

Supporting smallholder seed systems

Agronomy



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Uganda - Vegetable Oil Development Project

Introduction

Agriculture begins with seed. Without seed, there can be no crops and no food production. When harvests fail or seed stocks are lost, seed insecurity ensues, which can reduce food security and livelihoods.

In most smallholder farming systems farmers save seed from the previous harvest to plant in the next season. They select seed from the best plants and then dry, clean and store the seed in a safe place. These traditional seed-saving practices and farmers' sharing of seed are called the informal seed system, or the farmer/community-based seed system. They also add to their crop diversity with seed they obtain from social networks or purchase in local markets, from agro-dealers or seed companies. Complimenting this [informal seed system](#) is the [formal seed system](#), which is made up of public and private seed companies that develop high-quality seed of new crop varieties.

The challenge for seed sector development, as elaborated in this toolkit, is how to address both the informal and formal seed systems so that farmers have access to a sustainable supply of quality seed of improved crop varieties which is affordable, meets their needs (for food, feed and markets), is well adapted to the local agroecologies and adapted to climate change.

Background and context

Between now and 2050, the world's population will increase by one third, with most of the additional 2 billion people living in developing countries. The United Nations Food and Agriculture Organization (FAO) estimates that agricultural production will have to increase by 60 per cent before 2050 to satisfy the increased demand for food, feed and fibre. Agriculture faces the daunting task of boosting productivity in the face of an increasing scarcity of arable land and water, and while coping with the challenges of climate change. This task has recently been summarized and prioritized in the United Nations Sustainable Development Goal 2 (SDG2) – “End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.”

For national agricultural policy decision makers, IFAD country programme managers (CPMs) and country offices (COs), there are many important elements to be considered to increase agricultural productivity: (i) access to natural resources, including land, water and genetic resources, through improved varieties, landraces and other genetic material in national and international gene banks and breeding programmes; (ii) access to inputs (seed, fertilizers, phytosanitary products and mechanization); (iii) access to markets and finance sources; and (iv) access to knowledge, extension, research and information.

The IFAD Rural Poverty Report of 2016 noted that sustainable agricultural intensification requires a more systematic approach to sustainably managing natural resources, including diversified farming systems, management of soil fertility, appropriate crops and varieties, water management, plant protection, and related policies and institutions. Strategies to assist smallholder farmers to improve their livelihoods will require addressing many of these elements in an integrated approach. There are several other How To Do Notes (HTDNs) in this IFAD series that address different aspects of this integrated approach.

Within sustainable intensification, a key issue is for farming households to have timely and affordable access to high-quality seed of adapted varieties to grow food for their families and fodder for their livestock, or to pursue other income-generating opportunities. Farming households need seeds for a range of crop varieties that meet their local needs and tastes and are adapted to local agroecological and climatic conditions. Quality seed is a necessary but not sufficient condition for sustainable production. Seed is more than just an agricultural input and the following issues need to be better understood:

- The national seed system is complex and composed of two subsystems – the [formal seed system](#) and the [informal seed system](#). The national seed system involves a wide range of stakeholders, including: national governments, agricultural research institutes, gene banks, private-sector actors (e.g. seed companies, input dealers and agro-industries), farmers and farmer organizations, all of which have specific roles and responsibilities.
- The [national seed system](#) covers a range of interrelated areas, such as conservation and use of plant genetic resources, plant breeding and intellectual property rights, research, regulatory functions (for seed [quality assurance](#), variety registration and phytosanitary issues), seed production (by the public and private sectors), seed trade, community-based seed supply and how to respond to seed insecurity after emergencies.

The challenges of ensuring access and availability of quality seed of appropriate and adapted varieties for farmers, whether through the public or private sector or through the informal seed system, have been recurrent discussion points at the quality enhancement and quality assurance review stages of IFAD investment and grant projects. The complexity and requirements of the seed sector are often underestimated in the design and implementation of projects, both from the IFAD side as well as by implementing national partners. This toolkit is a response to these concerns and sets out a process of analysis to provide guidance in project design to ensure the formulation of effective interventions to improve farmers' access to quality seed to help them improve productivity and resilience, and respond to the challenges of climate change.

Rationale

National governments, IFAD and other development agencies have developed and implemented many initiatives to increase farmer access to quality seed of adapted varieties. These initiatives have targeted increasing the supply of quality seed, strengthening public and private seed companies, supporting seed certification agencies, developing seed policy and regulations, and establishing community seed production systems. However, these initiatives have often not achieved the desired impact on poor smallholder farming households. The lessons learned from these past projects are the topic of the second publication in this toolkit and are incorporated in the guidance provided for the design of more effective projects in the future.

One fundamental issue is that seed sector development has often been viewed from the perspective of governments or the private seed sector, overlooking the farming households' informal seed systems and the households' need for specific varieties adapted to their local agroecology and socio-economic conditions. What we need to know is:

- What are the farming households' needs?
 - Do they prefer their own local varieties, which they can easily save and plant the next season?
 - Is the available seed of adapted varieties responding to their food, feed and nutritional needs?
- Where do they source their seed?
 - How often do farming households purchase seed and who in the household buys it?
 - Where and how do farmers access improved varieties?
 - Are the crop varieties being sold by seed companies the ones that farming households need?
- Do they have the other inputs and follow the production practices needed for the seed to produce an increased yield?
- Are they linked to commodity value chains to be able to sell their surplus production and make a reasonable profit? Are the target farmer groups market-oriented or subsistence farmers, i.e. requiring a stable yield under harsh low-input conditions rather than a high yield highly dependent on external inputs?

A lack of understanding of these issues can lead to a focus on seed production rather than on assessing and responding to farmers' seed needs.

In addition, the quality of seed sold may not be of a high standard, fake seed may be in the market, seed may be too expensive for farming households to afford, or it may not be adapted to "marginal" agroecologies and production under low-input agriculture or may not be available when the farmers need it for sowing.

Finally, the larger context of agricultural production and marketing at the farming household level needs to be considered, such as soil fertility, production practices, water availability and commodity markets for what is produced. For farming households to purchase seed, the investment must provide them with a good return: it is essential that seed projects be designed to ensure this.

Basic concepts and challenges

To build on the lessons learned from previous projects and overcome their shortcomings, it is fundamental to understand seed as a system and appreciate how changes in one part of the system affect other parts. One way to conceptualize a national seed system is as three intersecting circles representing its main components (see Figure 1): agricultural research, the formal seed system and the informal seed system (FAO, 2005). At the intersection of all three circles sits plant genetic resources for food and agriculture (PGRFA), which is important for all three areas and includes genetic material conserved in gene banks, such as landraces and improved varieties and wild relatives of crops that are used in plant breeding.

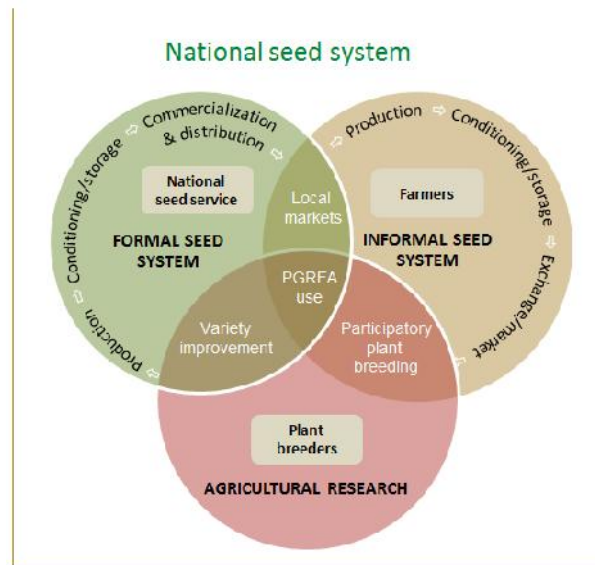


Figure 1. Main components of a national seed system

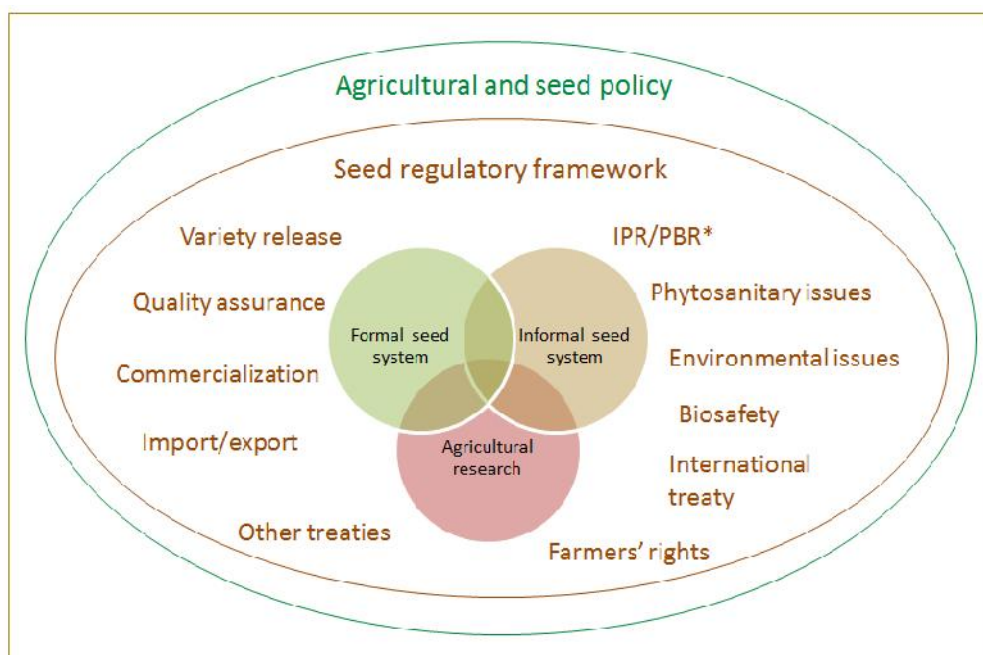
- The **informal seed system** represents farming households and communities producing, saving, selling or exchanging uncertified seed of improved varieties and local landraces. Farming households normally save seed from the previous harvest to plant the following season. If necessary, they source or exchange seed through their social networks or buy it on the local market. These are the main sources for more than 90 per cent of seed for smallholder farmers in the developing world, and understanding this system is critical to improving the livelihoods of farming households. This is commonly the case for staple crops or underutilized crops that are not profitable for the private sector and where governments no longer have the money to invest in seed multiplication. This system retains genetic diversity since landraces can differ even over short distances, depending on the local agroecology.
- The **formal seed system** represents certified/commercial seed production and marketing, usually by seed companies and sometimes by governments, and includes the importation of seed under the supervision of a national seed service. This seed is sold to farming households through, for example, agro-dealers, seed companies, government agencies and non-governmental organizations (NGOs). Farmers and traders may also sell seed of uncertified new varieties or local landraces in local markets (overlap of the circles in the middle). The formal seed system provides an essential link between the development of new varieties and getting them into the hands of farmers. Farmers' assessment of new varieties, through participatory plant breeding and participatory varietal selection, is critical to ensure that these new varieties are appropriate to their needs and that they will be ready to buy them and adopt them.
- Agricultural research** involves plant breeding by agricultural research institutes and the private sector to develop new, improved varieties. This process can take 5-15 years, depending on the

crop. These new varieties may be bred from germplasm brought in from outside a country or from local landraces of crop varieties preferred by farmers. Farmers may participate in this process through **participatory plant breeding** (PPB) (overlap of bottom circle and the circle on the right). Once the new variety is determined to be superior to existing varieties (i.e. more pest and disease resistance, earlier maturing, drought tolerant, improved nutritional qualities or higher yielding), it is officially released for further multiplication. This process appears in Figure 1 as variety improvement (overlap of the bottom circle and the circle on the left). Agricultural research provides the pre-basic (breeder) seed of improved varieties for multiplication within the formal seed system.

The development and release of new varieties is a key requirement for the formal seed system to provide farmers with suitable varieties responding to changes in climate, markets and nutritional needs, as well as to emerging biotic and abiotic stresses. Concern that currently used improved varieties and landraces may not be able to adapt quickly enough to climate change (FAO, 2015) makes access to new varieties more critical. An alternative approach to enhance the adaptation of crops to climate change is participatory **evolutionary plant breeding**, through which a wide range of selected genetic material from gene banks is provided to farmers to plant in their fields. Through natural selection, combined with farmer selection each season, new crop populations would develop with higher adaptation to local field and climate conditions while obtaining yields comparable to local or even improved varieties (see Lessons Learned publication and the glossary).

National seed system policy and regulatory framework

National seed systems function within a seed regulatory framework (see Figure 2), which includes seed laws and regulations and related legal instruments for the seed sector. This seed regulatory framework falls within agricultural policy (white oval) and, more specifically, national seed policy, which is implemented through a national seed plan/strategy. An effective national seed policy and a well implemented seed regulatory framework are essential for the effective development of a national seed system, including both formal and informal seed subsystems. The various regulatory elements are described in more detail in the glossary.



*IPR/PBR: Intellectual Property Rights/Plant Breeders' Rights

Figure 2. National seed system within the policy and regulatory framework

The previous diagrams and the brief explanation of their components are a useful way to start to conceptualize any national seed system in a specific country. The same diagrams can be used to demonstrate two scenarios found in country development contexts: (i) a national seed system in an early stage of development where the informal seed system dominates and (ii) a “mature” seed system where the formal seed system dominates.

In the majority of developing countries with subsistence or semi-commercial agriculture, informal seed systems will dominate and formal seed system will be quite small (Figure 3). This implies that attention needs to be given to understanding farming households’ needs and how they produce and exchange seed. Smallholder farmers in marginal agroecologies using low-input agriculture often find local landraces are better adapted than improved varieties, which may be developed for better agroecologies and high-input agriculture.

However, the situation can vary within a country based on type of crops, agroecology and the level of commercialization of a crop. For example, in Kenya or Tanzania, maize and vegetable production is dominated by the formal seed system in higher rainfall areas, but other minor dryland crops, such as millet and sorghum, are dominated by the informal seed system. Consequently, an understanding of the informal seed system is necessary to designing seed projects that will be effective in improving farmer access to quality seed of appropriate varieties, to support farmers’ rights to protect local landraces and for access to and benefit-sharing of local PGRFA. In addition, national seed policy and seed regulatory systems need to recognize and support the informal seed system since they are the most important source of seed for farmers.

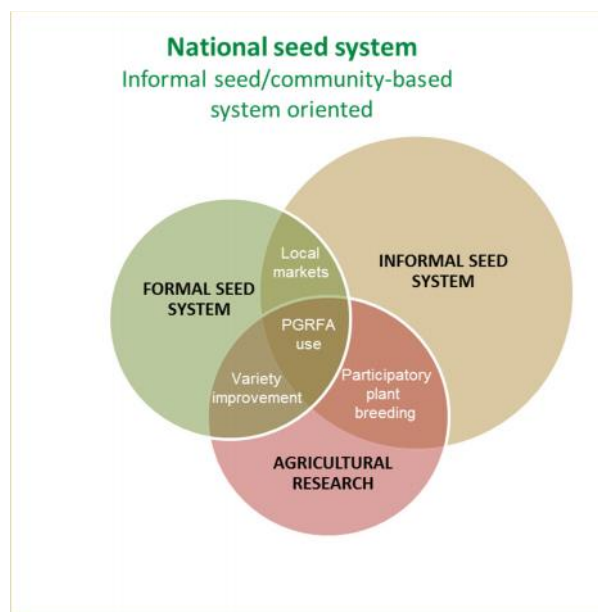


Figure 3. National seed system – case of a dominant farmer/community-based system

In countries with a highly commercial agriculture sector, such as South Africa, or in developed countries, agricultural research and the commercial seed sector are dominated by the private sector and focus mainly on production and sales of profitable crop varieties such as hybrids (Figure 4). Governments provide a policy and regulatory framework. The informal seed system is smaller, but usually remains important for minor crops of less commercial value but which are significant for nutritional security. Seed projects in these countries could be oriented to providing a conducive environment for seed companies through an appropriate policy and regulatory framework. Seed companies will develop their own improved varieties. National agricultural research institutes (NARI), in cooperation with farmers through participatory plant breeding and participatory varietal selection, can focus on crops that are important to farmers for nutrition or food security but that are less profitable for the seed companies.

These are basic elements of any national seed system, but their application can vary greatly since the system will be part of a larger agriculture economy. Therefore, it is important during country strategic opportunities programme (COSOP) formulation, or the project design process, to understand the dynamics of the agriculture sector within the context of the national economy, international trade and climate change. These dynamics directly affect national seed systems and determine the kinds of projects and interventions that may be relevant to improving the livelihoods of smallholder farmers.

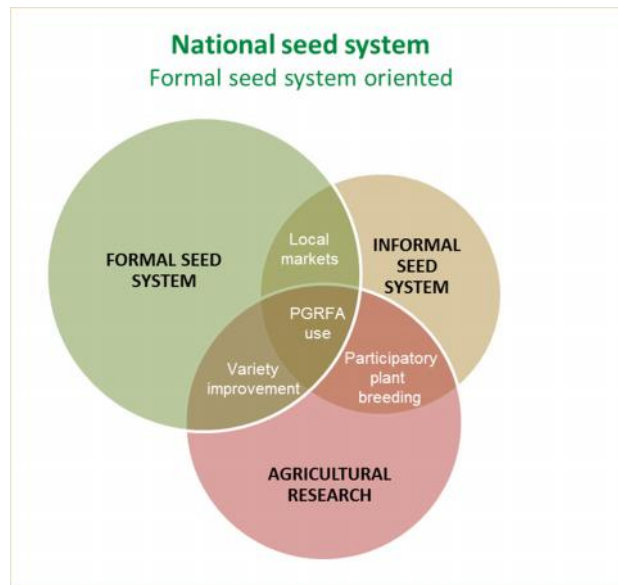


Figure 4. National seed system: the case of a more dominant, formal, commercially-oriented system

About the toolkit

This Teaser on seed systems aims at providing a brief introduction to the importance, challenges and concepts in understanding the seed sector and how it can impact the livelihoods of poor smallholder households.

The Lessons Learned publication further expands on some of the key lessons learned from IFAD projects with seed components and other sources to help inform the design and implementation of more effective seed projects.

The How To Do Note (HTDN) builds on the concepts in the Teaser and goes into more detail on assessing the elements of a national seed system. A framework of explanation, questions and potential interventions will form the basis of terms of reference (ToRs) for consultants and background studies needed to provide a better understanding of the seed sector to inform COSOPs and the design of projects, as well as guide supervision missions. The information gathered will also provide a basis for further discussion and validation of the findings with seed sector stakeholders.

Glossary of terms used in the toolkit

Basic (foundation) seed: Is the progeny of pre-basic (breeder) seed and is multiplied to producer certified (registered) seed, which is then used to produce certified 2 (certified) seed which is sold to farmers. It is produced by an agricultural research institute, or specialized government agency or the private sector (for details on seed production and multiplication refer to the section in the HTDN on Early generation seed production).

Biosafety protocol: Refers to the Cartagena Protocol on Biosafety to the Convention on Biological Diversity (CBD), which is an international treaty governing the movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another, i.e. transboundary movement only. It establishes an advance informed agreement (AIA) procedure for ensuring that countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory.
<https://bch.cbd.int/protocol>

Breeder seed: Refers to Pre-basic (breeder) seed.

CBD (Convention on Biological Diversity): The objectives of this Convention are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and technologies, and by appropriate funding. There is a close link between the CBD and the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) (see below International treaty). The CBD includes all biological diversity, while the ITPGRFA includes only the 64 most important agricultural species.
<https://www.cbd.int/>

Certified seed: Seed of a prescribed standard of quality, produced under a controlled multiplication scheme, normally from certified 1 (registered) seed. It is intended for sale to farmers (refer also to Basic seed).

CGIAR (Consultative Group on International Agricultural Research): A global partnership that unites organizations engaged in research for a food secure future carried out by 15 centres, which are members of the CGIAR Consortium. The work is done in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector.

Commercialization: Refers to the quality assurance (see below) system and standards, licensing requirements for seed producers and sellers, and monitoring of seed quality in the market, along with the penalties for non-compliance, which control the seed market to ensure seed is of high quality.

Community seed supply system: The production and saving of seed by farmers and the exchange of seed within communities and social networks and in local markets. The seed can be from landraces and uncertified improved varieties.

Cross-pollinated: Plant species in which self-pollination is prevented by mechanical, biological or other means and as a result these plants have the potential to be more heterogeneous and require greater isolation distances to produce quality seed that is genetically pure and uniform.

Cultivar: Synonymous with the term “variety” and indicates a distinct population of plants within a crop species. With improved varieties, the population is relatively uniform/homogenous.

DUS testing (distinct, uniform and stable): Refers to tests to determine the varietal identity in the sense it is distinct from other varieties; it also tests if the plant population is uniform and stable over time.

Early generation seed production: Refers to the small quantities of very high-quality seed that are multiplied over a series of generations to eventually produce certified seed for sale to farmers. The name of the generation of seed is based on two systems: 1) the OECD Seed Scheme that will be used in this publication and 2) the AOSCA (Association of Official Seed Certifying Agencies).

Environmental issues: Environmental regulations related to seed include regulations regarding the safe handling and use of pesticides in seed treatment and living genetically modified organisms (GMOs), referred to as living modified organisms (LMOs) in the Cartagena Protocol on Biosafety. For example, after a living GMO is imported into a country based on the procedures of the Cartagena Protocol (see above), there are national GMO regulations and procedures for variety testing of GMO crops with isolation systems in place to prevent gene flow into the environment, environmental risk assessment of GM crops contaminating similar crops, and regulation of a GMO crop after it is released to farmers, to prevent contamination of conventional and organic crops.

Evolutionary plant breeding: An approach that consists of planting in farmers' fields mixtures (evolutionary populations) of very many different genetic types (genotypes) of the same crops (including improved varieties, landraces and genetic material from national and international gene banks). These populations will be mixed, planted and harvested year after year and due to natural crossing (higher in cross-pollinated and less in self-

pollinated crops), the genetic composition of the harvested seed is never the same as that of the planted seed. Accordingly, crop population evolves to become progressively better adapted to the environment (soil type, soil fertility, agronomic practices, including organic systems, rainfall, temperature, etc.) in which it is grown. The genetic makeup of the population will change from year to year with changes in climatic conditions, but genotypes better adapted to dominating biophysical conditions will gradually become more frequent in this farming/breeding system.

Farmer field school (FFS): The FFS approach is an innovative, participatory and interactive learning approach that emphasizes problem-solving and discovery-based learning. The FFS aims to build farmers' capacity to analyse their production systems, identify problems, test possible solutions, and eventually encourage the participants to adopt the practices most suitable to their farming systems. This group-based learning process has been used by governments, NGOs and international agencies to promote integrated pest management (IPM) and other agriculture-related topics, including production, sales and use of quality seed.

Farmers' rights: As outlined in the ITPGRFA (below), this refers to national regulations on the protection of knowledge on PGRFA, equitable benefit-sharing arising from the use of PGRFA and the right to participate in national decision-making on PGRFA conservation and sustainable use.

Farming households: Rural smallholder households engaged in agriculture consisting of all family members, i.e. women, men and children, and who work as a team in all the practices related to agricultural production.

Food grain: The portion of the farmer's harvest for consumption or sale.

Formal seed system: Refers to the commercially-oriented seed production and supply of improved varieties by seed enterprises and governments using standardized quality assurance systems and inspections to ensure the seed produced is of high quality. High-quality seed has the attributes of high germination, physical purity, genetic purity and freedom from pests and diseases.

GMO (genetically modified organism): An organism whose genetic material has been altered using genetic engineering techniques which is a laboratory process where genes from the DNA of one species are extracted and artificially inserted into the genes of an unrelated plant or animal.

Hybrid: A variety produced by controlled cross-pollination of two distinct parents to provide "hybrid vigour". The progeny will differ from the parents, so requiring farmers to buy hybrid seed every year rather than having the option of saving seed to plant from the harvest.

Improved variety: A crop cultivar that has been developed through modern plant-breeding methods and subsequently tested and selected for use by farmers based on its specific characteristics of yield, days to maturity, pest and disease resistance, culinary use or nutrition, etc. These varieties are bred to be homogenous and meet the Distinct Uniform and Stable test for variety uniformity.

Informal seed system: Refers to farmer and community-based seed systems for producing, saving and exchanging seed of landraces and uncertified improved varieties. This system is a significant source of seed of preferred varieties for farming households because of proximity to the farmers. The cost of seeds in the informal system is lower than the formal system and farmers may receive seed as a loan, a gift or through barter.

International treaty: The International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) governs access to plant genetic resources for food and agriculture (PGRFA) germplasm for the purpose of breeding new crop varieties. The ITPGRFA proposes guidelines for the equitable sharing of the benefits from 64 of the most important food and forage crop species, referred to as the multilateral system of access and benefit-sharing (the MLS). In addition there is a standard material transfer agreement (SMTA) to exchange germplasm for breeding of new varieties. www.planttreaty.org/

IPR/PBR (intellectual property rights/plant breeders' rights), also referred to as PVP (plant variety protection): National systems for intellectual property rights for new plant varieties which provide exclusive commercial rights (for example, royalties) to the plant breeder or institute that develops the variety for a specified number of years and, therefore, these rights are an incentive for the development of new varieties.

ISTA (International Seed Testing Association): An international association with the mandate to develop and issue standard procedures for seed sampling and testing, and to promote the uniform application of these procedures for evaluation of seed in international trade. This is accomplished through the publication of the international rules for seed testing, training and dissemination of knowledge in seed science and technology. It also operates an accreditation system for public and private seed testing laboratories so the accredited laboratories can issue seed testing certificates that are widely used in international seed trade. <https://www.seedtest.org/>

Landraces/traditional varieties: Dynamic populations of cultivated plants that have a historical origin (i.e. that have evolved, or been selected and cultivated in the area for a long time) and distinct identity, lack formal crop improvement, and are often genetically diverse, locally adapted and associated with traditional farming systems. These are often heterogeneous varieties that are adapted to marginal agroecologies and to low-input

agricultural practices in which stability of yield is more important than maximum yield under optimal conditions, i.e. conditions generated by good rainfall and use of inputs.

LMO (living modified organism): As defined in the Cartagena Protocol on Biosafety, any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology. The Cartagena Protocol on Biosafety regulates international trade in living GMOs and not the broader area of GMOs as food.

Local varieties: Refers to both local landraces that are indigenous to an area and uncertified, recycled, improved varieties that have been in the hands of farmers for many years.

Low-input agriculture: Refers to farming practices with minimum external inputs, such as fertilizer and pesticides, which may not be best for many modern varieties that are developed with optimal use of inputs to achieve maximum yield.

Mass selection: A method of selection that depends mainly on the selection of plants according to their appearance and performance; seed from selected plants are bulked for the next generation. This method is used to improve the overall population by positive or negative mass selection. Mass selection is only applied to a limited degree in self-pollinated crops and is an effective method for the improvement of landraces.

National seed policy: A statement of principles that guides government action and explains the roles of relevant stakeholders in the coordination, structure, functioning and development of a seed system comprising both formal and informal seed subsectors. Ideally, seed policy should be developed with wide stakeholder participation, including farmers/farmer organizations, agricultural research institutes, national gene banks, seed certification agencies, seed companies and policymakers.

National variety catalogue: The national list of officially released varieties in the country with the description of their characteristics.

Nucleus seed: Very high-quality seed produced by the original breeder/Institute in small quantities. A pedigree certificate is issued by the breeder producing the seed.

Open-pollinated: When the plants of an open-pollinated variety self-pollinate, or are pollinated by another plant of the same variety, the resulting seeds will produce plants roughly identical to their parents. Therefore, open-pollinated varieties (OPVs) can refer to species that are either self-pollinated or cross-pollinated as long as the seed is produced in a controlled way such that the progeny will be identical to the parents.

Organisation for Economic Co-operation and Development (OECD) Seed Schemes: Provide an international framework for the certification of seed. They aim to facilitate growth in seed trade by reducing technical barriers, improve transparency and lower transactions costs. The OECD schemes authorize the use of labels and certificates for seed produced and processed for international trade, according to agreed principles. www.oecd.org/tad/code/seeds.htm

Participatory plant breeding: A collaborative plant breeding programme between breeders and farmers, marketers, processors, consumers and policymakers (food security, health and nutrition, employment). In the developing world, participatory plant breeding involves close farmer-researcher collaboration to bring about genetic improvement within a species. It is important to develop a clear vision together with the stakeholders in the breeding process.

Participatory varietal selection: A methodology for breeders and agronomists to learn, in the early phases of the breeding cycle, which varieties perform well on-station and on-farm from the point of view of the farmers, who will be the end-users, as well as other value chain actors.

Phytosanitary regulations: The regulations established by the International Plant Protection Convention (IPPC) on phytosanitary regulations to control the risk of the importation and exportation of pests and disease on or in seed. The approach is science-based and uses the pest risk assessment (PRA) approach to avoid phytosanitary regulations being a barrier to trade.

Plant variety protection (PVP): Refers to national systems for intellectual property rights (IPR) for new plant varieties that provide IPR protection for a specified number of years to the plant breeder or institute that develops the variety.

Pre-basic (breeder) seed: Is produced from the nucleus seed by the agricultural research institute or other body often under the supervision of the plant breeder who developed the variety.

Quality assurance: The system by which the physical, physiological, genetic and phytosanitary quality attributes of seed are monitored during seed production to determine if the seed meets the quality standards of the country. The system includes field inspections, seed testing, post control plots and monitoring and traceability to ensure seed meets certain minimum standards. Standards vary for different quality assurance systems, which include compulsory certification, quality declared seed (QDS) or truthfully labelled seed where the seed label reflects the actual quality attributes of the seed.

Quality declared seed (QDS): A system designed to provide quality control during seed production, which is less demanding on government resources than other more developed quality control systems (e.g. certified

seeds), but is adequate for the production of good quality seed within a country. QDS is locally produced and commercialized quality seed of mostly locally adapted improved varieties, locally quality controlled by local seed inspectors licensed by a national seed quality control agency. The system is broadly based on four principles:

- i) A national list of eligible varieties for QDS is established.
- ii) Seed producers are required to be registered with the appropriate national authority.
- iii) The national authority will check at least 10 per cent of the seed crop.
- iv) The national authority will check at least 10 per cent of the seed offered for sale as quality declared seed.

Seed: For the purposes of this publication, seed refers to true botanical seed and not vegetative planting materials for which national seed systems are slightly different.

Seed companies: Refers mainly to both public and private, national and local, seed companies, including cooperative enterprises that produce and market seed to farmers. International seed companies are also involved in variety development, importation and production of seed.

Seed quality: In the formal seed system, this consists of four attributes – uniform and undamaged; high performance; genetic purity, which relates to specific genetic characteristics of variety; and seed health, which refers to the presence or absence of diseases and pests within the quantity of seed. In the informal seed sector, the definition of seed quality varies, but farmers often go by appearance – of being relatively clean, smelling fresh and being free of mold, showing minimum insect damage and not being shrivelled or discoloured. They trust their own seed – or the seed they obtain – to give reasonable germination. Farmers sometimes want heterogeneous landraces, for example, of sorghum in Ethiopia or millet in West Africa, or a mixture of varieties, such as varietal mixtures of bean in Burundi, rather than genetically pure types of varieties.

Seed replacement rate: The percentage of certified seed planted compared to the total amount of seed planted for specific crops. Typically, the replacement rate in developing countries is quite low at 10-20 per cent.

Seed security: Exists when men and women within the household have sufficient access to quantities of available good-quality seed and planting materials of preferred crop varieties at all times in both good and bad cropping seasons.

Self-pollinated species: Plant species in which the stamen (male organ) and stigma (female organ) of the flower are in close proximity in the same flower and the pollen release is timed with the receptiveness of the stigma, resulting in self-pollination. This results in varieties that are more homogenous and maintain their genetic purity and identity from one generation to the next. Examples include rice, wheat or legumes.

Truthfully labelled seed: Refers to seed produced for which the seed complies to the quality attributes indicated on the label and not an indicated minimum standard which is the case in compulsory and quality declared seed certification systems.

UPOV (International Union for the Protection of New Varieties of Plants): An intergovernmental organization which provides a system of plant variety protection, with the aim of encouraging the development of new varieties of plants. Most countries and intergovernmental organizations which have introduced a plant variety protection (PVP) system have chosen to base their system on the UPOV Convention in order to provide an effective, internationally recognized system. www.upov.int/members/en/

Variety: Synonymous with the term “cultivar” as defined in the International Code of Nomenclature for Cultivated Plants, 1980, Art. 10: “The international term cultivar denotes an assemblage of cultivated plants which is clearly distinguishable by a group of characters (morphological, physiological, cytological, chemical or others) and which, when reproduced (sexually or asexually), retains its distinguishing characteristics.”

Variety release: The procedures by which promising new varieties are tested and a decision is made on whether the variety should be included in the national variety register and released for use by farmers.

Variety release committee: A national committee of seed sector stakeholders which reviews the results of VCU tests of promising new varieties and decides if the variety should be included in the national variety register and be released for use by farmers.

VCU testing (value for cultivation and use): Variety testing is conducted to determine if a new variety has superior characteristics compared to existing varieties and should be included in the national variety register and be released for use by farmers.

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