2 Technical challenges in identifying farmers’ varieties

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Introduction

Discussions around the policy questions associated with farmers’ varieties and their possible protection have generally tended to treat farmers’ varieties as a monolithic entity. This notion is somewhat surprising as it denies the very diversity that is at the heart of farmers’ varieties. This chapter will examine through biological and cultural lenses the various attempts to define farmers’ varieties in an effort to isolate, if not clarify, some of the technical difficulties that beset a seemingly simple question such as, ‘Can we identify a landrace?’

Definitions

Nomenclature in this area is confused at best. One sees terms such as landrace, farmers’ variety, traditional variety, farmer selection and others used more or less interchangeably. One also sees fine distinctions being drawn among the various names to denote slightly different concepts. This chapter will generally refer to landraces and farmers’ varieties as if they were interchangeable, because usually they are. It is, however, worth looking at the historical development of the ideas that these various terms embrace, because it gives interesting insights into the role of the farmer in the process and, thus, may point to future changes.

The full name of a living thing is essentially a hierarchy of ever-smaller categories. Thus, durum wheat is *Triticum durum*; the genus *Triticum* indicates that it is closely related to other wheats, for example, *T. dicoccoides* (emmer wheat). The species *durum* indicates that durum wheat is not emmer wheat, which is a different species. One generally accepted definition (with exceptions, of course) is that even if they can interbreed, members of different species do not usually produce fertile offspring. Landraces and improved modern varieties alike fall below the rank of species. They can interbreed and produce fertile offspring. The rules that govern the characteristics that indicate the various different ranks are agreed by international bodies that publish the International Codes of Nomenclature.

There are four different codes. The International Code of Nomenclature for Bacteria was originally part of the International Code of Nomenclature for
Botany and was separated in 1975. The International Code of Botanical Nomenclature, in addition to plants, also covers organisms traditionally studied by botanists, such as blue-green algae and fungi, which are no longer considered to be plants. The International Code of Zoological Nomenclature is responsible for animals, and the International Committee on Taxonomy of Viruses manages the naming of viruses. Each of these bodies was established by agreement among the members of various international scholarly bodies, and each is responsible for setting the standards for naming and for adjudicating competing claims, which each does by virtue of its agreed constitution. Their chief purpose is to ensure that organisms have an agreed scientific name that is accepted worldwide.

Of particular concern to this chapter, the International Codes of Nomenclature also establish the rules governing the different ranks of a taxonomy – for example, the genus and species – and, thus, might be expected to shed light on the question of what constitutes a farmers’ variety. In botany and zoology, recognizably different populations of the same species that can interbreed and produce fertile offspring are known as subspecies. For cultivated plants, the problem is more complex and is addressed in part by the International Code of Nomenclature for Cultivated Plants (ICNCP). The ICNCP states that ‘the cultivar is the primary category of cultivated plants whose nomenclature is governed by this Code’ (Article 2.1) and it defines a cultivar as ‘an assemblage of plants that has been selected for a particular attribute or combination of attributes and that is clearly distinct, uniform and stable in its characteristics and that when propagated by appropriate means, retains those characteristics’ (Article 2.2). The ICNCP goes on to explain that while cultivars ‘differ in their mode of origin and reproduction … only those plants which maintain the characteristics that define a particular cultivar may be included within that cultivar’ (Article 2.5). The ICNCP recognizes clones of different kinds, and states that

an assemblage of individual plants grown from seed derived from uncontrolled pollination may form a cultivar when it meets the criteria laid down in Art 2.2 and when it can be distinguished consistently by one or more characters even though the individual plants of the assemblage may not necessarily be genetically uniform.

(Article 2.11)

Similarly, ‘an assemblage of plants grown from seed that is repeatedly collected from a particular provenance and this is clearly distinguishable by one or more characters (a topovariant) may form a cultivar’ (Article 2.15). Finally (for our purposes), the ICNCP notes that ‘in considering whether two or more plants belong to the same or different cultivars, their origins are irrelevant. Cultivars that cannot be distinguished from others by any of the means currently adopted … are treated as one cultivar’ (Article 2.17).

Crucial points to consider are that the ICNCP’s definitions are important largely in terms of the intellectual property rights protection that can be
afforded to a recognized cultivar, which by definition will be distinct from all other cultivars. ‘Cultivar’ thus is often treated as equivalent to ‘plant variety’ within the meaning of the International Union for the Protection of New Varieties of Plants (UPOV Convention), and the recognition of a cultivar or variety may be essential to provide its breeder (or other designated entity) with some legal protection.\(^7\) And while the ICNCP does not define a landrace or farmers’ variety on the basis of its definitions and exegesis, some farmers’ varieties might well qualify as cultivars, while others definitely would not because they fail to meet one or more of the essential qualities of distinctness, uniformity and stability.\(^8\)

The ICNCP is essentially an instrument drawn up by and for plant breeders, not farmers. The natural habitat of the ICNCP’s accepted definition of cultivar is the breeders’ fields, and the ‘appropriate means’ of propagation are those that ensure that the cultivar is indeed ‘distinct, uniform, and stable’ (DUS) and that it remains so. Landraces exist in farmers’ fields, and unless one knows about the use, cultivation, and management of a given landrace, it is impossible to decide whether it is likely to be DUS. This notion is expanded on later in this chapter, but, for example, a farmer may be exercising balancing selection on a variety in one part of her farm with the result that the characteristics of the ‘assemblage of plants’ remains stable from year to year, while in another part of the farm she is exerting directional selection such that the assemblage changes over time. Use, cultivation and management directly influence DUS characteristics.

**What is a landrace?**

The use of landrace to denote a biological entity associated with agriculture emerged first in the 1890s. A.C. Zeven (1998) provides a review of definitions since that time. In its original incarnation, a landrace was viewed as a source of material for plant breeding and little more. Landraces were recognized as genetically variable populations – which was one reason for their interest to breeders – with generally lower yields than improved varieties. The main use of the term was to distinguish some cultivated populations from wild species and from the products of scientific breeding. Early definitions also often involved the idea of endemism: a landrace was associated with a particular place (although usually not with the people who lived there). How long the landrace had to have been there varied from ‘time immemorial’ to ‘a generation or two.’

Stability of yield, which is often associated explicitly with adaptability and genetic diversity, is another characteristic often used to identify landraces and to distinguish them from scientifically bred and genetically uniform cultivars. Such stability can arise in two nonexclusive ways. First, genetic heterogeneity confers the wide adaptability that allows a population to yield under a wide range of environmental conditions during any one growing season. Second, the same adaptability based on genetic heterogeneity allows the population to respond to shifts in conditions from year to year, with concomitant shifts in the
most favoured genotypes. Scientific breeding tends to minimize the genetic heterogeneity of a cultivar, but something else clearly maintains the variability of a landrace.

Early authors dismissed the link between the activities of farmers in a particular place and the maintenance of landraces. Indeed, von Rümker (1908, cited by Zeven 1998) said that no human selection was involved. A landrace, he thought, was the result of unselected adaptation to growing conditions and would maintain its distinguishing characteristics even when grown outside its region of origin. This view persisted until the 1970s, when J. R. Harlan (1975) was one of the first to suggest that landraces depend on cultivation and, hence, a measure of artificial selection is essential to their survival. The importance of farmers in the maintenance of landraces quickly gained ground over the following decades, with several contributions based on theoretical and practical considerations. Hodgkin, Ramanatha and Riley (1993) state that ‘the most important feature’ of landraces is that human intervention is needed to create and maintain them. Brush (1995) agrees that landraces owe their existence to farmer selection. Louette (2000) demonstrates that selection by farmers is crucial to the maintenance of local maize varieties in Cuzalapa, Mexico, while Teshome and his colleagues (1999) show that farmers not only maintain local landraces but are also consistent in recognizing and distinguishing sorghum landraces with an accuracy that ‘approximates the accuracy of standard scientific taxonomic approaches.’ Prain and Campilan (1997, p. 325) demonstrate that in upland Irian Jaya certain sweet potato landraces (which they call cultivars) are culturally important in land consecration and rituals associated with first planting and that without this ‘cultural saliency’ these landraces might have vanished years ago.

Despite this more recent work, Zeven (1998, p. 127) concludes his review by defining a landrace as follows: ‘[A]n autochthonous landrace is a variety with a high capacity to tolerate biotic and abiotic stresses resulting in a high yield stability with an intermediate yield under a low input agricultural system.’ The insertion of ‘autochthonous’ (i.e. endemic) ignores the question of whether farmers outside the landrace’s area of origin can maintain that landrace. It also requires that one know about a plant population’s place of origin and agronomic performance in order to decide whether it is a landrace. And as Halewood and his colleagues (2006, p. 175) note, ‘it is curious that after providing such a full account of the development of the appreciation of farmers’ roles in landrace development, conservation and use, Zeven’s own definition underplays the element of dynamic farmer selection/maintenance.

In this chapter, we attempt to rectify what we see as Zeven’s omission. Yet before we do so, we should acknowledge that there is a distinct temptation to avoid grasping the nettle of attempting a definition, given that it could well be picked over and found wanting in the future. Nevertheless, there are certain characteristics of landraces or farmers’ varieties that must be taken into account. Landraces require the activities of farmers for their maintenance. In this necessity, they are like modern cultivars, which also require propagation.
by ‘appropriate means’ to retain their characteristics. Excepting individuals of a clonally propagated species, which are multiplied by vegetative methods rather than by sexual selection (see the following discussion) and which, as a result, are essentially genetically identical to one another, however, landraces represent a population of individuals that are genetically much more heterogeneous than the individuals of a modern cultivar. This characteristic reflects the necessarily less controlled practices of farmers compared to scientific plant breeders, who can take great pains to ensure that their selections are genetically uniform, both in order to deliver agronomic performance that is highly predictable and to ensure themselves of the protection afforded by a ‘cultivar’ that can be registered for plant breeders rights if so desired.9 A landrace is thus made up of individuals with different genotypes. The frequency distribution of any particular trait (or allele) will depend on the particular landrace. Of more interest is the fact that the frequency of different traits is likely to vary from year to year and from place to place, even in the absence of farmer selection. Since different genotypes will perform differently in any given season, the proportions of the various genotypes are extremely unlikely to be constant from year to year. (See also Box 2.1 on page 39.)

Consider two extremes. At one extreme is a farmer who buys a specific named and registered variety (cultivar) from a merchant in the formal sector every year. The farmer never saves seeds from his harvest and relies on the merchant to supply the same entity – the DUS cultivar reproduced by ‘appropriate means’ – each season. If growing conditions change, the farmer may notice a declining trend in yield until such a time as he decides to ask the merchant or seed company for a different cultivar, one that will perform better under the changed conditions. This farmer is definitely not growing a landrace or a farmers’ variety. If he decided to stop buying seed, saved all his own seed and was diligent about keeping it DUS it would still not be a farmers’ variety, as it would be identical to the cultivar that was originally obtained. A single sample in any field in any year would be sufficient to define the population.

At the other extreme is the farmer who never buys seed from the formal sector. Each year, she selects and saves seed from her harvest to plant the next season. She may additionally make other selections from different parts of the farm, perhaps to be sure of having some seed lots that perform well under wetter conditions. Even if she does not make a conscious selection, her variety will to some extent track changing growing conditions, especially if the trend is unidirectional year after year, because those individuals with genotypes better suited to the conditions will produce more seed than those less suited, and so will dominate the harvest to some extent. In between these two extremes are farmers who save much of their own seed, who exchange seed with neighbours, who sometimes obtain seed from further afield through informal channels and who may also experiment with small quantities of DUS cultivars obtained through the formal sector and through the efforts of government or nongovernmental organizations.
For the second kind of farmer, no snapshot based on a single season or a single locality will be able to capture a genetic or phenotypic description of her landraces. The shifting genotypes may cycle back so that over a period of a few seasons there will be an average composition. Alternatively, the average may be moving in response to some trend. As with the problem of defining palaeontological species, where the ability to interbreed is a matter of conjecture, this raises the issue of when the changes to a landrace over time require outsiders or farmers to recognize it as a new landrace. The genetic variability that characterizes landraces also underpins their most important characteristics for farmers: the fact that they are adaptable and resilient.

In the earlier discussion, we explored some definitions of landraces or farmers’ varieties and some of the difficulties of placing those definitions in a modern population biology framework. Our own view, that landraces are generally genetically more heterogeneous than cultivars and thus more adaptable and resilient, and that they require the activities of farmers (as opposed to breeders) for their maintenance, is not a definition but rather a description. Even so, there are undoubtedly exceptions that might be classified as farmers’ varieties or landraces but that do not fit the description.

Berg (2009) offers a more nuanced view that distinguishes between landraces and ‘folk varieties’ largely on the basis of how farmers select, sow, harvest and handle the crop in question. He points out that the rise of the use of the term landrace roughly coincides with the period in European agricultural history when modern cereal varieties, most notably wheat and barley, were beginning to be adopted. Landraces, Berg says, were ‘adapted to local growing conditions through natural selection, usually with no intentional selection. However, the term was quickly adopted as a generic for all farmers’ varieties, including those bred and maintained by active seed selection on-farm’ (2009, p. 423). Berg prefers to call the latter folk varieties. He points out that typical European cereals, such as wheat and barley, are sown broadcast, harvested in bulk, threshed soon after harvest and stored as bulk commodities. This process makes selection difficult. Crops such as rice, millet, sorghum and even maize tend to be handled individually at many stages, from planting through to threshing and even cooking, making it much easier for farmers to observe, select and retain individuals that possess desirable traits. Berg notes that these characteristics of the interaction between people and crops, what he calls ‘affordance,’ makes the emergence of a wide range of diversity more likely. He ‘define[s] folk variety as a farmers’ variety that is selected and maintained for one or more distinctive properties. It may be fairly uniform for the selected traits, but otherwise diverse and therefore responsive to new selection’ (Berg 2009, p. 426). He further notes that ‘farmers who have folk varieties exchange seeds as a routine’ (p. 427).

Perhaps the difficulty of arriving at a suitable all-encompassing definition reflects the fact that different crop species exhibit diverse reproductive systems, while the reproductive system has a crucial influence on the genetic heterogeneity and adaptability of plant populations. Reproductive systems also interact with agricultural practices. Thus, it makes sense to consider different crop species at least to some extent separately.
Landraces and farmers’ varieties as open and closed systems

The three major breeding systems in plants are cross-pollination, self-pollination and clonal propagation, although these categories are not always absolutely distinct. There is a continuum from completely clonal, with no evidence for any production of seed, through to obligated out-breeders that possess genetic and biochemical mechanisms to ensure self-sterility. From a simplistic point of view, species that are multiplied clonally (including potatoes, cassava, dates and olives) would maintain their distinctive features over time because no gene flow normally occurs among different selections and, hence, the only source of change is somatic mutation. Such mutations would first have to be noticed and then propagated to create a new variety, but establishing the new variety is extremely easy. This method of establishment is, in fact, a relatively common source of varieties, especially among long-lived perennials such as fruit trees, where the pink grapefruit, Shamouti orange and Red Delicious apple are well-known examples.

In-breeders (including beans, rice, wheat and barley) generally self-pollinate and change relatively slowly. However, any new characteristics that do arise in an in-breeding variety will be reasonably easy to select, and, thus, new varieties will be relatively easy to create. Out-breeders (including maize, pearl millet and the brassicas) cross-pollinate and change most rapidly.10 Thus, out-breeders would be the easiest and fastest crops for which to develop new and distinctive traits, but these traits will be difficult to maintain. It is also difficult for farmers to maintain an out-breeding variety in the face of the easy exchange of genes from other varieties of the same and closely related species.

This view, however, ignores the influence of human societies and the environment, which also vary in ways that could be described as open and closed. Commerce and trade serve to spread varieties and genes. Hence, societies that are more open to commerce and trade will probably be in receipt of genetic diversity that is likely to influence the stability and integrity of their landraces. Landraces associated with more closed societies are likely to remain more distinct. The environment will also exert a similar influence. Crops growing in isolated environments, such as high, deep valleys and dense tropical forests, are likely to change less rapidly than those in open environments such as windswept plains and areas well served by road networks. Crops in areas where the growing conditions are very different from year to year will change more rapidly than those in more stable environments. The nature of the society and the nature of the environment in which it is embedded will also interact in ways that are largely unpredictable. For example, one could argue a priori that a society confined to a closed environment, such as a mountain valley, might be extremely open to new species and varieties that do somehow find their way into that society through rare and highly valued interactions with other societies. Equally, one could argue a priori that such a society will shun everything unfamiliar. Similar arguments can be made, with similar validity,
communities occupying open environments. They might be receptive to novelty or they might not. In the absence of empirical data, it seems optimistic in the extreme to attempt to generalize.

**Influential variables**

*In-breeders*

Few in-breeders are absolutely self-pollinating. For most, a small amount of introgression, from wild and weedy relatives and from other varieties growing nearby, represents an injection of novel genes that can change the population's genetic make-up. This new genetic material will be of much greater consequence in a farmer-maintained variety than in a modern variety for which fresh seed is purchased in most seasons. Rice, for example, is mostly grown through in-breeding, but when two varieties, or even two closely related species, grow next to one another some crossing will occur. For farmers who buy fresh seed for every planting season, and even if they save their own seed from one or two harvests, this crossing is of no consequence. For farmers who routinely save their own seed and do not obtain fresh seed in bulk, it is an important source of adaptation and innovation. In Pahang, Malaysia, Pesagi swamp farmers grow ‘sticky’ and ‘normal’ (*japonica* and *indica*) varieties of rice together, which permits an exchange of genes between the two types (Lambert 1985). The farmers harvest ear by ear, which gives them an opportunity to select desired types for next season’s seed and to banish undesirable types. Each household improves its varieties continuously, and although different households may share varieties with the same name, those varieties can be genetically very distinct. Farmers also experiment with newly received varieties and with some of the off-types that they reject as seed for an already recognized variety. The rice landraces of the Pesagi farmers are thus in a constant state of dynamic flux despite being an in-breeding species.

Even for in-breeders, seed exchange among communities through what is generally referred to as the informal seed system will often result in a reduced distinctiveness of farmers’ varieties in the absence of selection. In Nepal, for example, groups of villages commonly exchange barley and wheat seed roughly every 3 years, which results in varieties being more similar across the district than might otherwise be expected (Iijima 1964).

*Out-breeders*

Out-breeders, as explained, will generally be more dynamic and change more rapidly than in-breeders precisely because individual plants must be fertilized by a genetically different individual, thus mixing genes. Farmers are therefore more likely to be actively concerned with maintaining the characteristics of a variety against ongoing introgression from other varieties and wild relatives. Perhaps the most detailed investigation of farmer selection in an out-breeder is
Louette’s (2000) study of maize in Cuzalapa, Mexico. The farmers in the study grew several kinds of maize in the presence of one another and in the presence of teosinte, a wild relative of maize. Among the more interesting results from this fascinating study is the constant interplay between the local varieties, including the farmers’ own stock and that of their neighbours and exotic seed from outside the area, governed by the active selection carried out by farmers. Louette studied the occurrence of purple kernels within white or yellow ears, which indicates pollination by a variety called Negro. Farmers made no attempt to isolate varieties, and in the outside rows of a plot of white or yellow varieties, 20–30 percent of the kernels might be purple. This number fell to 1 percent after moving two or three metres within the plot, but since Negro is itself not homozygous for kernel colour these figures probably underestimate the amount of out-breeding.11

Farmers maintain the characteristics of named varieties by selecting ears at harvest to use for seed lots. They generally choose well-filled kernels from healthy ears, and the mean weight of the ears selected for seed was approximately 30 percent higher than ears chosen at random from the harvest. Farmers did not deliberately select against ears from outside rows, and yet they somehow selected against cross-pollinated kernels. White and yellow kernels are recessive and, therefore, do not show up when they have crossed with Negro as the maternal parent. Negro normally yields about 7.5 percent nonpurple seeds when grown under controlled conditions with no crossing from other varieties. Unselected seeds from a deliberate cross of Negro with a white or yellow variety increased the proportion of nonpurple kernels to 16.5 percent, but when farmers selected seed lots from these deliberately crossed Negro plots, the proportion of nonpurple seeds remained constant relative to the parental generation at about 7.5 percent. Clearly, Cuzalapa farmers are able to maintain some aspects of variety distinctiveness in the face of considerable genetic introgression.

Louette (2000) concluded that the ways in which farmers actually managed their seed ‘call into question the genetic definition of a landrace’ (p. 110), although it is noteworthy that she did not herself offer such a genetic definition. She also concluded that ‘the assumption that traditional systems are closed and isolated with respect to the flow of genetic material is clearly contradicted by the results of this study’ (p. 133). Landraces of maize in Cuzalapa are distinct and diverse, but they are also subject to intense selection and rely on constant infusions from outside the area.

**Clones**

Clonally propagated species offer perhaps the clearest examples of identifiable varieties persisting unchanged over generations, even millennia (Robinson 1996). The Dottato fig, for example, is mentioned by Pliny (23–79 C.E.) and is still grown in Italy. The Ari lop fig has been grown in Turkey for 2,000 years, and the ancient variety Verdonne has been cultivated around the Adriatic for centuries. Aroids, date palms, olives, ginger, garlic, grapes, saffron, sisal, vanilla and black pepper are among the many crops in which several ancient clonal
selections exist. These clonal selections have presumably changed little, and the very ease of their propagation means that many have spread widely around the globe. Many of the most ancient varieties are of long-lived perennial species, and any one of these selections would, if it were novel, almost certainly qualify for protection under existing laws.

A further distinction can be made between those varieties that people choose to maintain clonally, such as potato and cassava and most fruit trees, and those that lack all ability to reproduce sexually, such as garlic and many kinds of banana. Those species that can reproduce sexually often make important contributions to the diversity and identity of landraces. Brush, Carney and Huaman (1981) argue that potato cultivation in Peru favours diversity and change because the people sow mixtures of different species and genotypes in a single field, and the results of chance pollination are often harvested as ‘rogue’ tubers, which may then be saved for planting the following year. The same is true in the Altiplano of western Bolivia (Johns and Keen 1986). In addition, communities throughout the Andes frequently exchange tubers, further promoting a dynamic system. One might thus consider potatoes to be rather like common beans, in which the genotypes in a field at any one time might represent either a landrace themselves or a mixture of several landraces. For a community, its landraces might be characteristic of the particular locale in the medium term, but they are also components of a large, open and interlinked genetic system.

Similar considerations apply to other crops that are capable of sexual reproduction but that farmers normally choose to propagate clonally. Cassava, for example, is a perennial out-breeder in the wild. Boster (1984) has shown that among the Jivaro people of the Peruvian tropical rainforest, there is a constant turnover as old varieties are lost and new ones that appear as volunteers, possibly hybrids with wild relatives, are nurtured and join the farmer’s arsenal of landraces. However, the cassava-farming communities of the Amazon are relatively isolated, and so local populations of cassava remain distinct from one another (Salick, Cellinese and Knapp 1997). Sweet potato is subject to a very similar regime in New Guinea, where considerable local knowledge is associated with volunteer seedlings and their incorporation into existing varieties (Schneider 1995).

Finally, it should be noted that Berg’s (2009) distinction between landraces and folk varieties adds another dimension to the matrix, namely, how people interact with their crop. Such activity can also depend on the circumstances. Berg draws attention to Harlan’s record of great diversity among barleys in Ethiopia and contrasts that with his conclusion that in Europe there were a limited number of types. Ethiopian farmers created large numbers of folk varieties from their barley, while European farmers maintained a few landraces.

Preliminary evaluation of policy implications

This necessarily brief summary of the interacting influences of the reproductive system, culture and environment is enough to suggest that a blanket approach to
the identification of farmers’ varieties for the purposes of protection is unlikely to be fruitful. Two conclusions about landraces emerge. Landraces are generally components of large, interconnected and dynamic networks of exchange (among communities and among gene pools) that defy strict definition. And without continuous intervention by farmers, their varieties would cease to exist. This understanding applies even to those long-lived, clonally propagated species, which would inevitably die out if not replanted or regrafted.

Thus, it might be useful to consider individual cases along the three dimensions that have been examined: breeding system, environment and human activities. At one extreme (closed, closed, closed) are cases such as cassava among the Jivaro people of the Peruvian Amazon. Individual selections are maintained clonally, and there is little trade or commerce among the different communities. Hence, farmers’ varieties are DUS, at least in the short term. However, because of the use that farmers make of introgression from the wild and from other varieties, stability cannot be guaranteed in the long term. At the other extreme (open, open, open) are cases such as the maize farmers of Cuzalapa in Mexico. Seed is brought in from neighbours and from outside, crossing takes place readily, and farmers take no great pains during the growing season to isolate their varieties. One might expect farmers’ varieties in such cases to be indistinct, nonuniform and unstable, and, yet, as a result of the selection by farmers of seed lots that are a nonrandom subset of the harvest, varieties do maintain a certain identity that is DUS. Among these two extremes will lie other clusters of conditions that make farmers’ varieties more or less identifiable, both in themselves and with a specific community. The improved lines of Jethobudho rice in Nepal (discussed in Chapter 4 of this volume) represent a concerted and successful effort to develop a farmers’ variety that was both identifiable and protectable. Other similar cases may well arise, but the properties of the farmers’ varieties concerned cannot be predicted in advance. (See Box 2.2 on page 40.)

Perverse incentives

A word of caution about perverse incentives – in general, farmers are managing systems whose strength may be based, in part, on high levels of informal exchange with neighbouring farmers and on the integration of new materials from manifold sources. They do so primarily to retain and enhance the adaptability and resilience of their varieties and systems. If the genetic make-up of a variety changes as a result, but it continues to deliver what they require, including organoleptic qualities, the genetic changes are of no concern to them. Legalistic definitions, however, often require the process of ongoing change to stop or slow considerably. Protection associated with definition requires a variety to be ‘owned’ by reasonably few individuals or communities. It would be counterproductive to create a system of protection that encourages farmers to stop sharing their materials with others in an attempt to maintain their privileged relationship with the variety in question. Equally, it could well be important not to reward farmers for preserving the identity or ‘purity’ of the
landrace if that threatens the ability of the landrace to deliver the qualities that prompted its selection and maintenance in the first place. Essentially, one does not want any system to radically change farmers’ behaviour. In a small community, a refusal to share could be a problem. In a large community, freeloaders, who make use of the variety but do nothing to maintain it, could be a problem. In both cases, vigilance against such perverse incentives will be needed.

Conclusions

Other contributors to this volume have treated in detail the various reasons for which one might want to be able to identify a landrace and the consequences that might flow from this identification. As far as the biological issues are concerned, there will indeed be occasions in which the confluence of factors is such that a variety can both be identified and associated with individuals or a community. In this sense, one could define and protect a farmers’ variety. It is, however, impossible to predict with any degree of certainty how often the constellations of factors will be aligned, and, in general, pessimism seems more appropriate than optimism.

An analogy from the world of music may be helpful. While ‘music’ has connotations of ‘art’ and ‘aesthetic content,’ organized sound is a universal element in all human cultures. In every human culture, ‘organized sound’ (music sensu latu) serves a purpose and is not necessarily supposed to be beautiful or aesthetic. Different cultures, and different members of one society, may disagree as to what specifically constitutes music, but all would agree that there is something that can be called music. Much of this music can be called folk music. It is not written down but is transmitted orally and aurally. Themes, melodies, storylines and all other elements are often shared among neighbouring communities. Sometimes a folk song will be carried far afield when its ‘owners’ emigrate. Words change, emphasis shifts, melodies mutate and remembered histories adapt, until only an expert academic musicologist can demonstrate that a tune such as ‘Cumberland Gap’ is the mutated descendant of ‘Bonnie George Campbell.’ Folk tunes are landraces.

A minor part of music can be considered ‘high art’ or ‘classical.’ It is written down or codified in some other way, and each composition is essentially fixed, apart from such fleeting aspects as interpretation or expressiveness. Many composers, however, find inspiration in folk tunes, using them as a basis on which to build works that, while they have much in common with the folk tunes on which they are based, are nevertheless not folk tunes. They are formal compositions – registered varieties, if you will.

There are opportunities for confusion in music and in plant varieties – compositions mistaken for folk tunes and scientifically bred varieties passing into lore as ‘heirlooms,’ but seldom in the other direction. The question then arises: why would you want to capture a folk tune? I do not presume to know why a composer would want to do so, but collectors do it for much the same reason that farmers exchange varieties and gene banks save landraces – as a foundation for scholarship, as the basis for future developments and, in many cases,
as a means of specifically strengthening the identification of a society with its geographical antecedents. Collectors do indeed manage to overcome the technical challenges of identifying folk tunes, but the continuing evolution of those tunes means that the collection represents one instance that ‘belongs’ to the nexus between singer and collector alone.

The various definitions of cultivar in the ICNCP all include ‘attribute[s] or combination of attributes’ that are ‘clearly distinct, uniform and stable when propagated by appropriate means.’ As we have shown, landraces or farmers’ varieties certainly can meet these conditions. If they could not, farmers would not be able to identify them from place to place or from time to time, which they can. (One way in which they might be encouraged to do so in a way that would help researchers to make use of their knowledge would be through the widespread adoption of a standard set of descriptors, such as the List of Descriptors for Farmers’ Knowledge of Plants prepared by Bioversity International [2009].) Whether a particular landrace maintains its unique characteristics for a long enough period or can be unequivocally associated with one farmer or small community is much more debatable. Certainly, when farmers are propagating their varieties ‘by appropriate means,’ the expectation is that they will not retain their characteristics because one reason farmers keep landraces, and one goal of their management, is to allow the crop to adapt to fluctuating conditions. If the farmers were to be persuaded to fix the variety, it might no longer meet their needs and might no longer be considered a landrace.

The question has been asked: are the traits selected for by farmers consistent enough over space and time to be able to say that a landrace is distinct or identifiable enough for protective systems such as *sui generis* intellectual property rights, registration, defensive publication or other schemes that require a definition? To this the only answer is, ‘possibly.’

**Box 2.1  Names are not varieties are not names**

The naive view that equates distinct names with genetically distinct varieties has now been shown repeatedly to be just that – naive. There are two problems. The same name may refer to genetically different populations. Or the same genetic population may go under many different names. In fact, the name a farmer gives to a variety is almost inevitably an imperfect piece of information if our interest is actually in the genetic make-up of the variety.

Chakauya and his colleagues studied sorghum landrace diversity over a 20-year period in Zimbabwe and Mali. In the humid south of Mali, perhaps 70 percent of the variety names have been lost over the past 20 years. Nevertheless, far fewer agronomically important traits were lost over the same period. Genetic diversity has been largely maintained even though
particular names have not. Bean farmers in Malawi and elsewhere often distinguish the different seed coat colours in a mixture with different names, but a single coat colour could be associated with several different underlying genotypes and an otherwise uniform genotype could possess two different coat-colour alleles (Martin and Adams 1987).

Busso and his colleagues (2000) used molecular markers to investigate the underlying genetic diversity of pearl millet landraces in two Nigerian villages. Differently named varieties growing on a single farm were more similar than identically named varieties grown by different farmers in the same village. Where clonally reproduced varieties are incorporating new material from hybrids and volunteers, the genetic make-up is bound to change even though the names remain the same.

Box 2.2  Specific research questions

One characteristic of nonclonally propagated farmers’ varieties is that they are genetically heterogeneous. The limits of this variation are very poorly understood. Over time, the composition of a landrace will trace a path through genetic space that may keep it within certain boundaries. Will the space occupied by two landraces that are accepted as different always be completely nonoverlapping? Or will there be seasons in which one landrace is, at least as far as its genetic make-up is concerned, ‘the same’ as a different landrace in a different season? Similarly, if the landrace is undergoing some sort of directional selection, at what point will it have moved far away enough from the previous population to merit a new name, at least in the eyes of researchers, if not farmers?

The UPOV Convention permits the registration of population varieties that show a certain permissible level of variation in their distinguishing characteristics. In general, farmers’ varieties will be considerably more variable than this level. However, is there some level of variability that would permit farmers’ varieties to be registered? Or would this possibility undermine the standards for conventional cultivars? Indeed, information on the frequency distributions and variability of traits important to farmers in their landraces is still lacking, and better information on customary levels of variation in farmers’ varieties might help to answer questions of definition and identification.

Notes
1 This chapter revisits and expands upon issues that I addressed as part of a research team in a previous co-authored publication: Halewood, M., J.J. Cherfas, J.M.M. Engels, T.H. Hazekamp, T. Hodgkin and J. Robinson (2006). ‘Farmers, Landraces, and Property Rights: Challenges to Allocating Sui
Generis Intellectual Property Rights to Communities over their Varieties,' in S. Biber-Klemm and T. Cottier (eds.), Rights to Plant Genetic Resources and Traditional Knowledge: Basic Issues and Perspectives. CAB International Publishing, Wallingford, UK, pp. 173–202. This earlier publication was supported by the Swiss Development Corporation through a project coordinated by the World Trade Institute.

2 International Committee on Systematics of Prokaryotes, online: <www.the-icsp.org> (last accessed 15 June 2012).


8 Here, in the absence of suitable definitions (see later), being used interchangeably.

9 But see also the discussion under in-breeder of heterogeneous landrace versus mixture of homogeneous landraces.

10 Note that a farmer variety of an out-breeding species will consist of individuals that are heterozygous at most alleles, while a farmer variety of an in-breeding species will be made up of several different, but largely homozygous, types of individual. This in itself is a source of confusion. Some authors (Martin and Adams (1971) cited by Zeven 1998) describe the mix of diverse genotypes of common bean (Phaseolus vulgaris, an in-breeder) as a landrace. Others (Voss 1992) also cited by Zeven (1998) would say that the same farmer is growing a mixture of several landraces.

11 The allele for purple kernel colour is dominant. So any given distinctively purple seed of Negro might be homozygous, with two purple alleles, or heterozygous, with one purple allele and one other colour, perhaps yellow or white. These heterozygotes will produce two kinds of pollen grain, purple and yellow. An ovum of the white or yellow variety in the test plot that is fertilized by a purple pollen grain will be visible and counted. One that looks yellow might nevertheless have been pollinated by a yellow pollen grain from the adjacent Negro plants, rather than by a yellow pollen grain from the test plot. The percentage of purple kernels thus underestimates the amount of gene flow from the Negro plants, and underestimates the amount of out-breeding affecting the plants in the test plots.

12 The ‘enola bean’ case may be one example, although in the end this attempt to ‘recognize’ a landrace within a legal system of intellectual property protection was exposed as unjustified.

13 The parallels are considerable, as a reading of the life of Cecil Sharp, the collector of English folk tunes, and some modern criticism reveals. Critics of Sharp ‘reflect an idiosyncratic Trotskyist Marxist framework that views any and all folk song collecting, scholarship, and attempts at revival as malign forms of appropriation and exploitation by the bourgeoisie of the working class.’ <http://en.wikipedia.org/wiki/Cecil_SharP> (last accessed 15 June 2012). Similar criticisms can be found of efforts to identify, collect and study farmers’ varieties and landraces.

References


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