

**Towards national
and regional seed
policies in Africa
that recognise and
support farmer
seed systems**



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On the 7th of April 2015 the African Centre for Biosafety officially changed its name to the African Centre for Biodiversity. This name change was decided upon by mutual consultation within the ACB to reflect the expanded scope of our work over the past few years.

All ACB publications prior to this date will continue to go under our old name of African Centre for Biosafety, and should continue to be referenced as such.

We remain committed to dismantling inequalities in the food and agriculture system in Africa and believe in peoples' right to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.

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Introduction

This is a synthesis of reflections on seed systems policy, arising from ACB's research and advocacy work, especially in Southern and East Africa, in recent years.

Our starting point is that seed policies and laws, as they are being developed across Africa and globally today neither recognise nor support farmer seed systems. Their primary objective is to construct and maintain a commercial seed sector, driven by multinational interests. Concentrated multinational corporations today dominate global commercial seed production, biotechnology and pesticides: Bayer-Monsanto, ChemChina-Syngenta, Dow-DuPont, BASF and others. The entire thrust of agricultural policy on the African continent is driven by these commercial interests through a combination of multinational public, private and philanthropic investments co-ordinated towards this end.

Farmer seed systems are entirely displaced from this picture. These systems are not recognised in formal policy except as being 'outside'. Although, to a greater or lesser extent breeders and government officials 'informally' recognise these systems, for a long time they have been treated as backward, inferior, obsolete and destined for disappearance. However, more recent times have seen a growing recognition that farmer seed systems remain the foundation of agricultural production across Africa and in other places, globally, and are intricately linked to the ability to transition agriculture towards agro-ecology through supporting and strengthening biodiversity, with 'downstream' effects throughout the food system.

Worldwide, smallholder farmers are active in breeding, selection, management, processing, storage and conservation of plant resources. Smallholder farmers play a critical role in the maintenance and stewardship of biodiversity, including agricultural biodiversity. This role falls



specifically to smallholder farmers, because survival strategies incorporate polycultures, including agroforestry. This is in contrast to large-scale commercial agriculture and Green Revolution approaches to agriculture in general, where mono-cropping is the order of the day, creating segregated zones of production with low levels of biodiversity. Crop husbandry and stewardship by cultivators themselves has been the bedrock of agriculture for thousands of years. Farmers have been actively involved in selecting, adapting, and enhancing agricultural biodiversity. Women, in particular, play a critical role in identifying and bringing wild plants into food systems, and women hold extensive and detailed knowledge about food, fodder and medicine.¹

Only a few major crops amenable to scalable standardised industrial production, processing, packaging and shipping, such as maize, soya and commercial horticulture and other cash crops have been captured by the commercial

1. Elias, M. 2013. 'The importance of gender in agricultural research'. In S. Sthapit et al. (eds) *Strengthening the role of custodian farmers in the national conservation programme of Nepal*. National workshop proceedings, 31 July to 2 August, Pokhara, Nepal.



sector. Even then, farmer varieties² flourish, for example, there are numerous farmer varieties of maize in active production across Africa, highly adapted and with special characteristics favoured in the areas of production. Public sector breeding for local conditions has played an important role historically. Germplasm is from the national gene banks and Consultative Group for International Agricultural Research (CGIAR), who gather the material from farmers, and do in situ conservation to maintain vigour. This has contributed valued germplasm into local gene pools, and public sector research institutes have more adapted materials available on their shelves.

Commercial seed, including hybrids, brings with it an entire Green Revolution package of synthetic fertilisers, pesticides and other high cost external inputs. Hybrids and other conventional varieties are mostly planted alongside farmer varieties. However, there is displacement of farmer varieties over time,

as farming households and communities are pressured into cash crop production for diverse reasons. Lack of dedicated support to and strengthening of existing beneficial farming practices (such as maintaining and adapting diverse varieties for local conditions outside the commercial sector) contributes to biodiversity loss.

Current seed policies and laws do not adequately consider the role of farmer seed systems, especially in Africa, where the majority of seed for the majority of crops are maintained and improved by farmers themselves, with little or no external support. This goes beyond lack of recognition, and begins to have negative implications for farmer seed systems because the seed policies and laws apply rules that affect everyone handling genetic materials.³

Most notable are:

- Restrictions on use and exchange, including sale of some crops and varieties as a result

2. Farmer varieties are defined as germplasm and seed either derived from indigenous landraces and their variations under continuous cultivation, or introduced varieties that have been maintained, adapted and absorbed into local seed and food production over time. We refer to conventional varieties, including hybrids, as seed varieties that enter the system from outside at the time of first planting. Thereafter, maintenance and adaptation of that seed over time becomes part of the farmer seed system and is a farmer variety. This is based on the principle that any proprietary claim on seed varieties should apply only to first planting. Thereafter, any product ceases to be the property of the holder of the exclusive rights (if any) on seed varieties.

of plant variety protection (PVP), especially those based on International Union for the Protection of Plant Varieties (UPOV) 1991 criteria;

- Restrictions on using and sharing genetic materials without passing through a series of tests designed for the commercial system, including:
 - A restricted and rigid variety testing and registration process; and
 - An inflexible quality control system for seed multiplication, storage and packaging.

This discussion paper is not a call for greater regulation of smallholder farmer⁴ seed systems and practices. It is a call for their recognition and flexibility in policies, laws and regulations to accommodate and nurture these systems and practices. We feel it necessary to insert a reminder of the importance of smallholder farmers for ongoing agricultural and wider biodiversity maintenance and use in Africa and globally. This is integrally related to climate change and drought response, in Southern Africa, in particular.

In this discussion paper we propose a two-pronged response to the limitations of formal seed sector laws and regulations:

- Well-defined exemptions for non-commercial seed production and use and for designated commercial producer categories (defined at national level), such as smallholder farmers or smallholder farmer-owned enterprises,⁵ based on a defined commercial threshold, with non-commercial production governed by farmers' rights as expressed in Article 9 of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA); and
- Greater flexibility in regulations and

standards, even above the commercial threshold for farmer varieties, especially with regard to registration – including distinct, uniform and stable (DUS) and value for cultivation and use (VCU) tests; and certification – including seed production quality controls, storage and packaging.

The proposal is to contain existing regulations to the commercial system, defined at a sufficiently high threshold to allow the development of small seed enterprises without unnecessary regulation, and to build flexibility into the system for farmer varieties sold above the commercial threshold, as well as to encourage their use, and facilitate adaptability. The issue is that farmer varieties cannot be pinned down so neatly, as required in the laws and regulations. For example, the cyclical nature of farmer seed systems means that seed selection, production, harvest and dissemination interconnect as a seamless whole. In contrast, formal variety registration and seed certification processes require defined breaks, such as pinning a variety down to a specific set of 'fixed' and reproducible characteristics for registration purposes. This does not mean farmer seed is not of good quality. It just functions in a more integrated way with the socio-ecology and is not measurable in the same terms as the formal system requires.

This discussion paper has two main sections. The first looks at the (presumably mostly) unintended impacts of commercial seed regulation on farmer seed systems, looking at PVP, registration and certification. The second section offers proposals on exemptions and flexibility. The discussion can be read for both national and regional levels.

3. The term 'genetic materials' refers to germplasm, seed and vegetatively propagated material, such as vines. Germplasm is the breeders' name for genetic materials that are prepared for scientific research. In farmer seed systems, the distinction between germplasm and seed is non-existent, because the harvest cycles back into seed/germplasm for ongoing selection and enhancement in the field. In this way, too, the distinction between seed and grain is non-existent in farmer seed systems, because the harvest from the best plants is saved for future planting.
4. Following Cousins, we make a distinction between smallholder (land size) and small scale (enterprise size). Cousins, B. 2014. 'What is a smallholder farmer in South Africa today?' Paper for a workshop on 'Opportunities, constraints and innovative approaches in small-scale agriculture in South Africa', C3 Initiative on Strategies to Overcome Poverty and Inequality, Goedgedacht, 6–8 August 2014.
5. Enterprises refer to individuals, partnerships and groups who breed, adapt, produce and exchange seed below the commercial threshold. This includes farmers and their associations and cooperatives.



1: Adverse impacts of commercial seed laws and regulations on farmer seed systems

1.1 Restrictions on use and exchange, including sale of some crops and varieties through plant variety protection (PVP)

The purpose of PVP is to define and regulate private monopoly rights to genetic materials and associated knowledge. We are in the era of the knowledge economy, with intellectual property (IP) rights to dematerialised data and analysis as the basis for forecasting and organising large-scale material production. Registered plant varieties are eligible for protection. Protection – the grant of plant breeders’ rights – allows for exclusive use of a defined variety for a period specified in PVP laws and regulations, and the right to license use to others for a fee. Anyone is permitted to multiply and sell a variety that is registered but not protected (conditional on meeting certification requirements, such as business registration and quality controls). Commercial enterprises usually apply for protection of varieties to prevent others from using them without payment. PVP is designed to protect large corporations from other large corporations, mainly for hybrid and genetically modified (GM) varieties, or other varieties with high commercial value.

The existing PVP frameworks do recognise exceptions to breeders’ rights for protected varieties, which allow breeders access to genetic materials to carry out research and development (R&D) using these materials. In principle, this could include farmers involved in selection and adaptation, although there could be formal requirements for access, such as registration as a breeder and compliance with regulations. However, any commercialisation of derived materials is restricted to conditions from the holder of the protected variety. These may be in the form of fees or royalties on sales.

PVP may be limited to crops specified in regulations, unless a written request is made. There is a difference between PVP laws based on UPOV 1978 and those based on UPOV 1991, on the protection of genera and species and in relation to exemptions, etc. UPOV 1978 does not require protection of all crops, while UPOV 1991 does. There are also PVP laws that include farmers’ rights i.e. in *sui generis* PVP laws. Plants not included in regulations are automatically exempted, although there may be procedures and requirements to access germplasm from the formal sector (e.g. the conditions of the Standard Materials Transfer Agreement). In some cases, there may be exemptions for open pollinated varieties (OPVs) even of scheduled and protected crops. For example, the South African Plant Breeders’ Rights Bill (currently under review) says ‘... a plant breeder’s right in respect of a variety obtained in a legitimate manner does not extend to ... a farmer who uses the protected variety in accordance with ... the category or categories of plants that may be used’. This latter category is defined by the Minister and could include specific types of plants.

PVP is a separate process from registration, although there is overlap on DUS tests, which are relevant to both. Where PVP is sought on a variety, it must have passed the DUS tests for registration and then it must also be a new variety, that is, not previously in use; hence a requirement for new, distinct, uniform and stable (NDUS) if a variety is to be protected. We have a number of problems with the current PVP model:

- It undermines farmers’ rights to freely save, use, exchange and sell farm saved seeds.
- In many (though not all) countries PVP does not recognise farmer varieties that have not gone through formal registration, and is costly and inappropriate for these varieties.
- It stifles innovation and raises input costs for farmers.
- It allows commercial breeders to appropriate and privatise historical social knowledge and natural ecological processes embedded in seeds.

Variety protection could theoretically be beneficial to farmers to protect their diverse



seed from biopiracy⁶. However, farmer seed generally is not currently recognised in the PVP system, unless registered on the basis of distinct, uniform and stable (DUS) tests. Some jurisdictions, e.g. Malaysia, which provide for protection of farmer varieties, apply the criteria of new, distinct and identifiable for farmer varieties.

Applying for variety protection will be costly and difficult to manage for farmers or small seed enterprises. Even if financial costs in the form of fees and levies are waived, it will be almost impossible for farmers to access the relevant institutions and authorities. Smallholder farmers have no institutional capacity to enforce their rights, even if they are able to apply for and secure PVP for their varieties. And even beyond these practical challenges, variety protection also presumes a clearly defined variety that can be protected. Such a model does not even make sense in the context of the complex flows and diffusion of genetic materials in farmer seed systems and the plasticity/adaptability of varieties, which is a favourable trait in farmer seed systems but is not wanted in the formal seed breeding and production process.

IP restrictions raise the costs of inputs for farmers through adding a knowledge ownership and control premium. It also skews R&D towards profitable avenues measured in multinational terms, at the expense of responding to needs where large-scale profitability is not evident. Most farmers and other users are, therefore, ignored. In the commercial core, the result is ever more expensive and dependency-creating stacked GM varieties, coupled with proprietary agrochemicals. This is at the expense of a wide range of crops that are important to farmers and consumers in local pockets, but which do not have the economies of scale to warrant multinational private sector investment. The public sector is being denuded of resources



and capabilities over time. We are in a vicious cycle of multinational financial-corporate concentration and widening inequalities in resources, wealth and control, and consequent loss of sovereignty.

PVP stifles innovation and widens the gap between IP rights holders and small enterprises by withholding genetic materials and knowledge from beneficial use. Information and knowledge (including that embedded in seed) are non-rivalrous goods⁷ with zero marginal cost⁸. Exclusive control over varieties and technologies prevents access to and use of knowledge accumulated in the society in the common interest.

All existing formally registered and protected materials are based on experimentation and knowledge that was accumulated through diverse social activities over centuries, and which is embedded in the seed. This is not

6. Biopiracy is the appropriation and privatisation of common pool resources, including genetic materials and associated knowledge.

7. They can be used repeatedly without the holder losing anything (such as data and information), as opposed to a 'rivalrous' good, such as an apple, which, once consumed, cannot be consumed again.

8. Once the information is produced, there are no further production costs for additional units, unlike a material product, which requires costs to produce another one. There may be distribution costs, especially related to communications infrastructure, which is, however, a separate issue.



is to create artificial scarcity. The counter-argument is that this is warranted to justify the risks of large-scale investment. PVP is used by governments to encourage investment, particularly around developing breeding and the formal sector. Corporations, it is said, need to recoup their costs, carry the costs of research that does not lead to commercialisation, and make a profit to keep shareholders happy (otherwise they will not invest). This is a circular logic that uses the very failure of the system to justify its continuation and further entrenchment. An alternative logic is required that unlocks and connects to decentralised local innovation and creativity that is based on the population and ecology of a given place, and that supports open access technologies.⁹

PVP may apply to certain types of commercial relations, but there must be exemptions and blanket protection of biodiversity as a common good and protection against biopiracy. PVP itself should apply to relations between large-scale commercial interests that want protection from cannibalising each other. There may also be a role in PVP for public sector varieties (and even farmer varieties, but on a voluntary basis) with regard to use and sale by large commercial enterprises. In the medium term, property rights to genetic materials should recognise socially embedded knowledge through collective rights and systems for maintenance and use¹⁰ outside the large commercial enterprises. The protection is defensive, to protect from misappropriation, and also includes a remuneration right for benefit sharing, with a complete exception for small-scale farmers¹¹. A number of contemporary initiatives, such as the Open Source Seed Initiative (OSSI), the work of the Centre for Sustainable Agriculture (CSA) and the Apna Beej open source seed network in India, also seek to develop legal/institutional frameworks that recognise farmers' collective sovereignty over seed. This includes: allowing

recognised in the exclusive rights granted to commercial rights holders, even though it forms by far the bulk of the socially produced knowledge embedded in the seed. IP on so-called 'new' varieties and technologies in the form of PVP or patents allows large corporations to enclose and appropriate ownership of this knowledge.

The free flow and diverse reworking of the common pool of knowledge is beneficial to society at large. There should be no legal impediment to its free use. The only reason to restrict the flow of information and knowledge

9. IPES-Food 2017. 'Too big to feed: Exploring the impact of mega-mergers, consolidation and concentration of power in the agri-food sector'. http://www.ipes-food.org/images/Reports/Concentration_FullReport.pdf

10. Tilahun, S. and Edwards, S. (eds) 1996. *The movement for collective intellectual rights*. Institute for Sustainable Development/Gaia Foundation, Addis Ababa/London.

11. Correa, C., Shashikant, S. and Meienberg, F. 2015. 'Plant variety protection in developing countries: A tool for designing a *sui generis* plant variety protection system – an alternative to UPOV 1991'. ABREPEPES, http://www.utviklingsfondet.no/files/uf/documents/PVP_Tool_English.pdf

farmers to freely exchange, save, improve and sell seed; enabling farmers and formal breeders to work together to develop new varieties; and allowing the marketing of seed that is not patented or use-restricted¹². Such systems could start with farmer varieties and, over time, expand to incorporate all seed.

1.2 Restrictions on exchange and use of genetic materials, without passing through a series of commercial quality control and standards tests

Variety registration and seed production quality controls are designed to construct and maintain commercial-scale production systems suited for commercial output markets. As a result, they inadequately accommodate farmer seed systems, where diverse genetic materials diffuse into the production system, based on user¹³ preference, rather than on a set of standardised, externally authorised criteria.

Formal variety registration/release requirements may include:¹⁴

- Description of the breeding procedure used, origin of germplasm, etc.;
- Phenotypic¹⁵ characterisation of the accessions, including resistance to common pests and diseases;
- Performance of the accessions in on-station and on-farm trials across agro-ecological zones targeted for release (VCU);
- An inspection plot (generally on-station) where the potential variety can be inspected, and where sufficient planting material is available to demonstrate that release is feasible in practice;
- A description of post-harvest attributes; and
- DUS tests for crops covered by the law.

Legally speaking, unregistered varieties may not be sold¹⁶. It is common for farmers to



sell their own (unregistered) varieties and a blind eye may be turned to this, but this is not technically legal, unless there are specific exemptions. Sales outside the regulated process may pose a threat to corporate profitability, and this is why large-scale commercial producers do not like to enter into markets for seed that can be recycled for a number of seasons, such as legumes or wheat. If farmers want to sell their own varieties, they will be required to pass through the detailed and rigorous set of procedures; otherwise, they will need to sell their varieties as 'grain', not as 'seed'. Formal procedures for selling seed are based on breeding standards that are not always of use to smallholder farmers/seed producers in diverse contexts. The overarching issue is that farmer seed is not fixed to (supposedly) stable, 'finished' varieties, as required by the formal registration process. No variety is ever finished, because, with constant use, these varieties continue to adapt under natural, including human, selection processes. Although hybrids are sold as stable, in reality they are by their nature inherently unstable, since their characteristics disintegrate after first use.

For genetic materials (including protected varieties) produced and used below the commercial threshold, such detailed reporting

12. Kloppenburg, J. 2014. 'The unexpected outcome of the Open Source Seed Initiative's licensing debate', <https://opensource.com/law/14/5/legal-issues-open-source-seed-initiative>; CSA (Centre for Sustainable Agriculture) 2014. 'Building open source seed systems'. CSA, Sekunderabad.

13. Users include seed users, product processors and end consumers at relevant scales.

14. Manu Aduening, J., Lamboll, R., Ampong Mensah, G., Lamptey, J., Moses, E., Dankyi, A. and Gibson, R. 2006. 'Development of superior cassava cultivars in Ghana by farmers and scientists: The process adopted, outcomes and contributions and changed roles of different stakeholders'. *Euphytica*, 150:47–61.

15. Observable characteristics

16. Discussions on sale also refer to trade.

does not appear to be necessary. Most of the listed registration requirements, as indicated above, will only reflect a fixed snapshot of the genetic flow, even for varieties that farmers may want to multiply and sell. Technical requirements include type of cross or mutation; method of propagation; detailed characteristics of the variety, with specific questions for crop type; specifics of disease resistance; similarities and differences between closely related varieties; and physical submission of plant materials, following a set of procedures¹⁷. This lockdown is required in the formal registration process, in order to capture a static image for comparison with static images of different varieties for IP allocation purposes, and to attempt to fix the expected results of planting in very narrow terms. In reality, this is mainly a market share issue for multinational corporations. In this way, registration requirements and IP rights are very closely interconnected. These procedures mean the exclusion of varieties that are not registered, narrowing of genetic diversity, and restrictions on sale.

Is there value of registration for farmer varieties below the threshold? Farmer breeders may simply wish to secure recognition that registration provides for their varieties/ genotypes, or to sell and exchange their own varieties. Registration should be voluntary, and a set of appropriate standards developed together with breeders, seed producers and users. Registration can also form the basis for protection against biopiracy, although this is based on relatively restricted access and benefit sharing (ABS) mechanisms.

It is difficult for farmers to gain much benefit from existing ABS mechanisms. They are designed for a royalties-based model in cases of commercialisation of the registered materials, including derived materials. Individualised proof of ownership, quantification of contribution, etc. will be difficult for farmers to show, and specific individuals will end up getting virtually nothing, from a financial

viewpoint. There could be ABS systems with non-monetary benefit sharing, and where communities (rather than individuals) are the beneficiaries, and the system recognises collective rights to seed. Of greater concern, in the current context, is that registration of landraces and other farmer varieties can open the way for biopiracy and potential appropriation by commercial seed producers using existing ABS agreements and laws, by making visible the genetic resources held by farmers, along with the characteristics of genotypes¹⁸. Further discussion can be had on other benefit sharing options, apart from, or in addition to the existing ABS structure, that could be favourable to farmers, if they want to register their varieties, and/or to external corporations/breeders who may be interested in acquiring these varieties. These benefit sharing options could be context specific or general, depending on diverse farmer needs.

1.2a A restricted and rigid variety registration process

Within the formal registration process, we focus our attention on DUS and VCU testing. DUS combines criteria for IP rights and breeding standards geared for uniform and standardised agricultural production and processing. DUS testing is done to establish the unique character of a variety for registration and IP purposes. A variety must be distinct from an already registered variety so that ownership can be conferred for a period. To secure PVP, the variety must also be 'new', that is, not previously in use in its distinct form, hence NDUS.

'Uniformity' refers to the progeny of the seed having the same characteristics as one another. 'Stable' means the advertised traits must be faithfully replicated in the progeny and the seed must breed 'true to type', at least for the first crop planting. With hybrid seed, these characteristics disintegrate with further plantings, as indicated above, so they are not actually stable in reality beyond first planting. The formal system requires uniformity and

17. See DAFF 'Application forms and technical questionnaires', <http://www.nda.agric.za/doaDev/sideMenu/geneticResources/appFormTechQues.html#second>

18. The genetic constitution or make-up of a particular organism





stability, to provide a distinct identity in comparison to other varieties. These criteria can also potentially be used to extend IP rights to derived materials.

Beyond IP rights, commercial production and processing requires uniformity and stability for standardised and mechanised production and processing. Even in more localised contexts, users may also favour uniformity, for example grain or meal colour.

But by and large, DUS is not appropriate for farmer needs, especially the needs for diversity and dynamic evolution¹⁹. DUS is too rigid to accommodate plasticity and constantly adapting genetic materials, a flexible flow of evolving genotypes. While technicians consider homogeneous lines a sign of genetic uniformity, this may not be what performs best in highly heterogeneous, risky environments. Having more genetic variability in the field

can be a way of avoiding the very real risk of total crop failure, and may be gained by mixing cultivars in the field. This is the site where local breeding takes place. Maintaining genetic lines is also crucial for farmers, and this knowledge of seed production is intrinsic to smallholder practices, in particular.

What other criteria could there be for registration, which can allow for recognition of constantly adapting farmer varieties and enable their protection from biopiracy? We propose flexibility, based on recognition of a range of related genotypes for farmer varieties under collective rights, rather than single, fixed varieties under exclusive ownership.

VCU trials are multi-environment trials to test the performance of the materials in a multitude of environments, for example: location; years; and different types of agronomic management for the prioritised

19. CENESTA (Centre for Sustainable Development) 2013. *Evolutionary plant breeding: A method to adapt crops to climate changes, increase on-farm biodiversity and support sustainable livelihoods*. CENESTA, Tehran, p.16.



traits, such as drought resistance, pest resistance, nutrition, etc. These tests are designed to compare the recommended variety with others in current use in diverse contexts over time. The aim is to have as many locations as possible. VCU allows for identification, over time, of appropriately adapted, high-yielding, stable genotypes²⁰. Tests must show added value for farmers of the new variety over existing available materials²¹. Where examination conditions and characteristics have been developed by the Registrar for these trials, we are doubtful that they are suited for the varieties of concern, since VCU would be primarily concerned with yield and quality. Exemptions should apply to farmer varieties and to production, use and exchange at a non-commercial scale. For those above a commercial threshold, flexibility – especially to accommodate farmer seed/genotypes – could be built into these processes very easily.

These trials have limited precision, so it is mostly negative selection, and obviously inferior breeding material is discarded in conventional processes. It may be that farmers in particular localities may favour both discarded and retained materials for further work or production, and they should have free access to these materials as part of ABS, in recognition of their ongoing work in seed selection, adaptation and use.

VCU may be under centralised control of a breeding institution or may be decentralised, with tests in numerous environments, through voluntary farmer participation. Farmers in diverse locations can benefit from doing VCU tests on their own or introduced varieties for their conditions. Recommended cultivars are distributed to farmers for testing and

comparison with locally favoured varieties. Crowdsourcing, which involves widespread dissemination to many farmers in diverse contexts, to carry out small trials and feed results back quickly, is an example of this²².

Advantages of a decentralised VCU approach are:²³

- An increase in the number and range of test environments;
- Reduction in the cost of VCU testing, because decentralised institutions are responsible for only one or a few locations;
- Control cultivars (usually the best in cultivation) are defined previously;
- Rules for inclusion, continuity of test lines and release of new cultivars can be decided in a collective manner; and
- It gives breeders an opportunity to test their best lines with other lines from other breeding programmes.

Disadvantages are:²⁴

- Lack of control over how the trials are performed by the participating institutions and the quality of experimental data; and
- The new lines will be available to third parties (which is only an issue if exclusive ownership is sought).

There is lack of official recognition of VCU-type testing by farmers, even if this is rigorous. For example, in Syria, after farmers had tested the material in their own fields for four years, this was not recognised in the formal process and there was still a requirement for another three years of on-farm trials, from scratch²⁵. Even where farmers do follow the procedures, bottlenecks in multiplication, dissemination and promotion may limit greater adoption of varieties they have produced.

20. Ceccarelli, S. 2009. 'Main stages of a plant breeding programme'. In S. Ceccarelli, E. Guimaraes and E. Weltzien (eds) *Plant breeding and farmer participation*. FAO, Rome, p.71.

21. Kaimenyi, K. 2017. 'Seed certification critical to quality seed production'. CIMMYT, <http://www.cimmyt.org/seed-certification-critical-to-quality-seed-production/>

22. <https://www.biodiversityinternational.org/innovations/seeds-for-needs/crowdsourcing/>; Steinke, J., Vernooy, R. and van Etten, J. 2016. 'Field testing'. In R. Vernooy, G. Bessette and P. Rudebjer (eds) *Resource box for resilient seed systems: Handbook*. Biodiversity International, Rome.

23. Federizzi, L., Carbonell, S., Pacheco, M. and Nava, I. 2012. 'Breeders' work after cultivar development – the stage of recommendation'. *Crop Breeding and Applied Biotechnology*, S2:69–70.

24. Federizzi, L., Carbonell, S., Pacheco, M. and Nava, I. 2012. 'Breeders' work after cultivar development – the stage of recommendation'. *Crop Breeding and Applied Biotechnology*, S2:69–70.

25. Ceccarelli, S. 2016. 'Participatory barley breeding in Syria: Policy bottlenecks and responses.' In M. Halewood (ed.) *Farmers' crop varieties and farmers' rights: Challenges in taxonomy and law*. Routledge, Oxon.



1.2b An inflexible quality control system for seed multiplication, storage and packaging

Existing seed production quality controls are based on Organisation for Economic Co-operation and Development's (OECD) Schemes for the Varietal Certification or the Control of Seed Moving in International Trade, and International Seed Testing Association (ISTA) standards and procedures. As with PVP and registration, they are based on building and maintaining commercial systems.

Breeder seed is multiplied out in successive batches, with quality controls to ensure the seed retains its registered characteristics and to make sure it performs according to claims. Seed is planted in certification plots with quality control inspections, and post-harvest supervision for sealing of raw seed and processing. Seed samples are sent to a registered seed certification authority to verify conformity to standards, including genetic and physical purity (field test), germination rate, moisture content, and to ensure the batch is free of weed seed and seed-borne disease²⁶. These standards and procedures are mainly designed to provide an official guarantee that seed is of appropriate quality and is identifiable at the time of purchase²⁷.

In most countries, a variety must be registered and certified before it can be legally sold, unless there are explicit exemptions. In participatory plant breeding, genetic materials that have gone through systematic breeding processes may be distributed and shared amongst farmers, even if not formally registered. This includes genotypes, whether 'finished' or not, in use in different locations. This becomes farmer material and is integrated into farmer systems.

It is highly doubtful that formal sector institutions will sell varieties that have not been registered, though they may hand the materials out and even do or support multiplication to this end. However, such



programmes may fall foul of the law as currently defined. In some circumstances, the definition of sale may be widened to include any form of exchange, as is the case with current proposals to revise seed laws in South Africa²⁸. Legally speaking, this poses a threat to farmer exchange of any materials, even if not sold for money. Across the world, farmers do sell unregistered seed in varying quantities. Generally, this may be tolerated and not monitored closely, unless scale becomes significant and authorities get to hear about it. However, making exchange and sharing of seed below the commercial threshold illegal has the side effect of preventing public sector involvement in programmes and activities to support smallholder farmers and small seed enterprises, where the objective of the activities is to develop and produce enhanced varieties for local and non-commercial circulation. Issues of packaging, labelling, registration of seed businesses and

26. Agriinfo (n.d.) 'Seed certification procedure', <http://www.agriinfo.in/default.aspx?page=topic&superid=3&topicid=2303>

27. Visser, B. 2015. 'A summary of the impact of national seed legislation on the functioning of small-scale farmers' seed systems in Peru, Vietnam and Zimbabwe'. https://www.sdhsprogram.org/assets/wbb-publications/90/IFAD_excerpt_seedlaw_study_4%20january.pdf

28. ACB 2017. Preliminary comments on Plant Improvement Bill [B 8B – 2015]. ACB, Johannesburg; Republic of South Africa 2015. 'Plant Improvement Bill [B 8B-2015]'. RSA, Pretoria.



phytosanitary controls may be of relevance to users of the seed and systems will need to be designed to incorporate these at different levels of production.

In some cases, farmers indicate they are able to meet formal certification standards, but that these are not always necessary, because existing social structures are adequate in regulating seed quality²⁹. Below the threshold, farmers should be exempted from formal standards, with quality guarantees based on trust and reputation, and voluntary adoption of standards defined in interaction with users.

Above the commercial threshold, quality controls provide a guarantee and accountability in indirect sales relations. Laws and regulations should incorporate flexibility even above the commercial threshold for enterprises producing farmer varieties, and for other enterprise categories defined in national regulations. Quality controls for farmer varieties and for OPVs from conventional breeding may be relaxed, for example, quality declared seed (QDS) for defined enterprises for local distribution and sale still require certification through formal agencies, but could be expanded to incorporate flexible standards for farmer varieties above the threshold.

29. Visser, B. 2015. 'A summary of the impact of national seed legislation on the functioning of small-scale farmers' seed systems in Peru, Vietnam and Zimbabwe'. https://www.sdhsprogram.org/assets/wbb-publications/90/IFAD_excerpt_seedlaw_study_4%20january.pdf

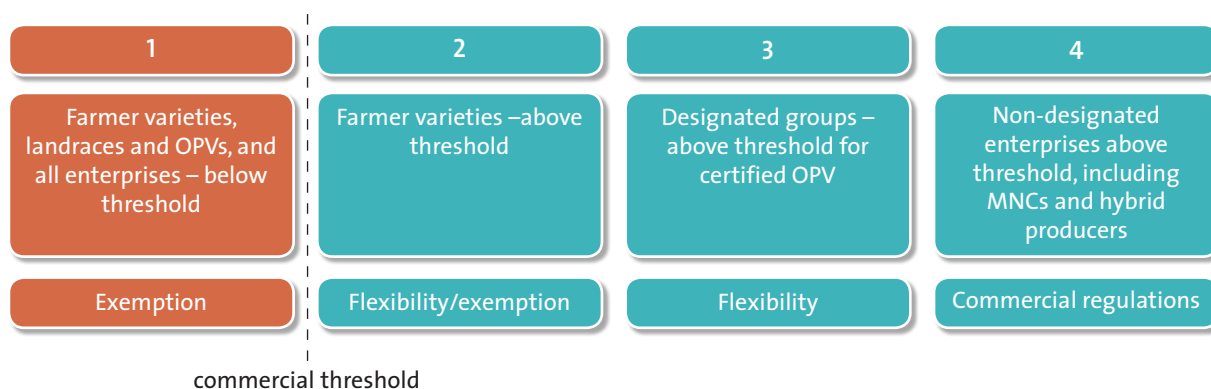
SECTION 2: Proposals

Table 1 (see below in this section) provides an overview of the proposals. Some elaboration follows on aspects of the proposals. As indicated above, there are two specific areas of proposal: the first looks at exemptions and recognition for farmer varieties outside the formal system, the second looks at flexibility within the prevailing regime. Exemption requires a clearly defined space where the exemption applies, and there is discussion on a threshold defining what is exempt and

what is not. We believe exemptions are very important, but, crucially, recognition must accompany them. This will allow public sector engagement to support and build diverse, decentralised, farmer-based biodiversity maintenance and use, crop improvement and seed production and distribution. Areas covered are PVP, DUS, VCU, registration, seed production quality controls, storage and packaging, and phytosanitary measures.

These are considered across four categories of producers, as indicated in Figure 1:

Figure 1: Producer categories



Category 1 covers farmer varieties and landraces, and any farmer or farmer enterprise breeding, producing and/or selling seed below the threshold. These varieties and enterprises are exempt from commercial regulations. Quality controls are based on trust and repeat business. Voluntary standards may be adopted, based on producer-user engagement (participatory quality controls)

Category 2 covers farmer varieties produced above the commercial threshold, and includes a combination of exemptions and flexibility in formal regulation, depending on circumstances.

Category 3 covers non-designated groups who breed and/or produce certified OPVs above the commercial threshold. In this category, designations are to be left to national decision-making, and can include groups such as smallholder farmers or enterprises owned by smallholder farmers; black- and/or women-owned enterprises in South Africa, for example, where historical redress is part of national priorities, etc. This category is regulated but flexibility is to be applied, e.g. QDS.

Category 4 covers all non-designated commercial enterprises above the commercial threshold for certified seed, including all hybrid and GM, where not prohibited, as well as certified OPVs for non-designated commercial enterprises. This includes, but is not limited to, multinational corporations. Existing commercial regulations are to apply.

Table 1: Proposals at a glance

	Category 1	Category 2	Category 3	Category 4
PVP	<ul style="list-style-type: none"> • Blanket protection from biopiracy on all farmer varieties (FV), whether registered and protected or not; • FV to include historical accessions to national, regional and global gene banks and collections; • Framework for recognition and protection of collective rights. 	<ul style="list-style-type: none"> • Blanket protection from biopiracy on all FV, whether registered and protected or not; • Framework for recognition and protection of collective rights. 	<ul style="list-style-type: none"> • Compulsory licencing for certified OPVs to give these enterprises access to registered materials; • Framework for recognition and protection of collective rights. 	<ul style="list-style-type: none"> • PVP restricted to relations between large enterprises; • Underlying germplasm freely available for all others for adaptation, multiplication and sale; • Framework for recognition and protection of collective rights.
DUS	<ul style="list-style-type: none"> • Voluntary, flexible registration to accommodate a range of associated genotypes and identifiability, rather than a distinct, 'finished' variety. 	<ul style="list-style-type: none"> • Voluntary, flexible registration to accommodate a range of associated genotypes and identifiability, rather than a distinct, 'finished' variety. 		<ul style="list-style-type: none"> • Applicable for relevant crops and varieties (e.g. for large-scale commercial and industrial production).
VCU	<ul style="list-style-type: none"> • Encourage voluntary, decentralised, in-field, farmer-led performance tests for different agro-ecological zones (AEZ); • Participatory development of standards and procedures for performance tests with breeder-producers and users, based on an expanded set of criteria (e.g. nutrition). 	<ul style="list-style-type: none"> • Compulsory decentralised, in-field, farmer-led performance tests for different AEZ. 	<ul style="list-style-type: none"> • Compulsory decentralised in-field performance testing of OPVs for different AEZ; • Encourage on-station performance tests in parallel. 	<ul style="list-style-type: none"> • Compulsory decentralised on-station and in-field performance testing, with active farmer participation for different AEZ.



	Category 1	Category 2	Category 3	Category 4
Registration	<ul style="list-style-type: none"> • Voluntary. • Decision to register includes exemption from DUS; • Flexibility to accommodate a range of associated genotypes, rather than a distinct, 'finished' variety; • Flexible VCU and results for registration of FV to indicate recommended AEZ and geographical variations. 	<ul style="list-style-type: none"> • Compulsory registration of FVs but flexibility; • Flexible to accommodate a range of associated genotypes rather than a distinct, 'finished' variety; • VCU and results for registration to indicate recommended AEZ and geographical variations. 	<ul style="list-style-type: none"> • Compulsory registration of OPVs; • Flexible on uniformity and stability tests, based on producer-user interactions; • VCU and results for registration to indicate recommended AEZ and geographical variations; • For hybrid and other conventional varieties from outside, DUS and VCU as for commercial. 	<ul style="list-style-type: none"> • Existing commercial regulations.
Seed production quality control (QC)	<ul style="list-style-type: none"> • Unregulated – based on trust and reputation; • Voluntary adoption of standards and procedures for quality guarantee. 	<ul style="list-style-type: none"> • Flexible QC for FV based on producer-user interactions; • Expand QDS to incorporate flexible participatory QC for FV. 	<ul style="list-style-type: none"> • Flexible QC for certified OPV, based on producer-user interactions; • Expand QDS to incorporate flexible participatory QC for certified OPV; • QDS or full QC for hybrids and other conventional varieties. 	<ul style="list-style-type: none"> • QC based on existing framework (e.g. OECD/ISTA).
Storage and packaging	<ul style="list-style-type: none"> • Unregulated – based on trust and reputation. 	<ul style="list-style-type: none"> • Flexible requirements for FV developed between farmers and users. 	<ul style="list-style-type: none"> • Flexible requirements for certified OPV; • Commercial regulations for hybrids and other conventional varieties. 	<ul style="list-style-type: none"> • As in existing commercial laws and regulations.
Phytosanitary measures	<ul style="list-style-type: none"> • Unregulated – encourage screening of materials to prevent spread of diseases and pathogens. 	<ul style="list-style-type: none"> • Screening of materials to prevent spread of diseases and pathogens in accordance with good practice, with participatory phytosanitary control measures where possible. 	<ul style="list-style-type: none"> • Screening of materials to prevent spread of diseases and pathogens in accordance with good practice, with participatory phytosanitary control measures where possible. 	<ul style="list-style-type: none"> • Screening of materials to prevent spread of diseases and pathogens, in accordance with good practice.



2.1 Well-defined exemptions for non-commercial seed enhancement, production and use, based on farmers' rights

Exemptions and thresholds

- Exemptions require a defined threshold for their application.
- There may be a number of existing exemptions in laws and regulations, including: crops that are not listed; breeders' ability to access protected materials for R&D; and potentially OPVs of certain crops, even if these crops are specified in PVP laws and regulations. Such exemptions should be retained and generalised to all enterprises.
- In some cases, there are exceptions based on production thresholds (e.g. income/turnover, volume or area of seed produced). Such commercial thresholds should become the basis for blanket exemptions. The level should be negotiated with relevant parties, including diverse farmers, breeders and seed producers at various scales.
- Other exemptions can be included in the framework according to national context, for example, costs of participation for designated groups. This should be left to national decision-making.
- There may be links between the threshold and national enterprise and business development policies, and particular government priorities (e.g. definition of small enterprises, race and gender redress in South Africa).

Category 1: Farmer varieties and landraces, and individuals/enterprises producing below the threshold

The bottom line is that seed enterprises (incorporating individuals and groups, as defined above) producing, using, adapting and exchanging seed below the commercial threshold should be exempt from any legal restrictions on these activities in seed laws. This needs to be stated explicitly in policy and the threshold(s) defined.

PVP

- Blanket protection on all farmer varieties/genotypes from biopiracy, whether registered or not.
- Farmer varieties to include historical

accessions to national, regional and global gene banks and collections.

- Automatic farmers' rights below the commercial threshold at national level, as expressed in Article 9 of ITPGRFA. Even countries that have not signed up to ITPGRFA can voluntarily implement these measures in national policies and laws, as good practice.
- Framework for recognition and protection of collective rights.

DUS, VCU and registration

- Voluntary, flexible registration to accommodate a range of associated genotypes and identifiability, rather than a distinct, 'finished' variety.
- Encourage flexible, decentralised, farmer-led VCU and results for (voluntary) registration of farmer varieties, to indicate recommended agro-ecological zones and any geographic variations.
- Participatory development of standards and procedures for performance tests with breeder-producers and users, based on an expanded set of criteria (e.g. nutrition).

Seed production quality controls, storage and packaging, and phytosanitary measures

- Exemptions from all regulations for interpersonal relations of exchange (i.e. direct sale by the breeder-producer to the end user).
- Seed production, storage and packaging are unregulated, based on trust and reputation.
- Voluntary adoption of standards and procedures for quality guarantee, based on farmer-user interactions and agreements (formal and informal). Further investigation is required into participatory, multi-stakeholder and collective quality guarantee models.
- Phytosanitary measures: Unregulated – encourage screening of farmer materials to prevent spread of diseases and pathogens.

2.2 Greater flexibility in commercial regulations and standards

Beyond exemptions, the flexibility of commercial regulations should also be considered for farmer varieties and also farmer-owned and other designated enterprises in breeding, production and exchange, including sale – especially with regard to DUS,



VCU, registration, seed production quality controls, certification, storage and packaging, and phytosanitary requirements. Laws and regulations should make allowances, and standards should be developed, working together with farmers, small enterprises and users for alternative quality controls in diverse contexts.

Category 2: Farmer varieties produced by farmers and farmer enterprises above the threshold

Even above the threshold production of farmer varieties, flexible standards are required, to accommodate the flexible character of these varieties, as well as to open space for smallholder farmers into seed breeding and production.

Some flexibility may need to be built in, to accommodate differentiated development. For example, if farmer seed enterprises surpass the commercial threshold in a particular crop (such as maize), the relevant commercial regulations should really only apply to them for that particular crop, and should not affect their rights to production and use of other crops.

PVP

- Blanket protection on farmer varieties from biopiracy, whether the varieties are registered and protected or not.
- Framework for recognition and protection of collective rights.

DUS, VCU and registration

- Compulsory registration of farmer varieties, but flexibility to accommodate a range of associated genotypes and identifiability, rather than a distinct, 'finished' variety.
- Compulsory decentralised, in-field, farmer-led performance tests for different agro-ecological zones.

Seed production quality controls, storage and packaging, and phytosanitary measures

- Flexible quality standards and procedures for farmer varieties, based on producer-user interactions.
- Expand QDS to incorporate flexible participatory quality controls for farmer varieties.
- Flexible storage and packaging requirements developed between producers and users.



- Phytosanitary measures: Screening of materials, including farmer varieties, to prevent spread of diseases and pathogens, in accordance with good practice and participatory processes, where possible.

Category 3 Designated groups producing certified OPVs

PVP

- Compulsory licencing for certified OPVs, to give these enterprises access to registered materials.
- Framework for recognition and protection of collective rights.

DUS, VCU and registration

- Compulsory, decentralised in-field performance testing of OPVs for different agro-ecological zones.
- Encourage on-station performance tests, in parallel with in-field performance tests.
- Compulsory registration of OPVs.



- Flexible on uniformity and stability tests, based on producer-user interactions.
- Compulsory, decentralised in-field performance testing of OPVs for different agro-ecological zones.
- Encourage on-station performance tests in parallel.
- For hybrid and other conventional varieties from outside, DUS and VCU, as for commercial.

Seed production quality controls, storage and packaging, and phytosanitary measures

- Flexible quality standards and procedures for OPVs, based on producer-user interactions.
- Develop standards and procedures based on interactions between breeder-producers and users.
- Compulsory, decentralised on-station and in-field testing, with active farmer participation for different agro-ecological zones.
- Expand QDS to incorporate flexible participatory quality controls for farmer varieties.
- QDS or full quality control for hybrids and other conventional varieties.

- Phytosanitary: Screening of materials, including farmer varieties, to prevent spread of diseases and pathogens in accordance with good practice, with participatory measures, where possible.

Category 4: Non-designated commercial enterprises, including MNCs

PVP

- PVP restricted to relations between these enterprises, with PVP focusing only on hybrids and GM varieties (if permitted).
- Following first sale, the genetic material is available for all others for use, to adapt, multiply and sell (at will below the threshold; according to flexible conditions above the threshold).
- Exclusive IP rights should be contained to relations between large enterprises above the commercial threshold, and only on specific crops and varieties. Exemptions for smallholder farmers for non-commercial use of protected varieties on own holdings, but these should be expanded to exchange, especially of derived products (conditional on meeting appropriate seed production

quality standards).

- Develop an alternative ABS approach to royalties or other financial benefit, based on free access in perpetuity to genetic materials and derivatives.

DUS, VCU and registration

- As with existing commercial varieties. Compulsory, decentralised on-station and in-field performance testing, with active farmer participation for different agro-ecological zones.

Seed production quality controls, storage and packaging, and phytosanitary measures

- Existing system based on OECD/ISTA standards.
- Screening of materials to prevent spread of diseases and pathogens, in accordance with good practice.

General – above the threshold

- Spaces should be opened for crowdsourcing, evolutionary plant breeding models, and other innovations, without imposing unnecessary constraints on the use and distribution of materials.
- Build decentralised, crowd-sourced VCU into the commercial seed registration process, with active farmer involvement and recognition of this work in the form of free access to the genetic materials used in the process, as well as any user-generated products of its use and adaptation (derived products). There is no phytosanitary issue, as the seed will have already gone through testing for diseases or pathogens prior to the VCU stage. This material will, therefore, be safe for use and farmers should be freely entitled to use it as they wish. This increases access to genetic materials and allows farmers to choose and adapt the materials they favour in their specific contexts. The enterprise can still go ahead and produce certified seed for sale, which has a defined quality guarantee system favoured especially by commercial farmers.

- Regional harmonisation of seed laws and regulations occurring in Africa at present seek to allow VCU tests in a few places and then for these to be applicable to the whole region³⁰. This runs counter to the purpose of VCU, which is to test varieties in specific, localised conditions. VCU should remain a national competency, so that, even if a variety is released at regional level, VCU testing will still be required at national level before release. There should be flexibility for national authorities to accept regional VCU tests, if these were conducted in the same or similar agro-ecological zones as the areas where the varieties are to be disseminated and used.
- For hybrid and other conventional varieties from outside, DUS and VCU, according to current laws and regulations.

PVP across the system, applicable to all

- Develop a framework for recognition and protection of collective rights, based on farmers' historical and ongoing contributions to maintenance and reproduction of genetic materials. Detailed work has been done on this already³¹.
- Recognition of collective farmer contributions, both of original materials (including through historical accessions to gene banks) and in ongoing processes of crop improvement, including formal and farmer-based selection, experimentation and testing. Ultimately, this should also apply even to registered and protected varieties. The changes made are minor to the entire seed but exclusive, private rights are granted over the entire seed. This is unpaid appropriation of social knowledge accrued over centuries.
- Free access and use in perpetuity of genetic materials, including protected varieties for smallholder and small enterprise seed adaptation, production and exchange below the commercial threshold. For corporations, this is not very important for hybrids, since they produce significantly less on replanting.

30. ACB 2018. 'Status report on the SADC, COMESA and EAC harmonised seed trade regulations: Where does this leave the region's smallholder farmers?' ACB, Johannesburg.

31. For example, Tilahun, S. and Edwards, S. (eds) 1996. *The movement for collective intellectual rights*. Institute for Sustainable Development/Gaia Foundation, Addis Ababa/London.





Most seed that will be saved will be OPVs, where recycling is actually good practice, to allow adaptation to the conditions, and the seed does not lose vigour as rapidly as a hybrid.

- Government/public sector programmes and budgets to accommodate support to non-

commercial seed breeding, production and dissemination enterprises and activities. This can also create a seedbed for the rise of enterprises that can go over the commercial threshold over time, although this should not be the sole objective and purpose of enterprise support.



Glossary

(*Bold italics* indicates a separate entry on the subject.)

Biopiracy is the appropriation and privatisation of common pool resources, including *genetic materials* and associated knowledge.

Breeders' rights are included in formal PVP laws to allow registered breeders to gain access to protected *genetic materials* for further research and development. Any product commercialised as a result will be liable to the rights of the owner of the protected materials.

Conventional varieties are all formally released seed varieties that enter agricultural production systems from outside at the time of first planting. These are varieties whose genetic traits have been 'fixed' on the basis of DUS testing for the purposes of defining the variety. This includes hybrids, genetically modified seed (where permitted) and *open pollinated varieties*. Thereafter maintenance, adaptation and use of the seed over time integrate it as part of *farmer seed systems* and the seed becomes a *farmer variety*.

Cultivar is used interchangeably with *conventional variety*.

Derived materials refers to any *genetic materials* that result from the planting and/or adaptation of acquired materials. Derived materials may include the harvest as well as the development of new varieties and *genotypes*.

Distinct, uniform and stable (DUS) testing is done to establish the unique character of a variety for *intellectual property* and certification purposes. The requirement for a variety to be distinct primarily is an IP issue. A variety must be distinct from an already registered variety, so that ownership can be conferred for a period. It must also not be genetically the same as a variety previously registered. *Uniformity and stability* contribute to providing a distinct identity in comparison to other varieties. DUS is not always appropriate for farmer needs, especially the need for diversity and dynamic evolution.

Enterprises refer to individuals, partnerships and groups who breed, adapt, produce and exchange seed below the commercial threshold. This includes farmers and their associations and cooperatives.

Farmer seed systems incorporate the conservation, use, adaptation, saving and exchange of *genetic materials* in agricultural production systems. The focus is on plants but the definition could easily be extended to livestock. According to the way we define farmer seed systems, *conventional varieties* become part of the farmer seed system as soon as they are reintegrated into production after the first year. This is necessarily preceded by selection of *seed* for reproduction, and, hence, farmers have already started working with and adapting the materials to their needs.

Farmer varieties are defined as *germplasm* and seed either derived from indigenous *landraces* and their variations under continuous cultivation, or introduced varieties that have been maintained, adapted and absorbed into local seed and food production over time (which can even be one season from formal acquisition). Because of this constant adaptation, farmer varieties are not easily pinned down to the definite set of 'fixed' traits required to meet the standards of *conventional varieties*. They can be better understood as a pool of related *genotypes*.

Formal registration refers to the process defined in seed laws and regulations through which recommended varieties undergo *DUS* and *VCU* tests. If the tests and other relevant requirements are met, a *conventional variety* is recognised for use and circulation within the regulated space (although subject to various other procedures for multiplication and dissemination).

Free access does not mean there are no costs involved in seed production, adaptation and exchange. It means open access to the use of genetic materials.

Genetic materials refers to *germplasm, seed* and vegetatively propagated material, such as vines.



Germplasm refers to living genetic materials, including seed, maintained for the purpose of breeding and further research. It is the breeders' name for genetic materials that are prepared for scientific research. In **farmer seed systems**, the distinction between germplasm and **seed** is non-existent because the harvest cycles back into seed/germplasm for ongoing selection and enhancement in the field.

Genotype refers to the genetic constitution or make-up of a particular organism.

Landraces refers to **genetic materials** that originally come from an area or have been used locally for a long period of time.

Intellectual property refers to quantification and allocation of ownership onto ideas.

Non-rivalrous goods can be used repeatedly without the holder losing anything (such as data and information), as opposed to a 'rivalrous' good, such as an apple, which, once consumed, cannot be consumed again.

Open pollinated varieties (OPVs) reproduce through uncontrolled pollination (unlike hybrids where crossing is tightly controlled). Improved OPVs consist of a small number of similar **genotypes**. Maintenance is through mild but continuous selection. Cross-pollinating OPVs are open to adaptation to local conditions. Because OPVs can be reproduced for a number of seasons, and even longer if maintained well, they are less commercially lucrative than hybrids, where the **genetic materials** are more easily controlled by commercial enterprises.

Phenotype refers to the observable characteristics of a plant.

Plasticity means **genetic materials** are adaptable to cultivation and ecological conditions over time.

Quality declared seed (QDS) refers to a slight relaxation of seed production quality controls, but still operating within the formal quality control and certification framework.

Seed refers to **genetic materials** planted for agricultural production. In the formal system, seed is restricted to that which is regulated by the relevant laws and regulations. This means that **farmer varieties** may not be recognised in the formal system as seed.

Small enterprises refer to individuals, partnerships and groups, including cooperatives, who breed, adapt, produce and exchange seed below the commercial threshold. This includes farmers and their associations.

True to type means the progeny must have the same characteristics as the parent. This applies only to the first planting.

Uniformity and stability, in addition to contributing to providing a distinct identity in comparison to other varieties in accordance with **DUS**, also test that the variety meets certain user requirements. Uniformity refers to the progeny of the seed having the same characteristics as one another. This is important for large-scale agro-industrial production, but local markets may at times also prefer some level of uniformity, for example, grain/meal colour. Stable means the advertised traits must be faithfully replicated in the progeny, the seed must breed 'true to type', at least for the first crop planting. With hybrid seed, these characteristics disintegrate with further plantings.

Users include seed users, product processors and end consumers at relevant scales. Farmers themselves will be included in one or more of these groups.

Zero marginal cost means they are no additional production costs, once something has been produced once, for example, information or data. This is in contrast to a material product, where additional costs will be incurred to produce another one. There may be distribution costs, especially related to communications infrastructure, but this is a separate issue.





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