SUMMARY

Production quality controls in farmer seed systems in Africa

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On 7 April 2015 the African Centre for Biosafety officially changed its name to the African Centre for Biodiversity (ACB). This name change was agreed by 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 remain 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 systems in Africa and our belief in people's right to healthy and culturally appropriate food, produced through ecologically sound and sustainable methods, and their right to define their own food and agricultural systems.

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Introduction

In sub-Saharan Africa, more than 65% of the population depends on agriculture for labour and livelihoods, producing around 80% of food consumed. These smallholder farmers source more than 90% of their seed from their own saving, relatives and neighbours, and local markets, and less than 10% from the formal seed sector. Smallholders need to maximise productivity through growing a diversity of crops for different growing seasons, using intercropping systems, and adapting their planting to climate change. This is only possible if they have easy access to locally adapted seed at the right time and in sufficient quantities suitable to particular cropping systems, soil, and climatic conditions.

However, farmer seed systems are under enormous pressure. Population growth and urbanisation are reshaping markets and diets. Climate change, drought, new and old pests and diseases, loss of soil fertility, and centralised markets for a narrow range of products are contributing to the movement of people off the land and to the loss of biodiversity. Interventions to introduce large-scale commercial farming or smallholder contract farming schemes, and new technologies threaten to further marginalise the majority of smallholders without the knowledge or resources to maintain production in these systems.

These pressures have negative knock-on effects for the ability of smallholder farmers to play their critical roles in maintaining, adapting and using agricultural biodiversity, as recognised in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and elsewhere. Loss of agricultural biodiversity can take the form of abandonment of seed populations under pressure to adopt formal sector seed. It can also take the form of genetic and quality degeneration as a result of marginalisation and an orientation of research and development (R&D) investments into a narrow range of commercially profitable crops and varieties.

This paper considers the means to maintain and enhance seed quality in smallholder farmer seed systems as a key element of maintenance and enhancement of agricultural biodiversity.

Quality seed is a significant contributor to smallholder productivity and is an easy and effective place to start when seeking to increase productivity. Quality refers to:

- Preferred traits of a seed variety or population, which vary depending on user and context;
- Ability to retain and transfer desired traits intact to the user in seed production

The report focuses on the latter – how seed quality is managed in production and distribution – and what assurances may be given to the buyer that the appropriate processes have been adequately followed.

Seed quality

The formal sector has a well-established system for maintaining seed quality in production and dissemination for commercial purposes. However, formal sector quality criteria mostly are developed at a distance from farmers, are very rigid, and are not always appropriate or feasible for diverse smallholder production contexts. Conversely, farmers have their own diverse range of practices for ensuring seed quality is retained and enhanced over time. But these quality controls in smallholder seed production systems are not uniformly or evenly practised, and are seldom adequately recognised or supported.

As seed and food sovereignty movements grow, and there is increased need to strengthen smallholder farmers' production capabilities, issues of farmers' independent seed development, production and distribution have arisen as practical considerations. This paper contributes to this movement by considering:

- **Quality controls (QC)** smallholder farmers are practising in their own systems
- **Challenges to effective quality control functions** in these systems – both internal (e.g. poor agronomic practices) and external (e.g. seed policies and laws, climate change)

- **Support options to strengthen these practices** without imposing a rigid formal structure designed for different purposes. (Table 1)

The intention is to report on and share findings and reflections with farmers, practitioners and activists, and amongst decision-makers in governments and institutions working on seed. The objective is to support an informed discussion about what kind of support systems may be required to recognise and strengthen farmers' diverse practices in maintaining, adapting and using agricultural biodiversity.

Seed systems and seed production

The **seed system continuum** ranges from formal, via quality declared seed (QDS) and intermediate systems, to farmer seed systems across three variables: source of planting materials, quality control and quality assurance.

Formal sector and QDS systems are based on registered seed, and defined external QC standards and quality assurance (QA) procedures. For QDS, there is some slight relaxation of QA procedures but it fits within the formal sector. **Intermediate** and **farmer seed systems** differ mainly in the source of planting materials: for intermediate systems registered varieties are used, whereas in farmer seed systems, heterogenous planting materials reproduced by farmers from year to year are the base. However, in both intermediate and farmer seed systems, QC is mostly farmer-based and QA is voluntary. The report considers QC and QA in intermediate and farmer seed systems.

Seed quality

Seed quality can be considered on the basis of four key elements: **genetic**, **physiological**, **analytical** and **sanitary**.

Genetic quality refers to maintaining the desired characteristics of the selected seed in the production process, e.g. short cycle, or drought tolerance. The seed variety or population must be identifiable by its essential characteristics, and it must maintain its purity (by not being mixed in the production process with other, unwanted traits). Genetic degeneration can occur in the field as well as after harvesting. In the field, this can happen through crossing with unwanted types, or with diseased or off-type plants, or through a build-up in negative mutations. Post-harvest degeneration can take place if the seed is not appropriately handled and stored, for example through mixing the seed or exposure to diseases.

Physiological quality refers to germination rates and the vigour of seedlings in a range of conditions on emergence. Moisture and temperature control in storage are critical QC elements for maintaining physiological quality. Low seed moisture content and low storage temperatures are preferable.

Analytical quality simply refers to a batch of seed having little or no weed seed, off seed (e.g. discoloured or damaged) or non-seed matter (e.g. stones or twigs).

Sanitary quality refers to the absence of seed-transmitted diseases such as fungi, bacteria or viruses.
(Figure 1)

Table 1: Seed system continuum

System	Variety	Quality control	Quality assurance
Formal	registered	defined external standards	defined procedures
Quality Declared Seed (QDS)	registered	defined external standards	defined procedures, with minor relaxation (e.g. fewer inspections)
Intermediate	registered	farmer-based	voluntary
Farmer	own	farmer-based	voluntary

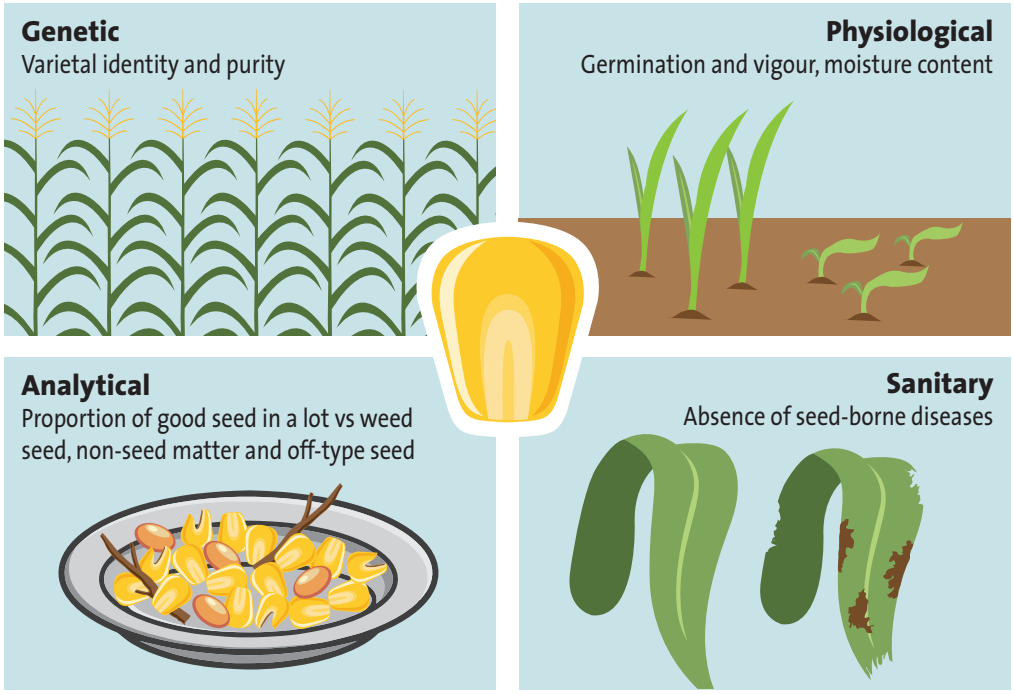

Figure 1: Four key elements of seed quality

Quality control and quality assurance in intermediate and farmer seed systems

Most seed used by smallholder farmers on the African continent is reproduced by farmers, outside any formal processes of control. There is abundant farmer knowledge on seed QC as an integrated part of crop production, as well as seed maintenance and adaptation, even if this knowledge is uneven and diverse. Evidence indicates that farmers often prefer their own seed over improved formal sector varieties, rating the quality of their seed as good.

Seed production in farmer and non-commercial intermediate systems is often integrated with crop production and is reproduced and adapted through continuous use. In most cases, seed is produced in the same field and at the same time as crops, with crop agronomic practices determining seed quality. Farmers may identify plants for seed early and treat these differently.

In farmer seed systems, **genetic quality** is controlled on the basis of good agronomic practices in the field. There are longstanding and widespread practices, such as selecting:

- The best and healthiest plants in the field for seed
- From the centre of the field and from different locations around the field
- From the centre of the cob for maize
- For seed density rather than size

Farmers use their experience and knowledge about seed, which includes being able to distinguish seed resistant to pests and diseases, for example.

On **physiological quality**, germination tests are unlikely to be widely practiced, since the seed is generally known and there are not always alternatives to using the seed. However, simple germination tests can be done at farm level. Farmers may dry their seed either in the field or post-harvest. Drying in the sun, or in a light shed with air circulation, works well and is widely practised. Racks can be used to improve ventilation and allow for quicker drying. Humid climates pose more of a problem for drying. Farmers use diverse techniques to ensure seed is stored in dry and cool conditions, such as mud structures and sealed containers, and use of ash and smoke to ward off pests.

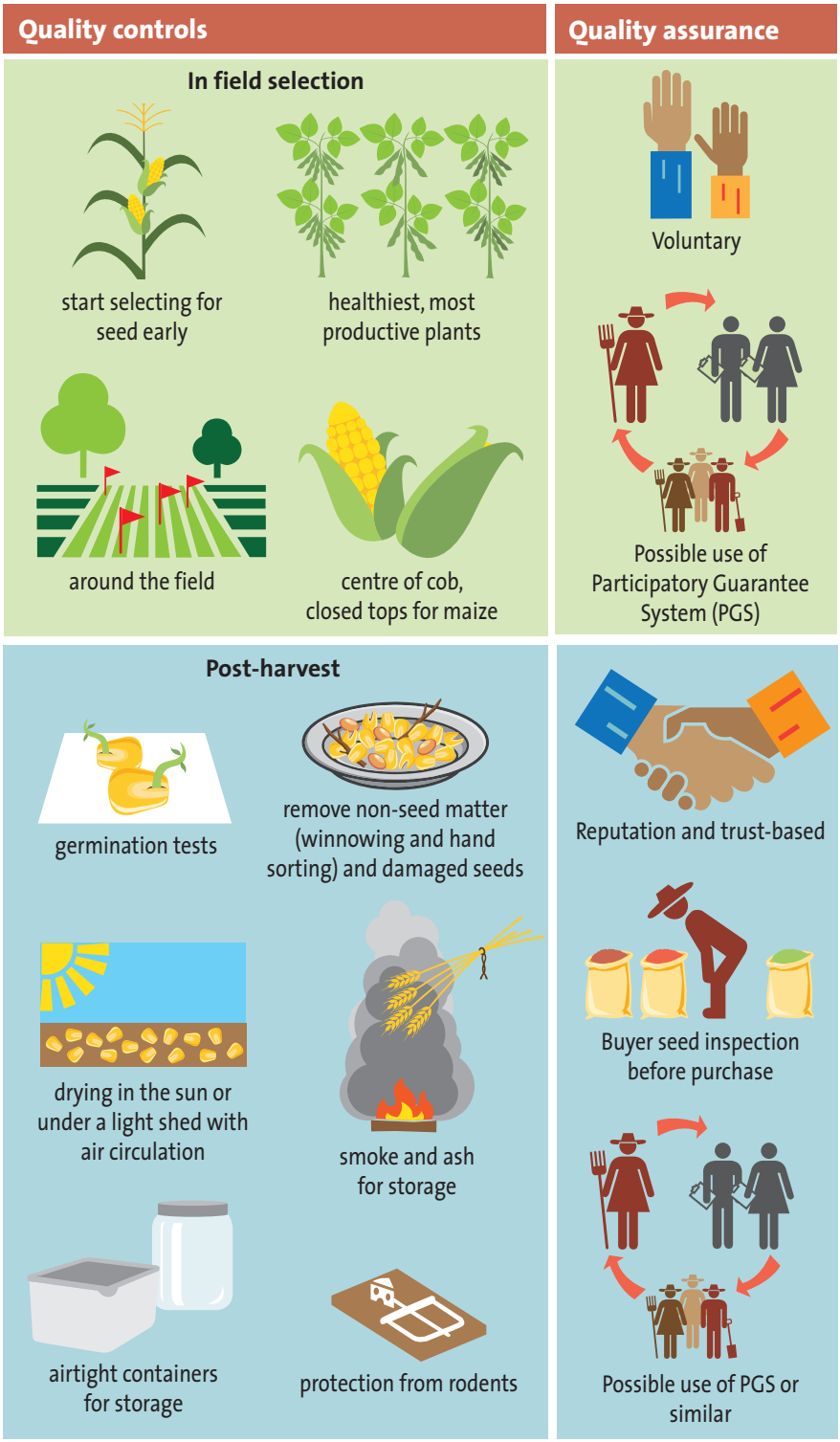

Figure 2: Farmer-based seed quality controls

For **analytical quality**, sorting through seed to remove off types, weed seed and non-seed materials is standard practice in many farming households. Sanitary quality may pose some challenges at the farm level since not all seed diseases can be seen with the naked eye. However, good selection and agronomic practices in the field can reduce disease problems.

Case studies of QC in farmer seed production

Generally smallholder farmers in Africa do not receive any form of technical or other assistance in enhancing the quality of their own seed unless they are part of a commercialisation project. Selected case studies from Brazil and East Africa show the different types of support that may be provided to smallholder farmers to produce quality seed from their own seed populations. The Brazilian case highlights a very impressive and successful model that responds to two key constraints facing farmers in producing their own seed for widespread dissemination: first, the lack of recognition of farmer seed, or restrictions on their sale if they are not registered; and second, the lack of organised markets for farmer seed, even if this seed may make a valuable contribution to food security beyond the locality in which they have emerged.

Based on sustained and long-term mobilisation and activities by civil society organisations (CSOs) and farmers, over time the Brazilian government recognised farmer seed, integrating it into provincial and national food security programmes through public procurement and distribution. The East African cases, in particular Ethiopia and Kenya, indicate a range of tried and tested and sometimes innovative approaches, including seed farmer schools based on farmer field school (FFS) methodologies, demonstration sites and comparative variety trials, training, and seed banks. Key institutional factors for successful interventions are multi-stakeholder partnerships incorporating farmers, NGOs, researchers, and extension; and public sector buy-in and participation.

Quality assurance in farmer seed systems

Quality assurance – the documentary verification processes that run alongside QC practices – is not needed where farmers are saving seed for their own use. Even where farmers exchange or sell seed locally, QA may not be essential since buyers will mostly know the seller and the exchange relationship will be based on trust and personal reputation. Buyers may be able to inspect the seed's performance in the field, if they live nearby.
QA becomes relevant in farmer systems where farmers want to sell commercial quantities of their own seed to buyers who do not know them personally. Third party certification is not always suitable for small operators and local market channels because of cost and complexity of norms. Group-based QA systems may be adopted where producers are working together, with internal quality checks based on an agreed protocol.

PGS is based on locally focused QA systems. Producers are certified through active stakeholder participation built on a foundation of trust, social networks and knowledge exchange. Farmers, buyers, consumers, and potentially others, such as extension workers, local agriculture departments, NGOs, academics/scientists, etc. all participate in shaping the vision, designing the system and structures, testing and implementing the system, peer review and decision-making.

Farmers form local associations and each appoints voluntary, unpaid QC officers and inspectors who check across groups to verify that appropriate quality controls have been performed. The main costs are training and

The **participatory guarantee system (PGS)** is a practical, farmer-based QA system that aims to provide a credible guarantee to buyers that appropriate quality controls have been performed. Although PGS has been used primarily in organic agriculture, the model can easily be adapted for farmer seed production, drawing on lessons learned from more than 20 years of experience in PGS in the organic sector. It is a decentralised process, where marginal smallholder farmers participate in certification processes for local markets. It offers an alternative to third party certification options, which are usually too expensive, controlled by agribusiness or inappropriate for local contexts.

Strengths of PGS include stronger producer–consumer relations; smallholder access to QA systems; local development based on local cultures, ownership and responsibility; low direct costs, and less bureaucracy. Evidence shows positive economic, social and ecological impacts of PGS, improved social bonds, farmer empowerment, lower production costs, better market access and regular sales, enhanced food security, and better management of natural resources.

farm inspections and the scheme is funded through revenue generated from group activities.

In developed PGS systems, local groups belong to regional and national networks to strengthen the system, reinforce trust, develop the PGS, carry out advocacy, and provide a platform for sharing experiences and tools.

PGS provides a good platform for sharing information, techniques and traditional knowledge amongst farmers. Field inspections and meetings are used not only to monitor but also to share information and knowledge. Important factors for success include access to markets, participation options, ownership, conflict resolution and gender roles.

Challenges include:
- Involving consumers, which is easier said than done
- Gaining public and government recognition for the QA system
- Getting financial and technical support from authorities
- Overcoming long distances and difficulties of access between members of groups and from farm to market
- Increasing the limited understanding of PGS, even amongst participants
- Improving poor documentation and record-keeping, which can be a result of illiteracy/low levels of education and lack of a culture of record keeping
- Dependence on voluntary work to make the system function

Key issues arising

It is evident that most crops and seeds are still being produced and circulated by farmers and remain critical for food security and agricultural biodiversity in many parts of the world. In many cases, farmers express a preference for their own seed, for reasons of yield stability, seed availability, preferred traits and adaptation to local conditions. Despite their ubiquity and value in smallholder production systems, farmer seeds are not recognised in the formal system, and may even be criminalised regarding sales.

Limitations imposed by commercial seed laws and formal sector rules, the skewing of R&D towards a narrow range of lucrative crops under the control of multinational corporations, and contract farming mean that farmers' activities around agricultural biodiversity conservation and use are uneven, and under serious pressure from climatic, demographic and production system changes. Likewise, farmer-based QC is also unevenly practised; not all farmers practise good selection, crop management, rogueing in the field, pest and disease control, soil fertility, harvesting and storage, and other methods that can ensure good quality seed. Sometimes this knowledge has been lost or farmers are not aware of the full range of possible practices that may be deployed.

There are many practical challenges to supporting farmer-based QC, including (among others):
- Costs and the general lack of resources; skills and knowledge shortfalls and costs of training
- Dependence on voluntarism; weak incentives for farmers to participate in seed production, because of limited financial returns and the high time and labour commitments required

Photo credit: Georgina Smith / CIAT

- Illiteracy and poor documentation, which makes systematic work more difficult
- The requirement for good facilitation skills
- Lack of farmer organisation and weak organisational structures.

Elements for success of interventions to support farmer-based QC:

- Almost all long-term successful activities are rooted in ***persistent and ongoing social mobilisation, coupled with practical farmer-based work***. Externally imposed projects will go nowhere if seed production and training is not demand driven and if there is no demand for the crops and seed varieties/populations.
- ***Participatory multi-stakeholder approaches*** should incorporate farmers, farmer associations, researchers/agronomists, NGOs, public sector extension, local government, consumer associations and others, with the use of existing skills base for training, research and extension.
- The Brazilian case was a nationally driven initiative, with farmers driving the demand and organising themselves. Brazil highlights the important roles of farmer organisation and mobilisation – including protest action – the state, changes in the seed laws, and partnerships between farmers and state/researchers without donor intermediaries.
- There are ***many tried and tested methods and practices***, including training (and the production of manuals and curricula); farmer field schools and farmer-based research groups, starting with identified seed custodians; demonstration plots and in-field comparative trials; seed fairs; seed banks, with local seed banks as a possible point of quality controlled multiplication of farmer seed and some possibly formal sector varieties (e.g. OPVs from the public sector that are shared with the seed bank); gene banks sharing germplasm with farmers for further development, multiplication and sharing; support for democratic organisation; decentralised farmer-to-farmer sharing and learning, facilitated by farmer associations, NGOs, and/or government extension; and active involvement of buyers and consumers in participatory QA systems.

Photo credit: Daniella Van Leggelo-Padilla / World Bank

Policy implications

Differentiated strategies are required for commercial and non-commercial production. Currently non-commercial production is neglected or even criminalised if farmers try to sell their own seed. This is unjust and ecologically dangerous. The aim should not be to impose QC unnecessarily. QC must benefit farmers as seed producers and users. For non-commercial production, any QC support should be tailored to respond to specific quality concerns arising from users, rather than imposing a blanket QC model on all farmers everywhere. QA does not appear to be essential for farmer seed for own use or non-commercial sale or exchange. It should be voluntary.

Existing ***seed laws*** should be ***restricted to the commercial sector***, based on a ***threshold*** to define commercial scale. There are various possible means of defining the threshold, but enterprise turnover (e.g. seed business or total enterprise) potentially offers the simplest and most inclusive means. Enterprise turnover could easily be linked to national definitions of small and medium enterprises.

Complete exemptions can be granted for farmer seed and/or categories of farmers ***below the threshold***. On categories, Brazil identifies smallholders, agrarian reform farmers, and indigenous communities and populations as eligible for automatic exemption. An important inclusion in some seed laws, such as in Brazil and India, is the farming community, because this opens the space for exemptions for local exchange between farmers.

Exemptions should go hand in hand with explicit ***recognition of farmer seed populations/varieties***, otherwise these seeds may not get any public sector support for their maintenance, enhancement and reproduction over time. Again, Brazilian and Indian seed laws offer good examples of explicit recognition of this sort to enable support to be channelled to farmer seed activities and varieties/populations.

Flexibilities/partial exemptions in commercial laws could be granted if complete exemptions are not. This could apply to non-

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commercial, and/or farmer seed, and/or for specific producer categories. Some examples of flexibilities or partial exemptions that do exist in some seed laws and policies are:

- Exemption from DUS, or replacement with distinct and identifiable (DI). There may still be specific markers defining a variety, to indicate the essential characteristics at various points in time. Farmers could potentially register populations and then adapted versions with similar characteristics in future years would remain on the register even as they change over time, as long as they can be identified;
- Exemption from VCU tests, on the basis that value has largely been proven by the years of cultivation in farmers' fields;
- Separate farmer seed lists with relaxed qualification criteria. Criteria for registration could be based on qualitative data from farmers, including major traits, the history of use in the farming community, and/or that the seeds were developed, adapted and produced by smallholder farmers;
- Exemptions or relaxed standards for premises and enterprise registration for seed production and selling to open space for farmers and their seed to enter into production, without fear of sanction;
- Subsidy or exemption from fees for categories of producers; and
- Possible relaxation of standards, such as for germination or percentage of off-types if these can be justified.

Expansion of non-commercial intermediate seed systems can be of great benefit in increasing smallholder access to quality seed and adapted seed varieties and populations. In essence, this means freely sharing formal public sector, PPB and open source varieties for unregulated further use. There are no quality issues, since the breeder and foundation seed has already passed through strenuous checks and the seed is safe for release for unregulated use in recommended agroecological areas. This can play a key role in overcoming the challenge of limited availability of quality source seed at the root of quality seed production.

Separate, distinct ***policies for farmer seed systems*** are needed, to recognise farmer seed, practices and categories of farmers, and to lay the basis for support and programming. There are strong links here to operationalising the ITPGRFA and farmers' rights, and a farmer

Photo credit: Andrew Wu, World Resources Institute

seed policy can connect closely with national plant genetic resources plans.
The content of such a policy could include:

- Forms of collective ownership of genetic resources that allow for continued free sharing and exchange of these resources at farmers' disposal;
- Participatory plant breeding and participatory variety selection;
- Recognition of diverse farmer-based QC practices and simple, cheap means of sharing (what farmers can do that does not involve a lot of training and external intervention);
- Documentation and sharing of key farmer-based QC practices and techniques; and
- Facilitating markets for farmer seed – in particular, public procurement of diverse crops for food and nutrition security programmes – and stimulating local markets through infrastructure support and promotion/advertising of diverse crops and farmer seed, e.g. nutrition information, processing methods, and recipes and preparation advice.

Although QC and QA should be voluntary for smallholder farmers for non-commercial production, producers can benefit from ***voluntary, clear, pragmatic crop-specific and decentralised QC management protocols*** offering norms, steps in crop management and administration through the growing season, and monitoring. Farmers working with researchers and extension can develop QC knowledge and techniques, with training and information shared in farmers' preferred formats.

Women traditionally manage seed in farmer systems and could play a central role in developing and sharing knowledge and techniques. Demonstration plots with lead farmers and experiential learning techniques, farmer field schools/farmer seed schools are key methods.

Key factors in quality seed production are:

- Quality genetic inputs;
- Good agronomic practices in the field;
- Selection practices; and
- Harvesting, handling and storage practices.

Exemptions, flexibilities and farmer seed policies and programmes will be developed and operationalised at national level. However, regional harmonisation of seed laws may pose obstacles to advancing recognition and support for farmer seed and farmer seed systems at national level. This requires ***adjustments to regional seed protocols and agreements*** to ensure the full recognition and support for farmer seed systems and appropriate QC measures.

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