

Chapter IV

Seed Systems in Cereals, Pulses, oil and Vegetable Crops

Integrated Seed Sector Development: Experiences in Africa

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Introduction

Agriculture is the main source of income for roughly two-third of all Africans of which some 80% are smallholder farmers having less than two hectares of land. Crop yields remain low as a result of very low use of agricultural technology including fertilizer, quality seed, improved varieties and mechanization (Paarlberg, 2008). Consequently, food security remains an important issue. Across Africa, the revival of agriculture as a leading strategic sector is recognized (Byerlee *et al.*, 2007; IAASTD, 2009) and underpinned by commitment at the highest political and policy levels within the framework of the Comprehensive African Agricultural Development Program (CAADP). African governments have committed themselves to invest at least 10% of their national budgets into agriculture, with the goal of achieving and sustaining growth at a minimum level of 6%, which is required to achieve agricultural led socioeconomic growth. However, agricultural development is dependent on smallholder farmers' access to inputs, amongst which quality seed is extremely critical since 'the genetic information contained in the seed sets the ultimate limit on the levels of crop productivity' (Zerbe, 2001).

Seed is one of the most important determinants of crop success or failure, alongside soil fertility and water. Consequently, well-functioning seed systems, understood as the entire complex web of organizations, individuals and institutions associated with the development, multiplication, processing, storage, distribution and marketing of seed, are important components of any efforts to increase agricultural production (Cromwell, 1991; AGRA, 2009). This paper explains the concepts of integrated seed sector development. It starts with introducing the informal and formal seed systems in the African context with their advantage and disadvantages. This is followed by introducing the concept of Integrated Seed Sector Development (ISSD) and put emphasis

on the importance of integrating the formal and informal system for better contribution to agricultural development in the African context. It shares the experiences of a project on seed systems analyses in six countries in Africa, as led by the Commission of the African Union and Wageningen University and Research Centre, the Netherlands, under the African Seed and Biotechnology Program. The paper specifically focuses on seed systems in Ethiopia, Zambia, and Mali.

The Informal Seed System

Partly because of the subsistence nature of agriculture in many African countries, most farmers in the continent still depend on their own farm saved seed, with seed production being an integrated component of crop production. In addition, farmers may exchange seed with neighbors and relatives, or may buy or sell seed at local markets. It is important to note that the seed selection, production, and diffusion are all within the farming community. The system of farmers saving their own seed together with local seed diffusion is called the informal seed system (Figure 1); it is also called the farmers' seed system, or the local seed system (Louwaars, 2007).

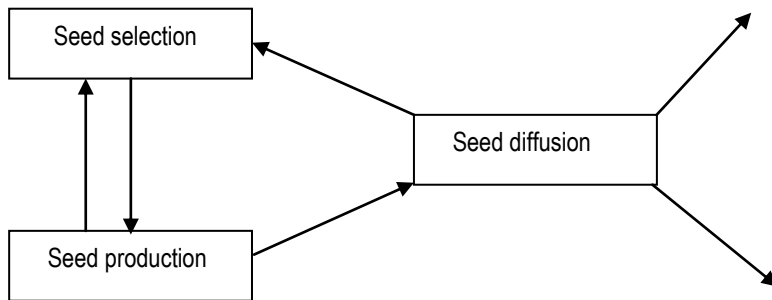


Figure 1. The informal seed system

Farm-saved seed gives subsistence farmers in Africa easy access to seed at the time they need it, and in the amount they want to use it. Since this is their own seed, they know the seed quality. Farmers' varieties are adapted to the local conditions as the seed has been grown for long in their particular environment. Moreover, farmers know why they prefer a particular variety compared with others, i.e. they have good reason of requiring seed of that particular crop variety. The role of the informal system in genetic resource conservation is significant, since farmers keep

different varieties not only because of yield, but because of many other traits important for them. Farmers' seed is also cheap, not only for the owner but also for others with whom they exchange or from whom they buy. In some cases, depending on the relationship and the amount of seed, the farmers may get the seed for free.

Purchase at the local market, exchange and gift are three ways in which farmers replenish the lost stock, which also keep the varieties in the local system (Tsegaye and Berg, 2007; McGuire, 2008). Through seed purchase and exchange also new varieties may enter the local system, which before have been introduced through the formal system. The function of rural markets in the informal seed system is increasingly studied in Africa, recognizing it as a potential area for public and private intervention (Lipper *et al.*, 2010; Sperling and McGuire, 2010). The informal seed system is efficient in distributing seed as there are fewer barriers in relation to accessibility, affordability, and quantity needed (Tsegaye and Berg, 2007).

On the other hand, several studies are also showing the limitations of informal seed systems in ensuring seed security through social networks (McGuire, 2008) and functioning of the markets (Lipper *et al.*, 2010; Sperling and McGuire, 2010), for example, because of lack of capacities in seed processing and storage (Latourniere-Moreno *et al.*, 2006). The assumption that farmers' seed is readily available to farmers may not hold true in the case of natural calamities destroying the whole crop in a given area. With a total reliance on farmers saved seed, under such conditions, farmers will have nothing to plant.

Another issue is the quality of farmers' seed, which may not be good, particularly in terms of biological quality, including germination and vigor, seed borne diseases and degeneration. The informal seed system has little capacity to control such quality; poor seed quality may affect food security. However, it should be noted that in the informal system, there are also farmers that have good knowledge of seed production, who produce seed of high quality.

Because of its efficiency and the diversity of crops grown in Africa, the informal system, and especially farm saved seed, covers the lion share of seed used by small-scale farmers. Because of the strength of seed networks, the informal seed system provides many opportunities for increasing seed security, through for example local seed business

development, i.e. engaging farmers in quality seed production and marketing, based on the local demand for quality seed of particular crops and varieties that are not addressed by the formal system; and participatory varietal selection, i.e. involving farmers in the selection of varieties fitting their specific localities (Abay *et al.*, 2011).

The Formal Seed System

The formal seed system considers seed production as a chain of specialized tasks, often implemented by separate organizations in either the public or the private sector (Figure 2) (Louwaars, 2007). Conservation is the first component in the chain, which makes available the genetic resources used for scientific breeding, the next step in the chain. After official release, high quality seed of the improved varieties is produced and marketed or distributed.

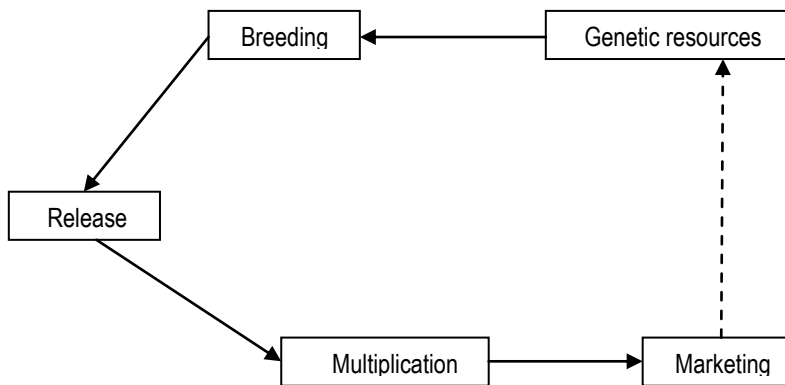


Figure 2. The formal seed system

In the private sector, companies generally focus on the development of varieties and seed multiplication and marketing of those crops of which they can easily make a profitable business. These are crops that farmers cannot easily reproduce themselves, like hybrid varieties, exotic horticultural crops, or seeds of those crops that suffer from seed-borne diseases, or seed degeneration. The public sector may support the formal seed system in variety development, seed quality control, promoting quality seed and improved varieties, and, in specific cases production and distribution of quality seed of crops that are required from a food security perspective.

In the formal system seed has to be produced according to standard production methodologies, with prescribed quality control procedures. This enables the production of uniform products, according to specific quality standards, that can be certified for the market. The formal system generally develops and releases varieties for wide adaptation, but may also develop different varieties for different agro-ecologies to optimize yield in a given environment. High quality seed, with uniform germination, of the improved varieties will significantly increase crop productivity, and as such contribute to food security.

Despite advantages, there are also different risks associated with farmers depending completely for their seed on the formal system. One of the major problems is its exclusivity, because of the nature of the crops addressed; the private sector will only focus on those crops for which they can make profit (like hybrid maize, exotic vegetables); the formal sector will focus on a few key crops important for food security (like maize and wheat). For instance, local root crops are commonly excluded from the formal seed sector.

Seed produced by the private sector may be expensive, as it includes, amongst others, the costs of development of the varieties, and the profit of the company. Small-scale farmers may not be able to afford this seed. Farmers shifting from growing their own local varieties and farm saved seed to purchasing seed of hybrid varieties, leads on the one hand to an improvement in crop productivity. But on the other hand, it also leads to erosion and loss of farmers' indigenous knowledge on seed selection, production, and storage. It creates farmers dependency on external seed sources, and the loss of the capacity to take control over their own development. Since the formal system is composed of a chain of activities, the system is as strong as its weakest link; i.e. if one of the components does not function well, the whole chain will break, and farmers will not have access to the seed they need.

The Integrated Seed System

One of the principles of the concept of integrated seed sector development (ISSD) is that it recognizes the existence and importance of the informal seed system, with farmer saved seed still the dominant source of seed to smallholder farmers in Sub-Saharan Africa, mainly because of the nature of their traditional crops and local varieties, in which the formal system is not interested.

Another principle of ISSD is that besides the informal seed system, it promotes the development of the formal seed system, and the integration of both systems at different stages of the seed value chain, i.e. conservation, breeding, seed multiplication and marketing (Figure 3) (Louwaars, 2007). Thus fundamental principles of the integrated seed sector development (ISSD) concept is the need to develop a twin track approach, where the effectiveness of both the informal seed systems and the formal seed system can be improved, and through a concerted effort ensuring that proper integration is promoted at every component of the seed value chain (Louwaars and de Boef, 2011).

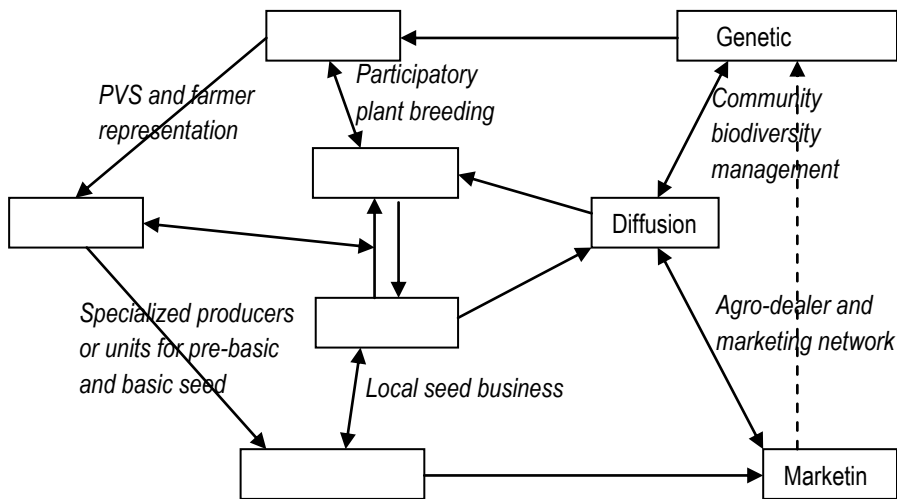


Figure 3. Integration between formal and informal seed systems

The formal and informal system may be integrated through, for example, supporting Community Biodiversity Management (linking conservation and diffusion); involving farmers in participatory plant breeding experiments (linking breeding and selection), farmer representation in official variety release trials (linking release and selection), establishing farmer producer units for early generation seed (linking release and production), supporting local seed business development (linking multiplication and production) and promoting the establishment of agro-dealers at local level (linking marketing and diffusion). The integration of the formal and informal systems will benefit both and thus the whole seed system to adequately respond to the seed demand.

In addition, ISSD recognizes the importance of both the public seed sector, which generally approaches the seed value chain from a development perspective, and the private sector, where markets and profits are driving the chain. In the latter, business may take place at different levels, and the sector may support large scale seed companies (focusing on few commercial crops and varieties), nationally operating seed companies (often producing quality seed of varieties bred by the public sector), local seed businesses (operating in a niche of quality seed of locally demanded crops and varieties), as well as agro-industries (requiring seed of specific crops, varieties and quality, operating with a closed value chain).

The ISSD concept promotes that the different seed systems within a country should be supported with a policy framework and specific actions, building on their strengths, and the type of crops and varieties, and seed they address. The following sub-chapters describe and compare Ethiopia, Zambia and Mali, with each a different agricultural development and historical background, leading to a very different the seed sector with different seed systems.

Seed Sectors in Selected African Countries

Like for many other countries in Africa, also in Ethiopia, Zambia and Mali, farm saved seed takes the lion share of all seed produced (Figure 4, 5 and 6). It is important not only in the amount produced, but also the type of crops and varieties addressed, of which many are not available through other sources, whereas in Zambia and Mali, farmer-saved seed mainly concerns local varieties; in Ethiopia it is also a source of released varieties, which after introduction by the formal system are saved by farmers and exchanged with and sold to other farmers (Figure 4). The farmer saved seed system is common in all three countries included in the study.

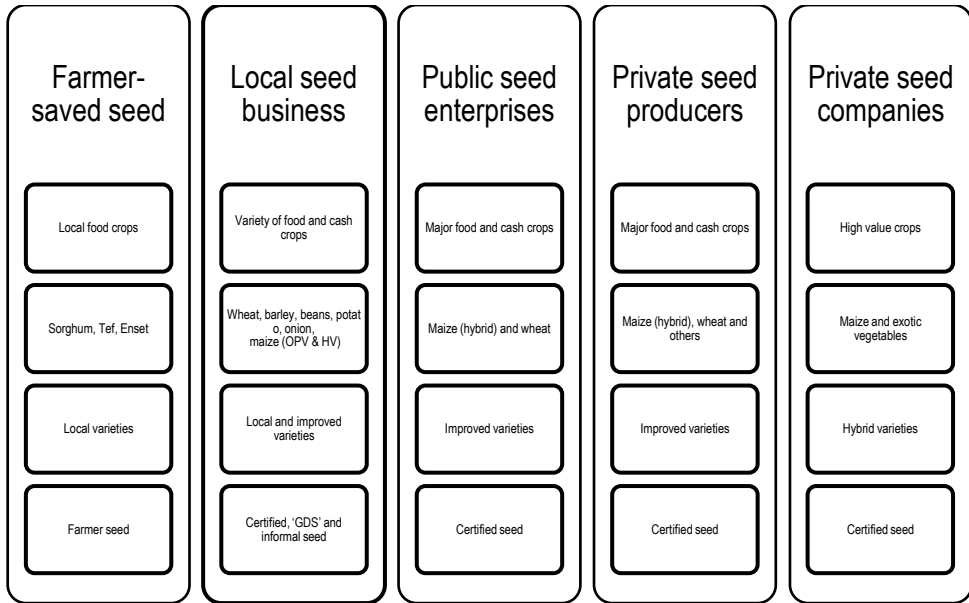


Figure 4. Seed systems in Ethiopia

In addition to the farmer-saved, community-based seed production and marketing is becoming a common strategy which fills the gap that is created between the informal system, where seed is an indirect output of crop production, and the formal system, whose major focus is on the business of seed. The community-based seed system may operate more or less autonomously, through traditional groups of farmers engaged in the production and marketing of informal seed (not certified, or quality declared) of local and/or improved varieties. Or, like in most countries, including Zambia and Mali, it may be mainly based on NGO-supported programs (Figure 5 and 6). Ethiopia has a different scenario in which both government and different development partners support the production of seed with organized farmer groups to fill the gap in national seed supply, such as realized in the local seed business project (Figure 4). Community-based (informal) market oriented seed production is increasingly recognized as an important system for reaching seed security, and increasing the number of farmers who buy commercial seed of their food crops. As such, the farmer groups engaged in this system should be supported in their commercial seed production efforts (MacRobert, 2009; Thijssen *et al.*, 2008; Neate and Guei, 2011).

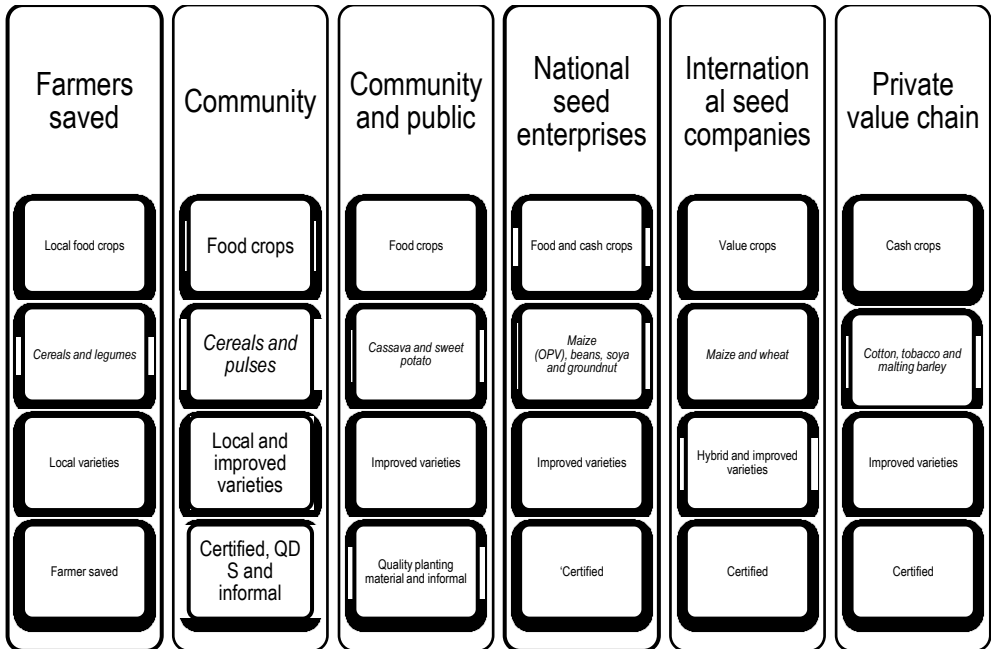


Figure 5. Seed systems in Zambia

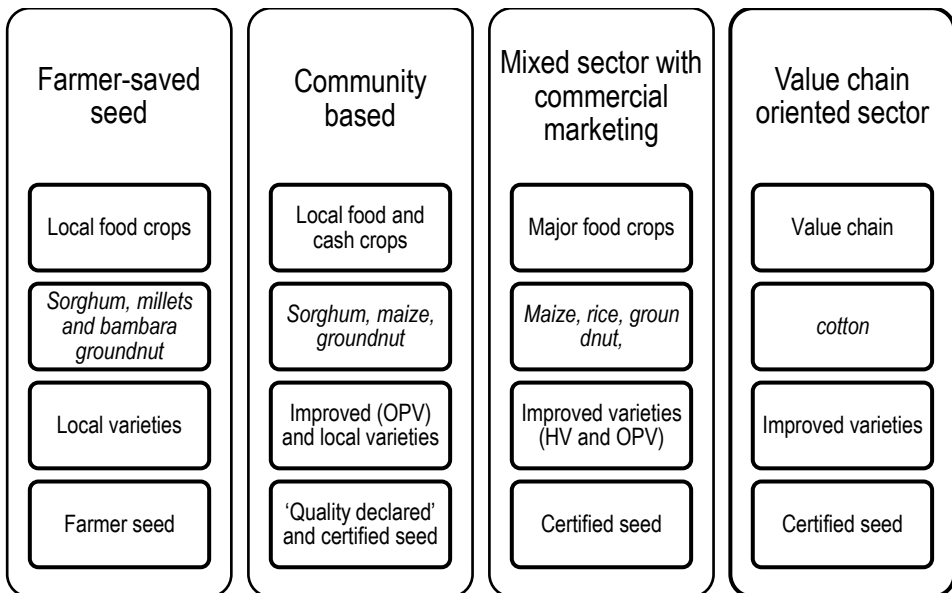


Figure 6. Seed systems in Mali

Because of historical reasons, within the formal sector in Ethiopia, the public system is very dominant. Until recently, the Ethiopian Seed Enterprise, a public seed enterprise, was the only formal seed producer and distributor; now three more public seed enterprises have been established and are operational (Figure 4). The public seed enterprises produce and market mainly hybrid maize and wheat seed, of a few varieties. From preliminary data of MoA, these two crops account for more than 87% of the seed supply of the public seed enterprises in 2011.

The private sector is just coming up, mainly in the production of hybrid maize and marketing of vegetable seed (Figure 4). For hybrid maize they supply hardly more than one-third of the total hybrid maize seed supplied in the country. And in reality, except for Pioneer Hi-bred, which is the only multinational company active in Ethiopia, all other national private companies are contract growers of the public seed enterprises, since they do not have own varieties; in Figure 4 we call this the system of private seed producers. Recently, some of them are licensed to produce seed of the public varieties.

In countries like Zambia (Figure 5) the private commercial seed system is strong, with a regulatory system supporting their emergence. Commonly, independent regulatory bodies like the Seed Certification and Control Institute (SCCI) in Zambia guarantee on the one hand the quality of the seed, and on the other hand the ownership of the seed produced. Royalty is paid to both public and private institutes that release varieties. In Zambia, for some industrial crops like cotton, tobacco and malting barley, seed is linked to downstream processing companies, with the company taking responsibility for effective seed production of the varieties and quality they require for their business, in that way operating as a closed value chain (Figure 5). However, it should be realized that in Zambia, the private sector is indirectly supported by government programs, which purchase at large scale certified seed of hybrid maize and other improved crop varieties, for dissemination to small scale farmers. On the short term this promotes seed industry development, but on the long term this strategy has many implications on the viability of the sector as a whole, undermining the other seed systems operating alongside the private sector.

At the same time, this strategy promotes the production of only a limited number of crops and varieties, and results in a favorable market for especially big international companies, and not necessary national seed

companies (Figure 5). It should be realized that the favorable climatic and agricultural conditions, linked to a highly enabling policy, regulatory and economic (tax) environment, has resulted in Zambia becoming Southern Africa's major commercial seed producer. More than 60% of the seed produced is exported to neighboring countries (Nakaponda, 2011).

The situation in Mali is very different, as seed companies are not yet operational. However, with the liberalization of the economy, the formal system of seed and variety dissemination is fully in the hands of the private sector, including companies and NGOs. However, in the generation of varieties, the public sector plays a key role. Seed is produced primarily by community-based seed producer cooperatives that are supported by public seed and extension services (Figure 6). However, final marketing of seed is fully in the hands of a commercial sector of traders. Government programs supporting the purchase and dissemination of quality seed and improved varieties target 'new' and high potential crops such as maize and rice. For all other crops vital for food security (sorghum, millets), and income generation (groundnut, various legumes and oil crops), this mixed sector is the predominant one.

Cooperatives are playing an important role in Ethiopia not only by producing and supplying seed themselves (local seed business; Figure 4), but also in producing seed on contract for the public seed enterprises. Public support to cooperative seed production is strong as cooperatives are expected to fill the gap of seed supply in the country. The government also supports the cooperatives in guaranteeing loans for buying inputs and distribution. Except for vegetable seed, seed in Ethiopia is hardly marketed; with support of the regional government it is distributed through the cooperatives. Seed marketing is the main issues in the Ethiopian seed system that needs due consideration. On the one hand farmers are clearly demanding seed, and on the other hand, large amounts of seed are remaining in store; this shows the inefficiency of the current seed need assessment and distribution system, and the need for a market orientation of the seed sector.

Conclusions

In Africa, with its huge diversity in agriculture and state of agricultural development, represented by differences in agro-ecological and socioeconomic and cultural conditions, and the huge variation in crops and varieties produced, one blueprint strategy for seed sector development does not suit the reality. The ISSD concept recognizes the coexistence of the different seed systems in each country, next to each other, and promotes the support of each system, building on its particular advantages and disadvantages. Simply supporting the development of the commercial sector—as part of the formal system—ignores the importance of the other systems, in addressing different crops and varieties, and supplying smallholder farmers with quality seed, and as such may put food security at risk. But also, focusing on only strengthening the informal sector, does not answer the issue of increase in agricultural production and food security. Thus the coexistence of the different seed systems should be embraced, not only because they mutually benefit from each other, but also since farmers and their communities cannot depend on one system only.

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