the role of farmers in conserving diversity through the use of landraces and the breeding of new varieties. FSO took into account participatory plant breeding (PPB) experiences for organic or low-input agriculture, with the goal of proposing regulation scenarios that recognize and encourage on-farm varietal innovation and selection.

Partners in the project included diverse stakeholders concerned with the conservation and use of varieties that do not fit the DUS (Distinction, Uniformity, and Stability) criteria of the current seed regulations. Participants were researchers involved in organic

agriculture (FiBL and LBI), genetic resources (CGN, IGSA and INRA), seed quality (PRI) and participatory plant breeding organizations (IIED and WUR), organic farmers' organizations (AIAB) and seed networks (RAS and RSP). The partners from IIED and WUR (WU, PRI and CGN) have extensive experience, including policy research, in developing countries.

28.2 Varieties, farmers and agriculture in Europe

28.2.1 Background

According to the dictionary, the word 'variety' means at the same time 'diversity' and a part of this diversity. Both meanings can be encountered within the field of agronomy and plant breeding. Before modern plant breeding was established, landraces were developed by farmers, with specific characteristics that made them distinguishable from each other. Diverse local growing environments, agronomic conditions and cultures made this variation in landraces possible. Since 1900, as modern plant breeding practices were increasingly adopted, these variable landraces were gradually replaced by more uniform cultivars that often had higher yields. The industrialization of agriculture has changed our vision of fields and plants, for both scientists and farmers. Even if the F1 hybrids of maize did not produce substantial increases in yield during the first three decades of the 20th century, the phenotypic uniformity of the cultivars developed was recognized as progress (Duvick 2001; Bonneuil 2007). The farmers living in the Corn Belt of the USA appreciated uniformity for machine harvesting but "furthermore, a field of corn in which all the plants are alike, each with a single ear at the same height, is aesthetically pleasing, and this appealed to many corn growers" (Crow 1998). The standardization and homogenization of agricultural production, the increasing use of chemical inputs and water, and the standardization of the market are the main pillars of what we define as agricultural modernization. Alongside these dominant conventional agricultural practices, a different agriculture strongly connected to 'terroir' (a French word that refers simultaneously to the soil, climate and cultural values of an area) has been preserved and is now re-emerging in Europe. This alternative agriculture is based on different varieties from those of conventional agriculture, ones with strong local adaptation. In effect, locally adapted varieties, old landraces and mixed populations play a more important role in organic than in conventional agriculture (Almekinders and Jongerden 2002). In addition, quality aspects linked to specific regional or artisan

products are generally important in alternative agricultural systems, and are often responsible for the preservation of local varieties.

The development of low-input or non-conventional agricultural practices is also related to the diversification of public demands, in particular for organic farming and local products. These agricultural systems are based on varieties covering a wide range of genetic states and categories, for which the criteria of stability and homogeneity are not intrinsic qualities and are not necessarily required. Landraces and local varieties are often involved in this form of agriculture. Moreover, the shortcomings or unsuitability of conventional varieties with respect to the needs of organic farming has stimulated several PPB initiatives for organic farming, e.g. in France and the Netherlands (Chable 2005; Lammerts van Bueren et al. 2005; Desclaux 2005). PPB varieties can be bred from diverse genetic resources using breeding methods that are in compliance with the IFOAM (International Federation of Organic Agriculture Movements) draft standards for organic plant breeding (IFOAM 2005). Their main characteristics are the ability to adapt and co-evolve within the environment and with farmers' practices and needs. They are not necessarily bound to a geographical area and the role of seed exchange in traditional agricultural practices has been widely acknowledged (e.g. Almekinders et al. 2000; Berthaud et al. 2001; Elias et al. 2001; Alvarez et al. 2005).

28.2.2 Case studies in Europe

FSO performed a survey of European initiatives that resulted in a list of 68 initiatives in 17 European countries. Several other farmer-driven initiatives were unfortunately not included in our inventory, as the information concerning these initiatives usually remained local and in the national language, which often resulted in difficulties in identifying these initiatives. Relatively few Eastern European countries were identified, and while this may be partly due to the reasons mentioned above, our discussions with key stakeholders from four Eastern European countries made clear that there are relatively few seed initiatives in this region (Osman and Chable 2009). This may be due to the past system of collective agriculture during the communist era and the transition to private ownership afterwards.

A primary objective of FSO is to get an overview of the diversity of organizations and individuals involved in seed multiplication and breeding of landraces in Europe. Our description was based on their main seed activities. Thus, we distinguished the following groups:

- 'Seed Savers', private initiatives with the aim of collecting and conserving old local varieties *in situ* and promoting their use
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- ‘Seed producers’, generally small-scale seed companies, often specialized in organic seed multiplication and conservation of traditional varieties
- ‘Farmer breeders’, farmers who breed their own varieties, often in collaboration with researchers in the framework of a PPB programme (Lammerts van Bueren et al. 2005; Vaz Patto et al. 2007; Chable et al. 2008)
- ‘Biodynamic breeders’, private (often non-profit) initiatives run by persons, mostly with an academic background (degree in plant breeding) who aim at improving landraces and old varieties.

It is important to note that there are no strict boundaries among these groups. Many initiatives belong to more than one group. For example farmer breeders are sometimes also seed savers or commercial producers of local varieties.

28.3 Evolution of the varieties on-farm

One important aim of FSO is to describe the varieties bred on-farm and to analyse the mechanisms (farmers’ practices, natural selection) that drive the evolution and adaptation of these varieties. FSO will adapt or develop the appropriate criteria to describe these varieties in the framework of the current regulations, but will also elaborate the concepts of ‘peasant/farmers’ variety’ and ‘on-farm breeding’ which are not yet taken into account in seed laws. The experimental data produced by the FSO project will be used as a reference to recommend modification of the current regulations and/or to suggest a new place for these types of varieties alongside the current regulations.

The field trials of the FSO project are being conducted over three years (2007 to 2009) by growing successive generations of various varieties of wheat, maize, spinach and beans in a European network (Italy, France, the Netherlands) on farms. Knowing that heterogeneity within a variety is largely dependent on the mating system, we have chosen allogamous and autogamous species to evaluate several ways of managing the variability within varieties. Thirty farmers from the three countries are involved in the experiment. Most of them apply organic or biodynamic agricultural practices. The others are engaged in low-input agriculture. Landraces, conservation varieties or farmers’ varieties have been chosen depending on the species. The experiment follows the breeding and seed production practices of the farmers, according to their own objectives and within the normal operation of their farms.

In the third year (2009), samples of the varieties grown in the network will be phenotypically evaluated both on-farm and in a common experiment. The evaluation data and the history of these

varieties will be analysed in relation to the associated farmers' practices in order to understand their temporal evolution and spatial differentiation. This will allow us to identify key factors for the maintenance of genetic diversity and the development of local adaptation (e.g. seed exchanges, environmental changes, plot sizes, number of varieties per farm...). The link between the level of heterogeneity of these landrace/conservation/farmers' varieties and their potential for adaptation will be explored. Because landraces have always been exchanged in the past and have an intrinsic heterogeneity, they are expected to show more adaptive flexibility when moved from their location of origin to a new environment. In fact, very few cultivated species have remained in their original area in our agricultural history.

Quality aspects of on-farm seed production are also considered. Requirements for the respective seed categories have to be evaluated with a view to maintaining the sustainability of this seed production activity in terms of qualitative and sanitary standards. However, there is insufficient factual knowledge available about on-farm seed production. During the three years of on-farm experiments, specific attention will be paid to different aspects of seed quality. Moreover, surveys and evaluation of seed quality will be extended to other PPB or farm seed production initiatives in the countries of the FSO consortium. The conditions will be studied at various locations, and recommendations will be developed for improving the situation and/or proceeding under such conditions. These recommendations will most likely include solutions currently known to organic farming practitioners but as yet unrecognized in conventional seed production.

28.4 Identification of regulation needs

During the last century, plant breeding activities in public research centres and private firms have led to the development of varieties answering to the needs of agricultural modernization. Seed laws established in this cultural framework aimed at increasing the use of modern varieties and at the same time protecting farmers as seed consumers. Today, current seed regulations conform to the dominant concept of cultivated varieties and include the criteria of Distinction, Uniformity, Stability (DUS) and Value for Cultivation and Use (VCU) for arable crops.

The first legal mention of cultivated varieties in France is dated 1 August 1905, and was made by the 'Répression des Fraudes'. In 1942, the Permanent Technical Committee on Seeds (Comité Technique Permanent des Semences), made up of seed industry representatives and government scientists, determined the DUS criteria for defining

varieties listed in the official French seed catalogue. In 1966, the European Community created the Common Catalogue. Any commercialization, whether for sale or free distribution, is illegal for varieties not listed in the national or European catalogues. Moreover, only certified seed producers are allowed to sell seeds.

In 1998, for the first time, the European Directive 98/95/CE mentions the essential need for ensuring the conservation of genetic resources and the necessity of introducing a new catalogue with different rules which would include varieties called 'conservation varieties' which are threatened with genetic erosion. After ten years of discussions, in 2008 the Commission released the first directive specifically on conservation varieties (in June 2008 with the Directive 2008/62/CE), but only for certain agricultural species. Vegetables and seed mixtures will be considered in two new separate directives still in discussion in the Permanent Seed Committee.

Even if EU Member States recognize the limitations of the exclusive use of DUS criteria, new regulations proposed for conservation varieties restrict allowable varieties to those that fit the DUS criteria as much as possible, and restrict their cultivation to a limited 'region of origin'. Landraces or any kind of local varieties become 'conservation varieties'. The term 'conservation' does not allow for the evolving character of these varieties in the field. Since the beginning of the negotiations, no one has considered that innovative varieties could emerge from outside conventional seed systems.

The FSO project has identified several types of varieties, which may need different rules for certification and protection. These categories are defined in relation to their ability to meet DUS criteria, the actors responsible for varietal development, the potential region of diffusion for varieties, and the targeted agricultural systems. It is possible to produce the following preliminary list:

- Modern varieties (DUS varieties), registered in the official catalogue, which are mainly the product of formal breeding programmes following the concept of wide adaptation
 - Local or old varieties that could fit the recent European definition of 'conservation varieties' and that could be registered in the new catalogue specifically for these varieties. They will be maintained by small-scale seed companies or breeders or farmers and will have a local or regional diffusion
 - Population varieties, heterogeneous PPB varieties, and local and old varieties that could be distinct, but for which the criteria of uniformity and stability can be verified for only a few characters and which do not fit within the concept of 'conservation varieties' due to their wide diffusion. They will be particularly useful for organic and low-input agriculture
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- Other varieties from farmer, professional and amateur breeding activities that will be continuously evolving with a variable level of homogeneity; these will be exchanged according to the willingness of the communities involved (farmers' organizations, associations), the definition of Farmers' Rights (Art. 9 of the International Treaty on Plant Genetic Resources for Food and Agriculture) and collective use rights in Europe.

28.5 Conclusion

Besides providing scientific support to policy makers, the FSO project is contributing to the recognition that plant breeding and the renewal of crop biodiversity or plant genetic resources can again be connected to farm production activities at a local level. Part of our inherited cultivated diversity has been rediscovered through PPB experiences on organic agriculture in Europe. This inheritance, which in recent years has been mostly maintained in genetic resource banks, must also be allowed to evolve on-farm (or in gardens) in order to keep its relevance in the context of rapid climate change. In this context, the efficiency of dynamic management for the maintenance of genetic diversity and the development of local adaptation were also demonstrated under experimental conditions (Goldringer et al. 2006).

An important part of the project is devoted to the integration of scientific and traditional knowledge to develop on-farm breeding methodologies, thus providing a basis for enhancing communication among stakeholder groups as well as between these groups and society at large. An important part of our activities is to share experiences and strategies among scientists and farmers from developed and developing countries. Since seed legislation poses a challenge to farmers in developing countries where on-farm breeding is still a daily practice (Louwaars 2007), breeding strategies will be compared in order to broaden seed laws at the international level. Collaboration with non-governmental organizations, collective seed organizations and farmers' rights movements in Europe and developing countries will result in recommendations for regulations that better meet the needs of farmers throughout the world and improve food sovereignty.

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