10 Variety registration

The evolution of registration systems with a special emphasis on agrobiodiversity conservation

Niels Louwaars and François Burgaud

Introduction

Variety registration procedures serve various purposes, and their origin and current application in different countries have a differential impact on the number of varieties available to farmers and the total genetic diversity that they represent. Most of the models for variety registration that have been developed to date do not recognize specifically farmers’ varieties such as traditional landraces or the new varieties developed by farmers in participatory plant breeding. Seed regulation and variety registration, in particular, were developed with the objective of increasing crop production by safeguarding farmers from purchasing bad quality seed of poorly performing varieties. When the archetype seed laws were originally developed – the same ones that many developing countries have copied – policy makers were not concerned with diversity conservation or how the use of farmers’ traditional varieties could play a role in the economic development of rural areas and specific local markets. The development of variety registration systems shows that they have evolved together with farmers’ changing needs, including current concerns about diversity.

This chapter deals with the origins of variety registration regulations, their implementation and their impacts on the use and improvement of farmers’ varieties. In this chapter, we document how variety registration systems have developed in Europe and the United States and how developing countries have adopted these models. Then we discuss how variety registration and sui generis models for the protection of plant varieties are linked. In addition, we discuss the operation of the current systems and how strict compulsory registration systems may outlaw the use, or at least the marketing, of the seeds from farmers’ varieties. We then examine attempts in Europe to correct this restriction and to merge the objectives of the seed and biodiversity policies. While these initiatives appear to have the potential for a positive impact on the use of farmers’ varieties, it is too early to assess their actual impact.

The origins of variety registration

The development of plant breeding

Agriculture has been a central element of human history for some 10,000 years. Through millennia of selecting, sowing and harvesting, plants have been
domesticated and bred to have traits that respond to the consumption needs (e.g. larger seeds) and the requirements of farming (e.g. nonshattering, erect plant architecture) – traits that distinguish the crops from their wild ancestors (Zeven and de Wet, 1982). By the early 1800s, agricultural techniques and cultivars had been improved, and seed production had started to become a business in several countries. In 1900, Gregor Mendel’s work on trait inheritance in peas was rediscovered, which created the foundation for the science of genetics and modern plant breeding; this sped up the creation of new varieties and formed the basis of hybrid technology during the early twentieth century.

Variety registration procedures developed along with advances in plant breeding. Prior to the rise of commercial seed production, which developed as farmers and farmer groups specialized in seed production, there had been no seed laws and no variety registration laws in particular. Of course, farmers have always been equally concerned about obtaining good seed and/or varieties with desirable traits. However, since farmers have traditionally obtained seed from saved stocks, through exchange with neighbours and relatives, or through local markets, issues related to ‘consumer protection’ and free-riding copycat seed supply did not merit the regulatory apparatus that later developed. Not surprisingly, therefore, the organization of plant breeding and seed sectors, as well as the policy makers that oversee these sectors, have determined to a large extent how these regulations have been framed.

Specialized plant breeding developed in Europe in the mid-nineteenth century, along with the emergence of seed production as a specialized business. Those selling seed started to promote good quality seed (i.e. germination capacity and purity). Since farmers cannot distinguish most of the qualities of good seed simply by looking at it, countries started to establish seed-testing stations from the 1860s onward in order to provide an independent quality assessment. In addition, the emerging seed companies sought to create added value by selling distinguishable selections (varieties) with useful agronomic qualities. These efforts by the seed producers had built upon the methods that farmers had used for years to select particular traits in their crops – that is to say, mass selection. In the latter part of this century, however, they engaged in what was then a new approach to plant breeding – pedigree selection and cross-breeding – which allowed for quicker advances and more uniform crops (see Box 10.1).

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**Box 10.1 Plant breeding and registration in France**

**The history of wheat breeding in France**

The history of wheat breeding in France retraces the way in which the agricultural world has been collectively responding to multiple demands that have evolved over the years.

In 1944, Jean Bustarret, chief inspector and then director of the Institut National de la Recherche Agronomique (INRA), noted that at the
beginning of the nineteenth century about 40 varieties of wheat existed in France that were ‘more or less heterogeneous, often of an unknown origin, well adapted as well as ill-adapted to the regional environment’ (Bustarret, 1944). Called ‘domestic wheat,’ these varieties were the double fruit from natural selection and the conscious mass selection carried out by farmers either in the field or when sorting the seeds. At this time, the main concern was to obtain varieties that were sufficiently productive and, above all, had yield stability. The best varieties of wheat yielded 12–15 metric quintals per hectare (i.e. 1.2–1.5 tonnes).

Starting from the first half of the nineteenth century, one variety (Noé) had established itself as the principal genitor of a wide variety of subsequently developed varieties. Noé had been discovered in 1826 in a field sowed in Nérac with seed from Odessa (in present-day Ukraine). It was cultivated in the winter and spring. The farmers realized that it was sturdier and less sensitive to the rain than the domestic varieties of wheat. Through cross-breeding, Noé became one of the most important progenitors of the varieties known as the ‘wheat of Aquitaine,’ including the Rouge de Bordeaux (red of Bordeaux), the Japhet, and the Gros Bleu (big blue).

From 1860 to 1880, France was the setting for one of the first agricultural revolutions, initiated by Henry de Vilmorin. He was responsible for an entire series of new varieties (Dattel, Bordier, Massy and Trésor), whose progenitors included the wheat of Aquitaine and varieties of wheat of British origin (Victoria white, Chiddam, red of Schotland [Rouge d’Ecosse] and Prince Albert), which were cultivated essentially in the north of France. As Robert Mayer, the former leader of the genetics and plant improvement station at Inra-Versailles stated: ‘What was truly a determining factor for the progress of plant improvement was the method utilized, which, at that time, was revolutionary: the creation of populations resulting from artificial hybridizations after a judicious selection of genitors.’

At the beginning of the twentieth century, these cultivated varieties were thus no longer the simple outcome of the observation of the farmers, but rather were developed by seed selectors who utilized the most advanced techniques of the times. These new varieties were readily adopted, and in 1926 a survey by Emile Schribaux indicated that the Vilmorin varieties of wheat represented 39 percent of the national wheat cultivation, compared to domestic varieties, which represented 35 percent. However, the breeders, captivated by these new French varieties and ignoring the foreign genitors, were making very little progress. Only Emile Schribaux provided any innovative ideas. He proved to be very concerned with this genetic impoverishment and wrote in 1928: ‘We do not adequately realize the paramount importance that the material drawn
from abroad could have for us, which is a real gold mine in which it would often be possible to discover, and almost without any effort, varieties that are likely to be the most useful and most precious for us’ (Schriboaux, 1928). Along with Charles Crepin, he introduced cross-breeding material from central and southern Europe as well as from North America, such as Oro, Thatcher and Martin. This diversification was also pursued after the Second World War, in particular by the Maison Desprez. In the 1980s, Nickerson, which was at that time a subsidiary of Royal Dutch Shell, put in place a pattern of selection of European varieties of wheat by setting up stations in Great Britain, France, Germany and Spain. During the same period, the INRA introduced resistances to the diseases originating from species other than wheat (*Aegilops ventricosa* and *Triticum cathlicum*) into its new varieties of wheat. In this manner, each important stage of progress in the evolution of varieties has been initiated by the contribution of genetic characteristics coming from lines that were very different from the ones present in the local territory.

**The history of the variety catalogue in France**

During the same period that wheat breeding was evolving in France, there was a parallel, incremental development in recordkeeping and the registration and marketing of plant varieties. Initially, these efforts were carried out by private experts in an attempt to systematize what they saw going around them ‘in the field’ as a means of recording a baseline and taking note of ‘genetic progress.’ In the mid-nineteenth century, M. de Vilmorin (and later his son) published a descriptive and comparative catalogue of wheat. The catalogue was based on existing European wheat types and proposed a first classification. These descriptions were useful for plant breeders in their breeding programs and for farmers who needed to choose wheat that was adapted to local environmental conditions.

On 8 December 1922, the public sector got involved in order to create transparency in a market where the customer was not able to identify the qualities of the product (seed) by simply looking at it. The first ‘register of selected plants’ on cereals was created by a ministerial decree, fixing the registration conditions of new varieties. Only new species or varieties that were identifiable and that showed ‘unquestionable progress’ could be registered. Independent field tests were carried out by the INRA to evaluate the nature and the value of the innovation through an agronomic evaluation. The committee that managed the register also established a ‘synonym’ catalogue. This evaluation involved 2 years of experimentation, and even though the concept of distinctness, uniformity and stability was not officially used, the concept of distinguishing a new variety from the known ones was being applied.
The INRA was also mandated to develop an administrative application examination. It was specified that the applicant should pay for the expenses incurred by the varietal examination. The decree ruled that the registration of a variety would last for 6 years and be renewable. A committee was installed, composed of eight permanent members from the administration and from the public, and 12 ‘private’ members who were nominated for 5 years, including four representatives from commercial seed companies. Any person who had bred, invented or discovered a species or a variety could apply for registration. The decree thus provided important information for farmers on the innovative characteristics of the varieties and their agronomic values, which was based on official tests. At the same time, it created a ‘brand’ protection for the breeder at a time when intellectual property rights were not being applied to varieties. It gave two rights to the applicant: (1) exclusive use of the variety denomination and (2) the exclusive ability to put ‘seeds registered within the register of selected plants’ on the seeds. Registration was not compulsory.

A ministerial decree of 1925 was developed to prevent fraud in the wheat seed trade. It required seed to be transported, marketed and sold with packaging that included (1) the variety name and average seed number, (2) the source of the seeds (French area name or country and area of import), (3) the guarantee that the seed would not contain more than 1 percent of another variety. The variety name had to be similar to the ‘usual denomination in conformity with local, honest and constant uses’ or in conformity with the synonym catalogue or the register of selected plants. The germination rate could not be less than 85 percent. The methods of sampling and analysis were fixed and could not be changed. Any other seed trade was forbidden. The report to the president of France, which introduced the decree, stated clearly:

The agriculture administration does its best efforts to improve the yield of wheat crop production . . . The farm production is essentially linked with the quality of seeds . . . In itself the regular use of good seeds would be sufficient to increase our production with 10 to 15% and this enormous increase would be 100% beneficiary because the cultivation of a good variety is not more costly than a bad one!4

In 1932, it became mandatory to register varieties in order to market seeds.5 Requests for registration in the catalogue had to provide a detailed description of the variety, enumerating its agricultural characteristics and indicating the origin and the breeding process for the species or the variety and providing a sample (seed, cutting, tuber, bulb or graft). When necessary, the applicant had to give the synonym name according to fair and traditional practices. In 1933, the Register for Wheat Varieties
was published. In the years that followed, registers for other species were published – in 1935–37 for major field crops and from 1944 onwards for a growing number of vegetable species and later for fruits and grapevines. A ministerial decree in 22 January 1960 instituted a catalogue of species and varieties of crop plants, which identified the varieties that were available in the market and characterized the innovations that had resulted from the various breeding programs.

Meanwhile, the certification of seed had also become commonplace and finally compulsory. Certification involved field inspection, seed sampling, and testing and labelling requirements. In order to perform seed certification, a variety had to be identifiable and thus stable (meaning that it was identifiable over time). In order for a variety to be stable, it had to be sufficiently uniform since genetically diverse landraces are bound to develop further based on natural and farmers’ selection. The variety registration requirements went hand in hand with seed certification leading towards identifiability (distinctness), stability and thus uniformity.

Meanwhile, there were many efforts to harmonize variety registration rules at the European regional level. France implemented the relevant European Union directives related to seed and seedling trade by virtue of a national decree, issued by the minister of agriculture in May 1981. This decree established, among other things, that in order to be registered in the national catalogue, varieties had to be distinct, sufficiently uniform and stable, based on standardized criteria that had been developed and standardized, in the meantime, for breeders’ rights by the International Convention for the Protection of New Varieties of Plants (UPOV Convention), established in 1961.

One underlying objective of all of these developments – as the catalogues went from private contributions to mandatory registration schemes with legally established criteria for registration – is that they offered transparency in the seed market by linking variety names to well-described varieties that had particular agronomic and use values.

These methods were applied with the aim of maximizing the positive alleles in the population – that is, creating more (cross-fertilizing crops) or very uniform (self-pollinators) varieties. The results of breeding could only be verified when the varieties were able to be distinguished from one another. An account of the agricultural fair in Malmö, Sweden, in 1898 states that the breeders had created ‘hundreds of distinct varieties’ (Nilsson, 1898). Although plant breeding originated in the private sector, primarily through cooperatives (e.g. Svalöf in Sweden), it was in the public sector that it became a thriving undertaking in most European countries in the early twentieth century. This development, however, did not occur quickly. For example, the Agricultural School
in Wageningen, the Netherlands (later Wageningen University), established its Institute for Plant Breeding in 1912 – well over a decade after the rediscovery of Mendel’s laws of inheritance by Hugo de Vries and the recognition of these laws by the scientific community.

This trend towards uniform varieties became even more pronounced after Mendel’s laws of inheritance were applied to self-fertilizing cereals and legumes in the early twentieth century. It took some time before knowledge about quantitative genetics could explain the behaviour of these populations of cross-fertilizing crops. The discovery of hybrid vigour in maize in the 1920s – that is, the advantages of first generation offspring of different parents based on the value of genetic diversity (alleles) within plants – spurred commercial seed production in the United States, beginning with H. Wallace’s establishment of the Pioneer Hi-Bred Company in 1929. The uniformity of varieties and hybrids became more important with the gradual mechanization of agriculture throughout North America and Europe from the 1930s onward.

Unlike the development of plant breeding in Europe, specialized plant breeding originated in the United States in the public sector, following the creation of the land grant colleges in 1887 – in particular, the experimental stations (see Box 10.2).

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**Box 10.2  Plant breeding and registration in the United States**

Specialized plant breeding did not start in the United States in the private sector as it did in Europe, but was established in the public sector following the Land Grant College Act of 1862, which established institutions for agricultural education on a total of 11 million acres of public land. This legislation was followed in 1887 by the Hatch Agricultural Experiment Stations Act, which included a system of federal budget allocations for research activities in each state. The first federal seed regulations were issued in 1905, but a full federal seed act was published in 1939. This act, which was opposite in many ways to its European counterparts, dealt primarily with labelling requirements for seed. These requirements included information about the supplier, the seed quality (germination percentage and so on) and even the variety’s name. With regard to ‘variety,’ the only limitation that the law specified was that a group of plants had to be distinct from other such groups.

At the state level, however, different rules were developed in the different states, and seed certification and testing systems were gradually initiated. In most states, these systems are voluntary compared to the compulsory systems that are predominant in Europe. This means, in practice, that seed producers who see a commercial benefit in attaching a
certification label to their seed will need to go through the cost and
trouble of having their crop fields inspected and their seeds sampled and
tested by a registered certification agency. An association of seed certi-
fication agencies from several states (and also the one in Canada) was
formed in 1919 in order to share experiences; this led to the harmoniza-
tion of their methodologies. In addition, varieties had to be distinct and
sufficiently uniform in order to certify their identity at the end of the
generation system. This standard, however, is a result of implementation
rules from the certification agencies rather than of the seed law. Criteria
of distinctness, uniformity and stability, in line with the UPOV Conven-
tion, are applied, however, if a breeder applies for breeders’ rights.

The origins of variety registration

Variety registration started in Europe and the United States in order to create
transparency in the marketplace. The different seed suppliers used the same
names for different varieties: when a variety became popular, it was tempting to
sell any seed under that popular name. The opposite also happened: using differ-
ent names for the same variety was popular to create a brand name for the seed
company based on a variety that was bred by a competitor. This confusion led
to a call from the farmers’ associations to the governments to develop a system
that would protect them from misrepresentation. In order to create a variety list,
it was necessary to be able to identify the different varieties and to validate the
claims of the seed producers with respect to their value for farmers. This need
led to coordinated variety trials for agronomic value organized by farmers’
associations (the Netherlands) or by the government (France), combined with
some form of morphological description. Thus, variety registration was able
to serve an additional objective – namely, to provide an independent source of
information for farmers on the value of the plant for cultivation and use. Variety
testing became a specialized procedure separate from plant-breeding activities.
The first official catalogues of recommended varieties appeared in the 1920s in
different European markets. To our knowledge, however, the first seed law was
the federal seed law of the United States in 1905, which concentrated entirely
on consumer (farmer) protection by introducing compulsory labelling.

In order to implement this transparency in the market, farmers had to be
sure that when they found a registered name on the label of the seed bag,
the seed would indeed be of that variety. Seed-testing services for germina-
tion and physical purity began to develop in the 1860s, yet guarantees on
the varietal identity and purity through what became known as seed cer-
tification emerged only in the 1950s. Grow-out tests to validate the variety
identity (post control) and field inspections preceded the concept of certifi-
cation through a regulated generation system that continues today. The gen-
eration system (from breeder’s seed to certified seed) with a strong emphasis
on variety maintenance by the breeder aims at securing varietal identity and uniformity throughout the seed multiplication phases. In order to perform a reliable seed certification, it is extremely important to have a detailed morphological description for each variety. The identification of off-types (plants that do not belong to the variety) can only be done well in uniform crops and, thus, the process of seed certification provides an additional institutional incentive for varietal uniformity.

The compulsory systems for variety registration and seed certification that were developed in Europe for political goals (mainly food security) and for consumer (farmer) protection were maintained even after the farmers started to become more educated and business oriented. One of the main reasons why these systems were maintained was that they created a level playing field for the seed companies. Since the seed companies were able to obtain an independent and publicly available review of the value of their varieties, they were less dependent on the marketing powers of the larger seed companies.

These trends were different in most parts of the United States where most varieties were bred and named by the public breeding stations at the universities, which did their variety trials as part of the breeding process. Following the hybrid revolution in maize, however, the system began to change, and there was an increased development of commercial plant-breeding companies that began to develop their own hybrid maize varieties. The public sector in the United States still has a significant role in breeding cereals and legume crops. Developments in other industrialized countries (notably Australia, New Zealand and Japan) are in most aspects somewhere in the middle of the United States and Europe.

These differences in origin between the two regions may be regarded as significant in explaining the different approaches taken on opposite sides of the Atlantic. In Europe, the governments were called to protect farmers through obligatory variety lists (and seed certification) from commercial seed producers misrepresenting the value of their varieties. In the United States these quality control systems remained voluntary initially because it was felt that the public breeding programs did not require the same level of scrutiny to protect farmers’ interests. In addition, it is important to realize that such regulation was felt to be unnecessary in the free market paradigm that was much stronger in the United States than it was in Europe in the twentieth century.

We can conclude that the history of seed regulation in Europe is a history of a joint concern by governments, farmers and the emerging seed producers for food security and sustainable rural development. Food security was a vital element in US policies in the nineteenth century when experimental stations were first established. In Europe, the security of food remained important due to the famines that occurred during the Second World War. Above all, the variety regulations were developed to advance agricultural production by (1) creating transparency in the emerging seed market; (2) making available to farmers information on crop varieties; and (3) creating a level playing field for the emerging seed industry.
Variety registration trends in developing countries

Copying variety registration regulations

As was the case in Europe and the United States, seed regulatory frameworks in developing countries have commonly been developed after the emergence of a formal seed sector. From the 1970s onwards, there was an especially vigorous development in order to make it possible for as many farmers as possible to take advantage of the benefits of the varieties emerging from the Green Revolution. The Seed Industry Development Programme, led by the Food and Agriculture Organization (FAO), assisted many countries in setting up seed farms, contract grower schemes and seed conditioning plants for their major food crop seeds (Feistritzer, 1984). These formal seed systems subsequently developed specialized in-house or independent seed quality control institutions – similar to the official seed certification agencies in the North – to create quality awareness among both seed producers and customers and to safeguard the interests of farmers. In an era when public institutions were being readily privatized, such as at the end of the 1980s, these seed quality control institutions became a driving force behind the development of seed legislation (Louwaars and van Marrewijk, 1996). Such legislation was intended to provide these institutions with the legal mandate and backing that was considered necessary for them to perform their task of policing seed production and marketing, especially in relation to the emerging private seed sector. Variety release systems, which had initially been developed as a kind of final stage of the breeder’s selection process, became regulated as well, partly because varietal identity was an important basis for seed certification.

Since the seed programs in developing countries were built using the effective formal seed systems in the North as their example, many national seed laws were also developed on the basis of these examples. In his discussion of this development, L. Bombin (1980) shows that the first Latin American seed laws were based on the Spanish example; that francophone African countries derived legislation from the French seed law; and that Commonwealth country seed laws resembled British or US regulations depending on which country was supporting their seed sector (the first Indian law adopted the US system). Subsequent changes, in some cases, have included issues that are specifically important for regulating seed systems in development, but the majority of seed laws in developing countries have focused on the formal sector only, making (support to) informal seed systems illegal (Louwaars, 2005).

Specific needs

In most developing countries, the formal seed systems provide only a small percentage of the seeds that farmers use, with the exception of some cash crops (e.g. vegetables) and hybrids (maize and pearl millet). This limited use is a result
of several different factors that are relevant to this chapter. First, the greater use of informally produced seed is due to the limited scope of the breeding programs, which often do not take into account traits that farmers consider important (e.g. the value of straw and the specific taste) or which are unable to select good varieties for every ecological niche. (Note that the use of fertilizers, pesticides and irrigation may reduce ecological diversity and thus facilitates breeding for a larger ‘recommendation domain.’) As a result, specifically adapted varieties are very important for smallhold farmers. Second, poverty may reduce the market potential for seeds from the formal sector; farmers may simply not be able to afford to purchase such seeds. Third, there may be instances when the quality factors of formally produced seed may not exceed those of farm-saved seed; a good farmer can produce good seed. It is very common that modern variety seeds are saved on the farm and shared between family, friends and neighbours.

Variety registration in developing countries could serve the same purposes that it did earlier in the industrialized world – that is, it could create transparency in the seed market and provide information on the value of the varieties for cultivation and use. However, such benefits can only be achieved when the system is effective and efficient. Robert Tripp and Niels Louwaars (1998) identify efficiency, standards, participation and transparency as key elements in effective variety controls. These are often limiting factors when official variety testing suffers from under investment, when the acceptance of new varieties is based on statistical analyses of yield data only and when an effective voice from stakeholders is lacking. When seed regulations are tacked on to bureaucratic structures and imposed upon both the seed producers and users, chances are that they will obstruct, rather than support, development. For instance, varieties may be released that do well under high-input regimes that most farmers cannot implement or varieties that have a specific adaptation to a particular region or use may not be identified at all (Ceccarelli, 1996). In some countries, varieties were not released at all for over a decade simply because the variety release committee did not meet in order to approve the release (e.g. in Yemen in the 1990s). As a result of all of these different factors, there is only a very narrow choice of varieties available in the market and there is a significant delay in the time it takes good varieties to reach farmers (see Louwaars, 2002, 2005, for more elaborate analyses of the seed laws of developing countries).

Compulsory or voluntary systems

Most developing countries have adopted compulsory seed certification and variety registration systems that are similar to the European models. However, some countries have a voluntary seed quality control system (such as is found in the United States, Australia, and India) or they use a variety of systems,
Variety registration depending on the species. The main reason for using a compulsory system for both variety registration and seed certification is that farmers can simply look at the seed tag and know that it is a quality-controlled seed (either the seed will have a tag or it will not). In a voluntary system – one in which there is an obligation to print the quality parameters on the label – illiterate farmers are unable to read the labels and thereby distinguish the quality parameters. This is one of the reasons why the new Indian seed bill of 2004 switched to a compulsory system. However, due to pressure from the emerging private sector, other countries have been relaxing the role that government plays in variety registration, particularly with respect to the inclusion of company data in the value for cultivation and use (VCU) system.

The advantage of voluntary registration is that a much wider array of varieties may be allowed in the seed market, which provides an enormous opportunity to develop commercial markets for both farmers’ varieties and imported seeds. A disadvantage of voluntary registration is that it provides a reduced transparency in the naming of varieties (and therefore less protection for the farmer).

Variety registration regulations and plant breeders’ rights

The emergence of scientific breeding in the first decades of the twentieth century and the later emergence of specialized breeders led to a call for protection for the breeders, similar to the protection of industrialized inventors in the nineteenth century. Living organisms were excluded from patentability because of ethical, legal and political reasons (Le Buanec, 2006). The variety registration procedure did succeed in fixing a variety to its name, but it did not give any exclusive rights to the breeder. This shortcoming was identified as early as 1919 at the Horticultural Congress in Paris, when the need to protect the commercial investments of breeders was first discussed (Bos, 1920). As a result, the Plant Patent Act was legislated in the United States in 1930, offering protection to breeders of vegetatively propagated horticultural crops. It only applied to these crops because they were considered to be absolutely uniform and stable, thus providing a clear description of the protected subject matter. This development is relevant to this discussion because it has had a marked impact on variety registration procedures and standards (notably uniformity). Edible roots and tubers were excluded from this protection in order to avoid the privatization of food security crops (Kloppenburg, 1988).

In the years that followed, more sui generis protection systems for plant varieties developed in Europe. For example, Germany protected plant breeders with a kind of trademark – a ‘breeder’s seal’ (Leskien and Flitner, 1997). Finally, in 1941, the first breeders’ rights law was established in the Netherlands and described in detail the various requirements of distinctness, uniformity and novelty. Other European countries followed suit, and five countries of the then
European Community for Coal and Steel harmonized their systems in the UPOV Convention and became the first members of the International Union for the Protection of New Varieties of Plants (UPOV).8 In this harmonization process, the five requirements for protection were formalized: distinctness, uniformity, stability, novelty and denomination (DUS-NN), and the standardized methodologies for establishing these requirements were developed. The Act of this convention was revised in 1972, 1978 and 1991, not only gradually strengthening the rights of the breeder but also maintaining the two exemptions: the breeders’ and the farmers’ exemptions. These criteria were derived from the distinctness and uniformity criteria in existing registration systems. These criteria were much more practical than the inventive step and use requirements of the patent system.

Membership in UPOV gradually expanded until, in the 1990s, many more countries joined following the entry into force of the World Trade Organization’s (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement).9 The TRIPS Agreement provides for minimum levels of protection to be included in national intellectual property rights laws in all WTO member countries. It has a specific clause in Article 27(3)(b) on the protection of plant varieties that provides an option to protect them through ‘a patent, an effective sui generis system or a combination thereof.’ The UPOV system was mentioned in early drafts of the TRIPS Agreement (Dhar, 2000), but it was not included in the final text. It is generally considered that the UPOV Convention provides an effective and internationally harmonized sui generis system and that it is better that it is rooted in the agricultural tradition than in the industrial patents that are available on plant varieties in a few countries.

The African Organisation for Intellectual Property (OAPI), with 17 member countries, joined UPOV on June 10, 2014. Prior to that, 26 developing or emerging countries were already UPOV members.

The legal protection of varieties thus led to the creation of yet another national variety list in addition to the lists of registered and recommended varieties (see Box 10.3). Both protection and registration for market regulation required that a clear description of the variety be provided so that the variety could be easily identified (and the protected subject matter be clearly demarcated). Both also required that the variety did not change after repeated reproduction (it had to be stable), and uniformity is generally considered to be the best measure for stability. As a result of these requirements, the DUS standards eventually became the same as the registration standards. This consistency makes application for both purposes easy – one set of variety trials may serve both for registration and protection procedures. These standards became more stringent over time, mainly as a result of the numbers of varieties that were entering the market – the more varieties that have to be identified, the stricter the distinctiveness standards have to be – and as a result of various technological developments, which made it possible to breed more uniform varieties, particularly for cross-fertilizing species.
Box 10.3 Summary of different variety registration systems

- Variety registration is used to create transparency in the market. A national variety list fixes the variety to a single name.
- Variety registration may also be used to provide information to the users of varieties. A national list of recommended varieties lists those varieties that have proven to have specific agronomic or use values.
- Variety registration may also be used to provide the breeder with legal protection (breeders’ rights). A national list of protected varieties is maintained for this reason.

Any registration system is valuable only if implemented effectively and efficiently.

Harmonization of variety registration

The existence of different registration procedures in different countries could potentially harm the international seed trade, particularly if registration procedures were time-consuming and bureaucratic and delayed the availability of foreign-bred varieties in the market. To combat these issues, the Organisation for Economic Co-operation and Development (OECD) developed its ‘seed schemes,’ and different regions in the world simultaneously developed their own harmonized systems. The most advanced system is the ‘common catalogue’ of the European Union (EU). The common catalogue includes all of the varieties that have been released in any of the member countries. In this way, national registration becomes EU-wide, which means that seed may then be traded throughout the union unless a country explicitly refuses to use such a variety. This means that a European farmer potentially has access to 50,000 varieties of species produced in Europe. These are of course not all suitable for all farmers, which means that farmers mainly rely on their own national lists. These lists are more common for field crops, but there are also recommended lists for vegetables, fruits and forest trees.

In 1970, the EEC Directive 70/457 on the Common Catalogue of Varieties of Agricultural Plant Species and the EC Directive 70/458 on the Marketing of Vegetable Seed set up the European Community catalogues for field crops and vegetables, respectively. Details were provided in 1972 with regard to the examination methods and standards for varieties to be included in the catalogue. For all of the crops listed in these catalogues, new varieties have to be distinct, uniform and stable; for field crops, their value for cultivation and use also has to be assessed. The EU also harmonized its plant breeders’ rights systems. At the regulatory level, the UPOV Convention had already provided...
the basis for a harmonized system, so the EU formed a harmonized system for implementation by establishing the Community Plant Variety Office, which administers applications and organizes centralized testing.

Regional harmonization is also being increasingly pursued in developing countries, notably in Africa, with the same aim of creating larger markets for the seed industry and a potentially broader choice for farmers (Muhhuku, 2002). This is likely to benefit the local seed companies in the various regions, including the ones with their bases in the North, and it may stimulate the development of a wider range of varieties with specific adaptation to local needs, on the basis of which smaller local companies may build their businesses. Harmonization was only completed in 2009 for the area encompassing the Economic Commission for West African States (ECOWAS), and it is too soon to judge whether there have been concrete results. Harmonization is also close to completed for the Southern African Development Community (SADC).

**Current variety registration procedures**

Variety registration developed in history as part of an attempt to create transparency in the naming of varieties in the market (Box 10.1). For this reason, varieties had to be identifiable and thus distinct from one another, and they had to be stable because the name had to represent the same variety over time. Increased uniformity was the result of early methods of plant breeding (pedigree selection), and it serves as a good proxy for stability. A genetically diverse variety is likely to change with time due to segregation and genetic drift. When official variety lists based on field trials (VCU) were introduced in the 1920s, the variety descriptions became even more formal. These descriptions included both morphological and agronomic characteristics. The former became more and more important for the purpose of variety listing when more (and more similar) varieties were developed. When rights were being granted on these varieties, the morphological description based on characters that are least influenced by the growing conditions of the plant became the basis of the DUS testing methods and standards that were harmonized by the UPOV Convention.

**Name**

A variety has to be named in such a way that it does not create confusion in the market. It should not be too similar to existing names, should not consist of numbers only (except where this is established practice), should not identify specific qualities and should not be disrespectful to the morals of the local community. When the varieties are actually selections from a known population (‘umbrella variety’), the variety name commonly consists of the name of the umbrella group plus a name to identify the specific variety (e.g. the name ‘Chantenay Red Cored’ carrot was chosen for a variety of the Chantenay type). Some countries have detailed rules for this naming process, but most use the rules established by the UPOV Convention. One challenge for a region with
different languages such as the EU is to know whether a variety name may have a specific meaning in another language. In this case, synonyms are accepted.

**Distinct, uniform and stable (DUS)**

Through the DUS criteria, the catalogue supports the traceability of the variety during the seed production phases. In order to be registered, a new variety must be distinct from all varieties of common knowledge (internationally). It also has to be sufficiently uniform in its essential characteristics and highly stable after repeated multiplication. ‘Common knowledge’ is interpreted narrowly in the United States.

The UPOV Convention outlines the DUS testing procedures for many crops. Most countries that apply these tests require the breeder of a new variety to complete a form from the official registration office. The office then requests that an independent institute test for DUS in field trials. In some countries, the breeder can provide the DUS test results obtained from his own trials. In this case, the office simply performs an administrative check.

The standards for DUS are fairly complex and flexible. Distinctness standards depend on what can be observed on the basis of a standard list of descriptors. If, on the basis of this list of descriptors, two varieties appear to be the same but are clearly different with respect to another trait, the registrar may accept an additional trait in the description. Distinctness is thus defined as a relative standard.

According to the UPOV Convention, uniformity is also a relative criterion. New varieties have to be uniform in their main characteristics, taking into account the reproduction system of the variety, and the standard is measured relative to the average uniformity of the existing set of varieties. This means that – together with the development of more and more varieties that have to be distinguished – uniformity standards technically tend to become stricter over time.

**Novelty**

There is no novelty criteria for the registration except the distinctness. It means that a variety may be considered as ‘new’ and registered even if this variety is already known in another country. It is very different for the list of protected varieties: novelty is an essential criterion. Novelty checks have to assess whether the variety has been commercialized anywhere in the world (including those countries that do not offer such protection), and if so, for how long. This check is done on the basis of seed company catalogues and using the expert knowledge of people who know the market very well.

**Value for cultivation and use (VCU)**

The VCU testing system is meant to support the use of improved varieties and, if performed well, is a key factor in a farmer's decision to buy a particular seed.
The compulsory system of variety testing for agronomic and use values was introduced in Europe in order for farmers to have an independent comparison of the yield, quality and value of the grain that they were producing (e.g. tests of baking quality of wheat). The official tests make the farmer less dependent on the promotion of the varieties by the breeding companies. At the same time, it is an agricultural development tool for the government. Since the tests are commonly performed under ‘good farmer’ conditions, the trials demonstrate the yield potential under ‘good management’ conditions and, thus, create incentives for farmers to use such practices. Another important aspect of general interest is the testing of disease resistance in varieties, which should serve to reduce epidemics. In addition, the tests are of particular interest for breeders since they can also evaluate the competitors’ varieties. Finally, small companies may benefit from the system since they would normally be unable to bear the cost of conducting their own trials throughout their country.

VCU experiments are organized through multilocal networks, which recognize the diversity of soil and climatic conditions in order to measure the productivity, agronomic (cold, disease or lodging resistance), and technological characteristics (oil, sugar and protein content). Some bonus points or penalties can be allotted to varieties that present favourable or unfavourable characteristics. These methods are regularly reexamined to take into account (1) new varietal innovations, (2) modification of crop cultivation practices and (3) new user needs.

Obviously, such tests only create benefits for both farmers and the seed sector when trials are performed effectively and efficiently and when decisions are made wisely. However, when trials are not performed well or decisions are made unwisely, the VCU regulations tend to create the opposite effect: there are fewer varieties available, there is less agrobiodiversity and there is less agricultural development. Hence, an important prerequisite for developing official VCU trials is that they represent the actual farming conditions. It is therefore essential that there is agreement between those planning and performing the trials and the farmers for whom these trials are to be laid out. It is important that they are consulted on what conditions should be (e.g. fertilizer levels) and which characteristics are to be observed. Countries differ widely in terms of farmer involvement, both with respect to the voice of their representatives and the representation structure itself. Too often, ‘professional’ farmer representatives, especially in developing countries, have insufficient links with the actual reality of crop production. The effectiveness of the system also depends on sufficient funds being available in the particular regions to do the work properly. A chronic lack of funds in certain areas may be one of the reasons why UK farmers now tend to select their varieties based on voluntary trial schemes rather than on the regulated trials.

In countries where VCU testing is not legally compulsory for variety registration (such as the United States), such variety trials are highly valued by farmers and often demanded by farmers’ organizations or by the extension service of a particular state. The big difference is that the outcome of these trials is
not binding on the decision of whether to market the seeds (to release them). Theoretically, this means that many more varieties are available to farmers, but, in practice, most farmers will only choose the varieties that perform well in the trials. Having said this, particular groups of farmers (e.g., organic farmers who do not want to use chemical fertilizers and pesticides) are free to conduct their own trials and select their own varieties that do best under these particular conditions. Under a compulsory VCU regime, such as in Europe, such independent trials are not taken in consideration, and those farmers who wish to do so have to lobby for separate official trials to be performed under their specific farming conditions. When such voices become strong enough, the official VCU trial system should adapt its methodologies to include coordinated trials under such conditions. In various countries, for example, Canada, Switzerland, France and the Netherlands, such variety trials are currently being performed.11

Examples of registering less uniform varieties

Variety registration makes the use of registered, uniform varieties mandatory and, as such, may reduce the use of old populations, old varieties or farmers’ varieties. For example, in the United States, genetically diverse varieties may be exchanged and marketed (e.g., through the Seed Savers Exchange, <www.seed savers.org>) parallel to the certified seed of uniform varieties. However, when registration is compulsory under strict DUS criteria and when, at the same time, the marketing of seed is restricted to registered varieties, it then becomes illegal to exchange or sell seed of landraces or farmers’ new varieties (Salazar, Louwaars and Visser, 2007). This situation is common in many countries that have created their seed laws based on the European example. In Europe itself, however, recent changes in the seed laws are creating some room for flexibility.

European countries

The basic rules on variety registration in the EU are very strict and essentially make the exchange and marketing of seed from varieties that are not registered in the common catalogue illegal. However, this does not mean that landraces and other old varieties have completely disappeared in the EU. Breeding companies and farmers are allowed to reproduce seed for themselves, but they are not allowed to sell it. Countries differ widely in their implementation of the term marketing. For example, France (except for old vegetable varieties for gardeners) is quite strict in regulating the market and holds very closely to the rules, while seed regulation authorities in the Netherlands openly allow some level of deviation from the rules. In England, farmers have successfully created clubs through which members – those who belong to the same legal entity – can exchange and even sell seed without violating the letter of the law.

Some European countries have had, for quite some time, special parallel lists for the registration of materials that would otherwise not satisfy the European
common catalogue and that would therefore risk falling out of use and disappearing. We briefly discuss those lists that are held for France (national/crop approach), Italy (regional approach), and the Netherlands (sectoral approach).

**France**

France opened a register for old vegetable varieties for home gardeners. To be included in this list, the variety has to be known – for example, it has to have been presented in an old commercial catalogue or in any other document. This requisite could restrict the inclusion of truly local varieties in the register since some may never have been described and published and it may be complicated to prove that these varieties were already known. To date, there has not been a denial of registration on this basis. As of 2009, the register included 300 varieties for about 30 species, including many varieties of squash, pumpkin, lettuce, tomato and melon. These varieties are registered at a minimal cost (about €100), based on a description provided by the applicant (Zaharia, 2003). The varieties are allowed to be commercialized only among amateur gardeners in France and only in small packets (e.g. a maximum of 2 grams for tomatoes, 15 grams for leeks and 5 grams for cauliflower). They must be labelled 'standard seeds' and marked with the statement ‘old variety exclusively reserved for home gardeners,’ which assumes that the produce is consumed at home. The seed quality parameters (germination, purity and seed health) are the same as in the regular market. France also opened in 1952 a national list of old fruit tree varieties for home gardeners, with more than 1,000 varieties of apple, pear, plum, hazel and walnut trees. A third special list created in 1993 is for old and well-known potato varieties that have a specific use in France. These varieties had been on the market for a long time and did not need additional VCU tests. The objective was to control the health risks in producing seed of these varieties and to regulate its variety maintenance. This list includes only five varieties.

**Italy**

A number of regions in Italy have adopted regulations since 1997 to protect and promote traditional farmers’ seeds and animal breeds as part of a movement upholding regional competence in agricultural issues according to the Italian Constitution. Each region addresses, in particular, the loss of traditional varieties. Variety registration seems to be just one part of a broader regional initiative to preserve traditional plant, animal and forest resources. The main regional mechanisms for conserving and enhancing traditional local varieties and breeds are:

- the establishment of a regional catalogue where individuals and organizations, on a voluntary basis, may register local traditional varieties and breeds; technical and scientific committees evaluate the proposed accessions to the regional register, which allows the variety seeds to be marketed within the region;
• the creation of a ‘network of conservation and enhancement’ for both on- 
farm and *ex situ* conservation;
• the recognition that the heritage of the local and traditional varieties 
belongs to the local communities (referring to Article 8(j) of the Con- 
vention on Biological Diversity [CBD]), and recognition of the regional 
authority as the body that manages and guarantees the collective and sus- 
tainable use of such resources.

The framework for saving and exchanging farmers’ seeds provided by regional 
regulations addresses a very specific situation in which only small numbers of 
farmers still grow and manage traditional varieties. Nevertheless, the regional 
regulations do create legal space for protecting and promoting traditional prod-
ucts based on specific varieties that are not recognized by national seed laws 
and registers and for recognizing the collective rights of the communities over 
their varieties.

The region of Tuscany is a good illustration of this framework as it currently 
leads the conservation initiatives in the country. The Tuscan legislation creates 
a register of conservation varieties (i.e. varieties that are at risk of extinction):

• species, races, varieties, crops, ecotypes and clones from the Tuscany region;
• species, races, varieties, crops, ecotypes and clones from outside Tuscany but 
that were introduced long ago and integrated in the traditional agriculture;
• species, races, varieties, crops and ecotypes that have been selected;
• species, races, varieties, crops and ecotypes from Tuscany that are no longer 
grown there and are conserved inside or outside Italy.

In principle, this legislation allows for the commercialization of conservation 
varieties’ seeds, but it specifies under which conditions these seeds can be sold. 
The register included hundreds of varieties of arboreal and fruit species and 
dozens of herbaceous species, of which the vast majority have been considered 
to be at risk of extinction. More information about Italian regional registra-
tion systems is available in Chapter 21 of this volume.

**The Netherlands**

At the request of the ecological (organic) farming sector, the Netherlands devel-
oped a special VCU testing regime in order to test new varieties that had been 
grown without the use of chemical fertilizers and pesticides (Osman and Pauw, 
2005). The idea was to develop a ‘green variety list’ that would list new varieties 
that would perform well under farming systems with no chemical input (so-
called organic or eco-farming). However, there appears to be little difference 
in the results from the trials of the regular and ‘green’ farming for most crops. 
Most varieties grown organically also performed well under ‘regular’ farming 
practices. In addition, various initiatives that promote the use of particular (non-
registered) varieties for local niche products have been implemented simply by
ignoring the existing seed regulations. As long as these varieties have remained quite local, the authorities have not taken action to strictly enforce the seed law.

Outside of Europe

There is a wide diversity in variety registration among developing countries outside of Europe. In most countries, there are no rules other than strict compulsory release and registration systems, and these systems are often not implemented at the local level. Algeria, however, introduced a section in its national variety catalogue for new farmers’ varieties.\textsuperscript{15} This addition has created an opportunity for the products of participatory plant breeding to be officially registered, even though they may not meet all of the uniformity standards. This list is based on a new interpretation of the existing seed legislation and not on a new seed law itself.

There are other cases where the products of participatory plant breeding have been registered through the regular system. For example, farmers participating in the Local Initiatives for Biodiversity Research and Development network in Nepal have recently released rice and maize varieties that appear to be sufficiently uniform and valuable for a wider use. See Chapters 4 and 18 of this volume for more about these developments in Nepal.

Recent regulations at the EU level: conservation varieties

EU member states have made a commitment towards the implementation of the 1992 Convention on Biological Diversity as well as the 2001 International Treaty on Plant Genetic Resources for Food and Agriculture. At the same time, civil society – in particular, the organic farming community – has requested a more open regime for variety registration. In 2009, some legal openings in European Community (EC) Directive 98/95 on the Marketing of Beet Seed, Fodder Plant Seed, Cereal Seed, Seed Potatoes, Seed of Oil and Fibre Plants and Vegetable Seed and on the Common Catalogue of Varieties of Agricultural Plant Species were used to create conditions to support the \textit{in situ} management of so-called conservation varieties by allowing seed of these varieties to be produced and marketed. The European Commission is developing derogations for conservation varieties. These are varieties that contribute to genetic diversity in the field and that are under threat of genetic erosion. By making this effort, the Commission is expecting that the diversity in farmers’ fields will be enhanced and that traditional varieties can be maintained \textit{in situ}. In practice, it means that the production and sale of seed from such varieties is being legalized, thereby enabling the reintroduction of old varieties into the farming system.

The EC directive for field crops was adopted in 2008 after stakeholders debated the issues over a four-year period. Directives for vegetables and seed mixtures, being more complex in economic and technical aspects, followed in 2009. These directives attempted to strike a new balance between the need of farmers for information and transparency in the marketplace and the necessity
to support the continued utilization of plant genetic resources, landraces and varieties in actual farm production. Key issues in the debate included: (1) if it was possible to define, identify or measure whether a variety is ‘threatened by genetic erosion’; (2) how much flexibility could or should be introduced on DUS and VCU standards to accommodate the varieties that are the intended subject of the directive; and (3) how much flexibility can or should be introduced on quality control, production and marketing of seeds of these varieties.

**Varieties ‘threatened by erosion’**

Ultimately, the directive includes the following definitions:

- ‘Conservation in situ’ means the conservation of genetic material in its natural environment and, in the case of cultivated plant species, in the farmed environment where it has developed its distinctive properties.
- ‘Genetic erosion’ means the loss of genetic diversity between and within populations or varieties of the same species over time or the reduction of the genetic basis of a species due to human intervention or environmental change.
- ‘Landrace’ means a set of populations or clones of a plant species that are naturally adapted to the environmental conditions of their region.

Only varieties that can be linked to a particular region can thus be called conservation varieties, including not only genetically diverse landraces but also old varieties that have disappeared from the common catalogue for some years and that have proven to be adapted to a particular region. The seed industry lobbied successfully to exclude the possibility of listing new genetically diverse varieties, such as varieties based on participatory breeding. The commercial seed sector was concerned that allowing new farmers’ varieties as conservation varieties would create a back-door opportunity for the registration of new varieties that do not meet the regular standards. Some conservationist and farmers groups, on the other hand, lobbied hard to have a broader definition of the term conservation varieties, particularly with regard to the possibility of using such varieties outside their region of origin and of allowing such varieties to be improved through selection (Chable, 2009).

**DUS and VCU criteria**

The uniformity criterion is flexible in that it includes the word ‘sufficient’ (as outlined in the UPOV Convention) and requires that only a limited set of criteria be described and that the applicant can provide these descriptions. VCU criteria may also be included in the description. Thus, certain populations (landraces) may be registered, but these species must be maintained in such a way that they are sufficiently stable – that is, they must remain within their description.
In 2014, the European Commission proposed a new seed regulation, which also includes a class called heterogeneous materials. This might create opportunities not only for the maintenance and use of old varieties, but also for new, but not uniform varieties, for example the result of participatory plant breeding. It proves difficult to balance the guarantees that seed legislation provides to farmers with the desire to open up the rules to allow for a wide diversity of wishes. The proposal was rejected by the European Parliament for procedural reasons and because too many issues were to be specified in ‘delegated acts’ over which the parliament does not have a say. It is likely that the discussion about regulating the seed sector will continue for several years. In any case, there appears to be a general consensus to open more doors for ‘particular’ varieties, and to keep the main pillars of EU regulation: compulsory registration of varieties and quality control of seeds under official authority.

**Quality control, production and marketing**

Some specific rules have been developed with regard to seed production. The conservation variety has to be linked to its ‘region of origin’ where it has to be maintained, and the seed has to be produced and marketed. Countries have the liberty of defining the regions themselves. For example, the Netherlands is able to consider the whole country as one region. The maximum amount of seed from these conservation varieties has also been defined. Each variety is limited to 0.5 percent of the total seed market (or to the quantity of seed required for 100 hectares when it is superior), and all conservation varieties of a single crop should not exceed 10 percent of the total.

**Discussion: variety registration and farmers’ varieties**

**Registration – DUS and biodiversity**

Strict compulsory variety release in combination with the uniformity requirement is, by definition, almost contrary to the desire to increase agrobiodiversity. Diversity may be looked at from two viewpoints: diversity within, and diversity among, varieties in a farming system. Obviously, DUS requirements reduce the genetic diversity within varieties. Plant breeders often have to add additional selection rounds that focus on the characteristics that will be taken into account in the DUS tests, once a variety is proven to be sufficiently uniform in its agronomically important characteristics (e.g. maturity period, plant architecture and height). Compulsory release systems for seed marketing (as in Europe) thus make it impossible to release varieties that are genetically diverse for a good agronomic reason. For example, the Netherlands delayed the release of a multi-line wheat variety – appropriately named Tumult (uproar) – which displayed a resistance to rust that was based on the presence of different resistance genes in different components of the variety. The release system could not deal with the obvious lack of uniformity in this single character.
In mechanized agriculture, most diversity is not productive, but breeding for diverse ecologies (e.g. in developing countries) may require the use of genetic diversity to enhance yield stability. Participatory plant breeding that is aimed at a specific adaptation of certain varieties commonly, but not by definition, results in varieties that are less uniform than conventional breeding under more controlled conditions. In situations where DUS testing is compulsory, such breeding strategies may not lead to new varieties in the market.

The situation may be different when diversity is looked at from the point of view of total diversity in a region where many uniform varieties are used. For example, molecular studies show that diversity and allelic richness have decreased in durum wheat in France but have increased in maize, peas and bread wheat in that same country as a result of breeding (FAO, 2010). This means that promoting investments in plant breeding, particularly when it is coupled with incentives to broaden the genetic basis of breeding, is likely to result in higher levels of diversity.

The new rules for conservation varieties create a solution for only part of the issue of diversity. It allows countries to register old varieties and amateur varieties of vegetables, but it does not allow them to improve those varieties that are the result of participatory breeding. Any new variety needs to be registered under the conventional (strict) system.

**VCU requirements**

The compulsory variety testing creates a wealth of information for both farmers and breeders. Having the latest varieties of competing companies in one trial field allows for an excellent comparison of the competitor’s results. These trials may also serve as a demonstration plot for farmers to see how the use of these new varieties can improve their agriculture. Having all of the data analyzed and presented in a national list of recommended varieties, as has been the case in the Netherlands since the early 1920s, greatly supports the farmers in their decision about which varieties to plant.

However, the trials have to be conducted with great care (at the farmers’ level of management) and must be done impartially. Farmers’ varieties commonly do not pass the official VCU tests, partly because their yield potential is not sufficient (their value often lies in yield stability and special quality aspects) and because their adaptation is commonly quite specific, which means that even though their performance may be excellent in their region of origin, their average performance throughout all testing sites may be insufficient.

**Options**

Options for countries to allow and promote the use of a wider range of varieties are multiple. In countries with a voluntary registration system, such as the United States, the regulatory framework does not create obstacles for the use and sale of seed from varieties that may not meet the registration standards (DUS or otherwise). In countries with a compulsory variety registration
system, there are two options: either create a special class of varieties, to which other registration standards apply (as is currently done in the EU) or carefully demarcate the scope of the seed regulation to the formal seed system, leaving the informal system free. The European example is a great advancement in regard to the possibilities for farmers to use their own farmers’ varieties, but since it remains a registration system there is a risk that it cannot easily deal with the plasticity of highly diverse farmers’ varieties, which are likely to change as a result of environmental and farmers’ selection. It is still too early to assess the effect that the implementation of EC Directive 98/95 will have on different EU countries in this respect.

Developing countries with compulsory variety registration systems will likely find it very difficult to follow the same solution. The large numbers of farmers’ varieties that have resulted due to the vast ecological diversity within their countries, in combination with the limited efficiency of variety registration due to insufficient human and technical resources, has made the registration of all farmers’ varieties an impracticable solution. On the other hand, turning their registration into a voluntary system may not suit their policies either since this option is based on a very competitive seed market and highly educated farmers. It might be much more suitable for developing countries to carefully design their seed regulatory framework in such a way that the formal sector would be closely regulated and the regulations and implementing institutions would not impinge on the informal sector. This strategy links up with the concept of ‘integrated seed systems’ (Louwaars, 1994), which has recently been adopted by the African Union and the FAO (FAO, 2006). This concept formally acknowledges that within the same country different seed systems must operate in parallel with the different needs for government support and controls. Translated to seed regulation, this means that a boundary has to be framed between the formal system and the farmers’ seed system, leaving the latter unregulated. Since farmers’ varieties would be used, exchanged and further developed in the farmers’ seed system, such deregulation of this system would provide sufficient opportunities to continue, and to support, the use of farmers’ varieties. However, for now, we have no full concrete example of this strategy.

**Registering farmers’ varieties and the objectives of registration**

The original objectives of variety registration were transparency in the market, the provision of information for farmers and increased agricultural production through the use of improved varieties. The inclusion of a fourth objective (biodiversity) should not counter the original ones. EC Directive 2008/62 on the Marketing of Conservation Varieties actually tries to do this very thing. Registration of traditional varieties through relaxed standards and without official agronomic trials allows for a clear naming of varieties. Even when the varieties are not fully stable in all characteristics, farmers will know what to expect from the seed of the named variety. Information on the agronomic performance of the variety is not very important in this case since we typically speak of well-known,
old varieties and not of new varieties of which farmers know little. The objective of increasing agricultural output is still valid. However, such output should focus on the creation of monetary value by raising the prices of regional products or through organic farming rather than on increasing yield levels.

Conclusions

Variety registration has developed alongside plant breeding and seed production. In some countries, such as the United States, government involvement is limited. In most other countries, including those in Europe and most developing countries, registration is a compulsory requirement for taking seed to market. Seed certification schemes and plant breeders’ rights systems all involve some form of variety registration.

Registration requirements and procedures are being harmonized partly in an attempt to stimulate international trade and partly as a result of international pressure to create globally harmonized intellectual property rights systems. Distinctiveness is a basic requirement of any registration system (a variety needs to be identified as distinct from any other in order to be registered), as is stability (a variety must remain the same in its important characteristics after repeated reproduction). Uniformity is considered to be the most reliable precondition for stability: uniform varieties are least likely to change over time. When more varieties are being developed, the similarities are bound to increase, which means that distinctness and uniformity standards are bound to become more strict over time, leaving less and less room for genetically diverse varieties to enter the market. Agronomic performance testing is often an additional component of the registration process. Ineffective implementation of this system in many developing countries can create a bottleneck for the number of varieties available to the farmer and may thus decreased diversity in the field.

Countries need to balance different policy objectives under the overall goal of promoting agricultural growth. For example, they need to (1) create a transparent market for seeds with a level playing field for competing companies; (2) provide farmers with suitable protection with respect to the identity of varieties and qualities of seed in the market; (3) support the conservation and use of genetic resources allowing farmers to use genetically diverse varieties; and (4) promote seed security, so that developing countries can no longer restrict the informal seed system and use of farmers’ varieties. In countries with a voluntary variety registration system and an educated farmer community, such objectives may be pursued jointly. In countries with compulsory variety registration systems, special derogations may need to be specified in the law (as is the case with conservation varieties in Europe), or the scope of the seed regulatory law framework may need to be limited to only the formal seed sector. Different countries have different farming and seed systems and obviously will arrive at different solutions. Whatever the system, countries that subscribe to the CBD and/or the UPOV Convention have a responsibility to promote the conservation and use of biodiversity.
Notes

1 A major part of this chapter is based on a European Union-funded project, Farm Seed Opportunities STREP 044345 of Framework Programme 6 (<www.farmseed.net> (last accessed 15 June 2012)). Niels Louwaars is in the Centre for Genetic Resources, Wageningen University, Wageningen, The Netherlands. François Burgaud is in the GNIS Inter-Professional National Group for Seeds and Plants, Paris, France.

2 Symposium on the Improvement of Plants Continuities and Ruptures, Montpellier, October 2002.

3 The need for this catalogue was explained in a monograph published in 1951 on common wheat in France by a scientist from the INRA, M. Jonard. He indicated that, since 1919, wheat improvement in France had achieved great progress. However, at the same time, he noted that many new marketed types were often incompletely fixed or were a simple copy of old cultivars.

4 Decree on the Fraud Prevention in Wheat Seed Trade, 26 March 1925, published on 29 March 1925 in the Official Gazette.

5 Presidential decree published on the 19 November 1932 in the Official Gazette.

6 Decree no. 81–605, 18 May 1981.


10 See Trade and Agriculture Directorate, online: <www.oecd.org/document/0,0,3343, en_2649_33905_1933504_1_1_1_1,00.html> (last accessed 15 June 2012).

11 For Canada, see <www.npsas.org/ovt.html> (last accessed 15 June 2012); for Switzerland, see <www.fibl.org/en/switzerland/location-ch.html> (last accessed 15 June 2012); for the Netherlands, see <www.louisbolk.org> (last accessed 15 June 2012).


13 Tuscany Regional Law, no. 64, 16 November 2004, Article 2.


15 Personal communication with S. Ceccarelli of the International Center for Agricultural Research in Dry Areas, 2010.

References


Bos, H. (1920). ‘Patentering van nieuwheden op tuinbouwgebied’ (Patenting of novelties in horticulture), *Floralia* [on file with the author].


