



Integrated Seed Sector Development (ISSD) – How Informal and Formal Seed Systems Can Work Together for the Conservation and Use of Agricultural Biodiversity

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Abstract

Agricultural biodiversity conservation and its availability for use are central to robust seed systems that support food security, poverty eradication and resilience to climate change. Recognising that smallholder farmers source seed of different qualities from a diversity of seed systems has resulted in the Integrated Seed Sector Development (ISSD) approach that supports the development of a pluralistic seed sector, which provides smallholder farmers with quality seed of the varieties they desire. The focus of the ISSD approach on the importance of different seed sources to cater for the diversity in demand by farmers offers also opportunities for better and more balanced support for both *in situ* and *ex situ* conservation of plant genetic resources, and strengthened use of agricultural biodiversity on farmers' fields and in both community and commercial seed development programmes.

The Background and Principles of Integrated Seed Sector Development (ISSD)

Farmers' access to seed is through a diversity of channels. A proportion of seed of especially maize and vegetable hybrids reaches farmers through formal and regulated channels. Informal, usually non-regulated seed systems do however continue to play an important role for seed supply to farmers, in particular for smallholder and family farmers in low and middle income countries. Estimates of the proportion of seed originating from informal sources range from on average 80% in Africa (Louwaars and de Boef, 2012) to more than 95% in six countries around the world (McGuire and Sperling, 2016). Farming households are likely to use a diversity of seed sources at the same time.

The individual farmers themselves use different seed systems for different crops, such as (international) commercial seed for exotic vegetables; seed from

national commercial chains based on international or public research for maize; local semi-commercial sources for groundnut seed produced for the city market; and farm-saved seed for mainly home-consumed crops like sorghum, finger millet, and beans (Louwaars and de Boef, 2012).

Based on these insights the Integrated Seed Sector Development (ISSD) approach supports the development of a vibrant, pluralistic, and market-oriented seed sector. The ISSD approach strives to intervene in different seed systems simultaneously, and aims to bridge emerging gaps and create synergies between the formal (public and private) seed systems and the informal seed systems. ISSD is based on the following eight principles (ISSD, 2014):

1. Foster pluralism and build programmes on diversity of seed systems
2. Work according to the structure of the seed value chain
3. Promote entrepreneurship and market orientation
4. Recognise the relevance of informal seed systems
5. Facilitate interactions between informal and formal seed systems
6. Recognise complementary roles of the public and private sector
7. Support enabling and evolving policies for a dynamic sector
8. Promote evidence based seed sector innovation

Louwaars and de Boef (2012) have visualised how the formal and informal seed systems operate, the latter usually in a more narrow and local environment than the former (Fig. 1). The figure also highlights the role and importance of agrobiodiversity conservation and use, with the formal sector being more linked to *ex situ*

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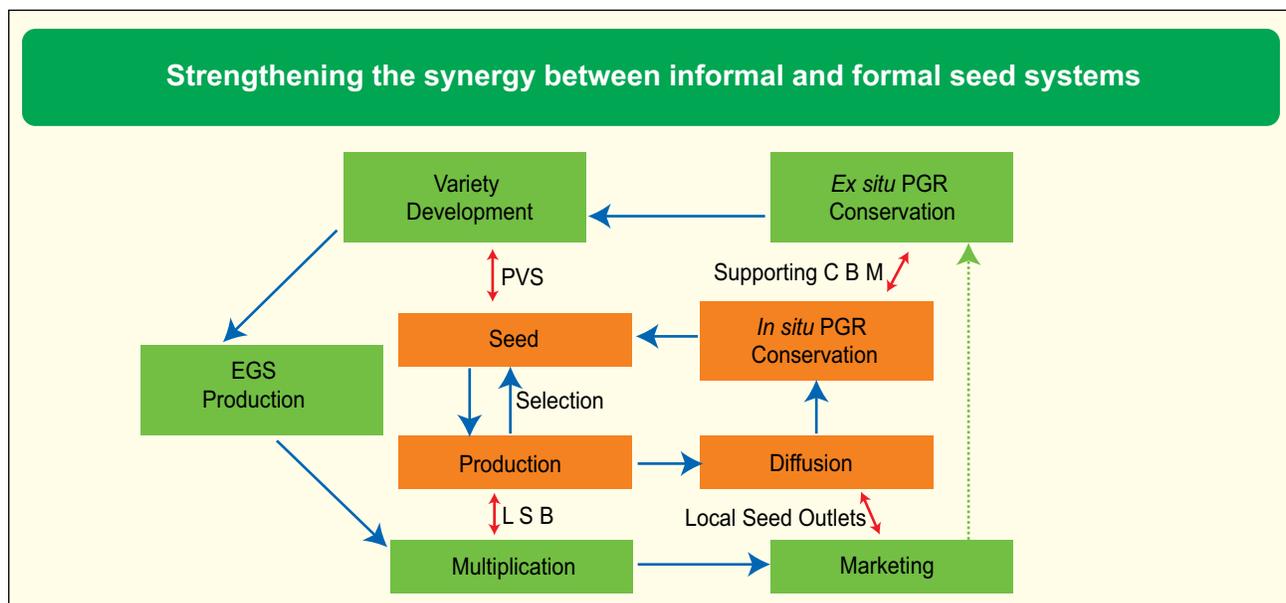


Fig. 1. Overview of ways to strengthen the synergy between formal and informal seed systems (red arrows), including agricultural biodiversity conservation and use. Orange – informal seed system; green – formal seed system. PGR – plant genetic resources; EGS – early generation seed; CBM – community biodiversity management; PVS – participatory variety selection; LSB – local seed businesses [adapted from Louwaars and de Boef (2012)]

and the informal sector to *in situ* conservation. Since in particular for *in situ* situations conservation and local use of agricultural biodiversity are strongly interwoven, the importance of Community Biodiversity Management (CBM) has been recognized (de Boef *et al.*, 2013). CBM contributes to the empowerment of farming communities to manage their biological resources and make informed decisions on the conservation and use of agricultural biodiversity.

The ISSD approach¹ has been embraced by the African Union Commission and several large programmes have been started. Both ISSD Ethiopia and ISSD Uganda started in 2012, and are entering their 2nd phase. ISSD Burundi started in 2014 for four years, and in Mozambique an education support programme introducing ISSD thinking was launched in 2015 for five years. The cross-cutting ISSD Africa programme was launched in 2014. It provides for a continental learning platform on Integrated Seed Sector Development and aims to provide African policy makers and seed sector decision makers with background studies to achieve not only country level but also continent-wide implementation and synergies.

¹ <http://www.issdseed.org/> (accessed on 19 September 2016)

Specific Effects of ISSD on Improved Agrobiodiversity Conservation and Use

Figure 1 indicates where ISSD in its quest to develop the seed sector by integration of pluralistic seed systems can contribute to interactions and synergy between Community Biodiversity Management and *ex situ* plant genetic resources conservation and use. Some examples are:

Improved Exchanges of Materials between CBM and Genebanks

Commonly the formal seed system is more linked with *ex situ* conservation of agricultural biodiversity in genebanks, and the informal seed system with *in situ* conservation as part of CBM, through the continued use of local varieties and community seed banks. By acknowledging the fact that genebanks need to make informed choices to limit themselves to high value and unique genotypes while *in situ* conservation is more adapted to genetically diverse populations, it is clear that creating room for both systems and coordination between them can optimize costly investments in conservation. It also can facilitate studies of change, for example between *ex situ* stored samples of local varieties and their *in situ* and in-use versions in the informal system,

informing both the conservation experts and breeders about the genetic stability and flexibility of agricultural biodiversity *in situ*. Bioversity International, one of the partners in ISSD Africa, uses the crowd sourcing approach to get feedback from smallholder farmers on genebank material distributed in tiny packets containing three to four accessions (Bioversity International, 2015; Kiambi, 2016). The Seeds for Needs initiative is showing that re-introducing selected varieties conserved in the national genebank of Ethiopia and Kenya to farming communities, can provide concrete options to increase productivity and satisfy multiple farmers' needs.

More dynamic exchange of material between seed user communities and *ex situ* conservation is becoming more and more relevant and important. As a result of climate change rain-fed agriculture is becoming less predictable, and failed harvests as a result of drought or flooding are becoming more frequent, with higher needs to call on genetic resources with potentially appropriate resilience. These could be old local varieties as well as germplasm from regions with climatic conditions resembling the changed environment of the farmer. Active exchange between *ex situ* conservation and local user communities can assure fast (re-)introduction of lost and new diversity. Studies undertaken as part of the ISSD Africa Theme 3 'Matching Global Commitments with National Realities' in Rwanda, Uganda, Zambia and Zimbabwe, showed that relevant germplasm is indeed available in genebanks, but the systems and the legal procedures [such as the Standard Material Transfer Agreement (SMTA) under the ITPGRFA] were found not to be ready (yet) to facilitate the introduction and use of these materials in CBM (Halewood *et al.*, 2016).

Seed Health Improvement in Community-based Seed Systems based on Improved Knowledge of Local Seed Businesses

Seed quality is not only dependent on genetics but also on phytosanitary health. The support by ISSD programmes for the development of local seed businesses will increase local knowledge about seed physiology, seed pests and diseases, and the effect of storage methods on seed health. Such knowledge when applied to community seedbanks may support more efficient storage of local varieties and other materials, not only of the more major crops that are likely to be part of the business of the local seed businesses, but also for the other less commercial local crops that are also part of the rotation

of smallholder farmers, and are mainly conserved *in situ* but not *ex situ*.

Improved Use of Agricultural Biodiversity in Breeding Programmes at Community, Public and Private Level

Figure 1 shows many points of entry for collaboration and/or synergy between the formal and informal sector, including participatory plant breeding. Increased mutual understanding of materials and selection approaches will on the one hand enable breeders to better target new varieties to the demands of smallholder farmers, while smallholder farmers will be able to start looking beyond their local diversity and explore the potential of a wider pool of more exotic and released varieties that may enable them to market more of their produce.

Developments and Trends in the Formal Sector

It is clear that agricultural biodiversity in farming systems, and hence a diverse portfolio of modern (hybrid) varieties as well as traditional local varieties, will depend on the use of the various crops by the farmer for food, fodder, market and/or crop-rotation practices, and that this diversity needs to be protected and further optimized within frameworks such as sustainable intensification. The importance of quality seed and improved varieties for meeting global food security and poverty reduction goals is widely acknowledged. Providing more of the world's smallholder farmers with quality seed is most frequently seen as a task of the formal sector, and increasingly so of the private sector actors in these. At the same time formal (*ex situ*) conservation of agricultural biodiversity continues to be considered a responsibility of the public sector.

It is noteworthy that more and more commercial seed companies recognise smallholder and family farms as an important client segment and use different strategies to enable access to their quality seed of improved varieties to such farmers (Access to Seeds Index 2016²). Very few commercial companies, however, were found to engage in the improvement of minor crops and/or in participatory plant breeding and variety selection activities. Regarding conservation global seed companies mainly collaborate with international genebanks and those in developed countries, while very few were found to have links with *ex situ* collections in low and middle

² www.accessstoseeds.org (accessed 19 September 2016)

income countries. Although seed companies active in and originating from Eastern African countries were found to collaborate mainly with *ex situ* collections in their countries of origin, there is a danger that with the growing importance of global seed companies in low and middle income countries there will be a shift to global level *ex situ* conservation, resulting in an even weaker link between *ex situ* conservation and CBM at the local farm level.

Conclusions

Importance of crops in smallholder agriculture are sometimes part of a largely informal and unregulated seed system (beans, finger millet), and in other crops (maize, vegetables) a more formal and regulated one. The ISSD approach aims to bridge gaps between breeders, seed producers and smallholder farmers in this formal-informal reality, and to mobilise the synergy between actors, including for better agricultural biodiversity management both from a conservation and use perspective. Agricultural biodiversity is a cornerstone for the development of the innovative sustainable agricultural systems the world needs, on smallholder farms as well as large estates. Therefore better interactions between the formal and informal seed sector in the area of agricultural biodiversity conservation and use deserve high priority.

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