

14 Development of an Integrated Rice Seed Sector in Sub-Saharan Africa: Meeting the Needs of Farmers

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Introduction

Seeds are the backbone of agricultural production. Despite this importance, however, rice farmers in Africa lack assured access to sufficient, good-quality seed of preferred varieties in time for sowing. In the 1970s and 1980s, public-sector seed programmes in sub-Saharan Africa generally promoted the dissemination of improved rice varieties. With the structural reforms of the 1990s, the seed sector was liberalized, though the private sector has only partly replaced the public sector in providing seed to farmers. With the growing awareness that promoting rice production in Africa is crucial for economic growth, food security and social stability (e.g. Diagne *et al.*, Chapter 3, this volume), 'seed' is firmly back on the agenda of many governments and technical and financial rice development partners. This became particularly evident after the 2008 food crisis, which was manifested as a 'rice crisis' in many African countries (Viatte *et al.*, 2009).

Farmers acquire rice seed through 'formal' and 'informal' channels. The formal system includes both the public, or government, and the private, or commercial, seed sectors (Louwaars, 1994; Bay, 1998; Louwaars and De Boef, 2012).

The 'informal' or 'farmer seed' system includes farmers managing their own seed, but also informal seed trade among farmers and purchase from the paddy grain market.

Establishing commercially viable seed systems for rice is particularly challenging in sub-Saharan Africa, because of the predominance of farm-saved seed for rice crops, the easy production of rice seed as it is self-pollinating, the complexity of African rice cropping systems and the great diversity of rice varieties.

In most of West and Central Africa, formal rice seed systems have been more development- than market-oriented. Such seed initiatives have the development goal of assisting farmers in accessing seed of new varieties, rather than a commercial goal of creating profitable seed enterprises. They are often characterized by heavy and inefficient bureaucratic structures within classic seed regulatory frameworks. These constraints are exacerbated by slow processes of variety development and evaluation (addressed in Kumashiro *et al.*, Chapter 5, this volume), and slow variety release and registration (addressed in Sanni *et al.*, Chapter 6, this volume).

In East and Southern Africa, examples exist of well-functioning commercially viable seed

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companies producing quality rice seed. Such seed companies often already produce hybrid maize seed and other cash crops and have added rice to their market portfolio, responding to a rapidly growing commercial rice sector in the region.

As part of structural adjustment reforms, formal seed systems have gone through several changes across sub-Saharan Africa. Public-sector seed services were reduced or eliminated and the private sector encouraged to assume a greater role, particularly in production and marketing of certified seed. This drive to 'privatize' the seed system has not succeeded and has rather left a void that has been partly filled by NGOs, development projects and farmers' associations, which have been providing smallholder farmers with free or subsidized seed. In the aftermath of the 2008 food crisis, there are renewed efforts to establish well-functioning seed systems. Though often not explicitly stated, this shift from a public to a private seed sector is also a shift from a 'development driver' to get new varieties to farmers to a 'commercial driver' to create profitable and sustainable seed enterprises (Louwaars, 2007).

This chapter discusses formal and informal seed systems and those with attributes of both, and describes the concept of integrated seed-sector development for rice based on Louwaars and De Boef (2012). This framework is discussed in the context of rice-sector development in Africa, highlighting roles and responsibilities of different actors and stakeholders.

African Seed Systems

African rice seed systems are characterized by the coexistence of a formal sector where seed is produced and commercialized by government agencies and private seed companies, and an informal sector where seed is produced by and exchanged among farmers.

Formal seed system

The formal seed system (also called the conventional seed system) is designed to provide certified seed. It relies on a well-organized seed system in which the original breeder-supplied seed is multiplied through a series of stages (from

breeder seed to foundation seed to certified seed) to obtain sufficient commercial seed. The use of release and seed certification procedures and the intervention of the processing industry¹ are the backbones of this system.

The functioning of the seed system is influenced by a large number of regulations in research (research protocols and variety maintenance), variety release procedures (DUS and VCU² evaluation procedures), seed production rules (production norms – isolation, presence of off-types, weeds, plant health protection, harvesting, etc.), trade (traceability), economics (marketability and profitability) and regulatory organs (seed boards, national release committees, national seed services).

Quality control aims to protect the interests of farmer customers. It is monitored by periodically inspecting seed fields and the seed dealer points (markets and other sales points), and has a constant vigil on the seed marketed by collecting seed samples to be analysed. Seed certification is a legally sanctioned system for the quality control of seed for sale. It is carried out by national seed services (NSS) through field inspections and laboratory analyses. Norms are adapted from international rules set by the International Seed Testing Association (ISTA). The NSS control the functioning of the whole system (delivery of agreements to seed growers and private seed companies, supervision of seed production and conditioning, certification, monitoring of commercialization, update of catalogues of varieties, etc.).

The system is typically managed by the ministries of agriculture. It faces many constraints, including: (i) limited supply of breeder seed; (ii) poor seed quality control; (iii) poor demand estimation; (iv) inadequate marketing and distribution systems; and (v) reluctance of small-scale rice farmers to pay premium prices for certified seed. This has led to a serious 'rice seed production gap' in many countries, especially in West and Central Africa.

Informal seed systems

Informal seed systems are traditional systems operating at the local and village level through farmer seed production and seed exchange mechanisms based on local considerations without

public-sector regulation or support. Within the household it is often women who manage the rice seed. Harvesting by hand, with panicle-selection, facilitates positive selection and seed can then be stored as panicle bunches, which prevents accidental physical mixture of varieties. Often, farmers manage seed of multiple varieties of different durations and stature suitable to different landscape positions and hydrological levels.

Individual farmers, and sometimes farmers' groups, obtain seed from their own harvest, their family, friends and relatives, or purchase seed on the local village market or from local paddy traders. These are individual transactions where the farmer usually knows the seed seller and is able to verify the origin of the seed being considered for purchase. Confidence in the seller is a proxy for seed certification and can perhaps be referred to as 'social certification'. The rate of adoption of improved varieties is generally low and ultimately dependent on access to seed of these varieties from the formal seed system. However, farmer seed systems offer a range of traditional and improved varieties that are accessible, of acceptable quality, and affordable and obtainable without cash transactions.

Informal seed systems do not respond to public norms and consequently do not receive the needed attention from policy makers, scientists and the general public. It is important to develop policies that recognize and support informal seed systems, their contribution to *in-situ* conservation and on-farm management of agro-biodiversity, the efficient diffusion of varieties, and the appropriate protection of farmers' and communities' rights.

Where are African farmers getting their rice seed?

Surveys conducted in 2009 by the Africa Rice Center (AfricaRice) and national (NARS) partners in 16 countries in sub-Saharan Africa, involving more than 30,000 farming households, provide a good source of information on seed access by rice farmers (Bonou *et al.*, 2012). About 90% of the farmers using traditional varieties, and 75% of those using improved varieties use 'informal' seed systems (Fig. 14.1).

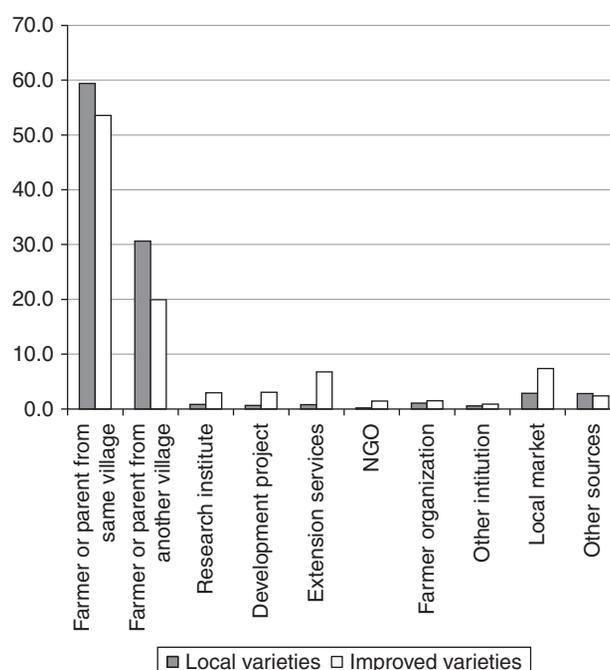


Fig. 14.1. Sources of access to seed by rice farmers in Africa. (Adapted from Bonou *et al.*, 2012.)

These farmers obtained seed from their previous harvest or they bought, exchanged or received seed from other farmers within their own village or from neighbouring villages. Other possible seed sources included development projects, NGOs and government extension agencies. Less than 10% of the farmers indicated that they had obtained seed of improved rice varieties from a local market. Percentages were even lower for traditional varieties (Fig. 14.1). These figures show the informal sector to be the dominant source of seed for African rice farmers.

Bonou *et al.* (2012) also analysed farmer involvement in different types of seed transactions, i.e. the extent to which farmers use their own saved seed (farmer-saved seed) and are engaged in different market and non-market seed transaction activities (Fig. 14.2). Use of farmer-saved seed was reported by more than 52% of farmers cultivating traditional varieties and 44% of farmers cultivating improved varieties; purchasing of seed was reported by more than 23% of farmers cultivating traditional varieties and more than 26% of farmers cultivating improved varieties; selling seed was reported by more than 24% of farmers cultivating traditional varieties and more than 23% of farmers cultivating improved varieties; giving seed free to other farmers was reported by about 35% of farmers cultivating traditional varieties and more than 34% of farmers cultivating improved varieties; receipt of free seed was reported by more than 20% of farmers cultivating traditional varieties and 25% of farmers cultivating improved varieties; and exchange of seed was reported by 20% of farmers cultivating traditional varieties and more than 19% of farmers cultivating improved varieties. Thus, consistent with the figures on the sources of seed, the majority of farmer seed transactions are informal – for both traditional and improved varieties. Nevertheless, the fact that about 24% of the farmers indicated that they had bought at least part of their seed needs indicates there is a market for seed. A deeper analysis of data on purchased seed sources shows that, apart from the local market, farmers purchase seeds from other commercial routes. More than 70% of purchased seed is from their colleagues within their own village or from neighboring villages.

Towards Integrated Rice Seed Sector Development

Louwaars and De Boef (2012) highlight the importance of facilitating interactions between the formal and informal seed systems to encourage development of the seed sector; and accepting the pluralistic nature of seed-sector development with roles for the public and commercial sector, as well as for farmers, community seed producers and NGOs. Rice seed sector development in Africa needs to address issues of availability, accessibility, seed quality, varietal quality and purity, and resilience to effectively contribute to increasing productivity and sustainability of rice seed systems in Africa (Table 14.1).

Figure 14.3 is a proposed framework for rice seed sector development in sub-Saharan Africa. The informal seed system is central, with the rice farmer as both a 'customer and manager' of seed (depicted in the central hexagon). Farmers use their own saved seed to produce paddy, or seed obtained from neighbours or other sources without either support or interference from the public or private sectors. However, farmers may be able to access seed of a new or local variety from 'outside' the farming community, either through a commercially oriented seed value chain (left side of figure) or a development-oriented seed value chain (right side of figure).

In the absence of a reliable seed market, farmers are likely to rely on their own saved seed and informal seed systems. Farmers may profit from development-oriented interventions that stimulate community-based seed production and the production of 'acceptable quality' seed through seed fairs and donations of seed in emergency situations or purchase of seed through an exchange of vouchers. Development-oriented interventions can also reinforce farmers' capacities with respect to selecting and storing good-quality seed from their own production.

On the other hand, in cases where, for example, input subsidies for mineral fertilizer are linked with purchase of certified seed, many farmers may rely on specialized seed production systems, purchasing certified seed from seed enterprises, seed unions and agro-input dealers. Such commercially oriented seed value chains are more likely to emerge around irrigated systems, whereas rainfed upland and lowland

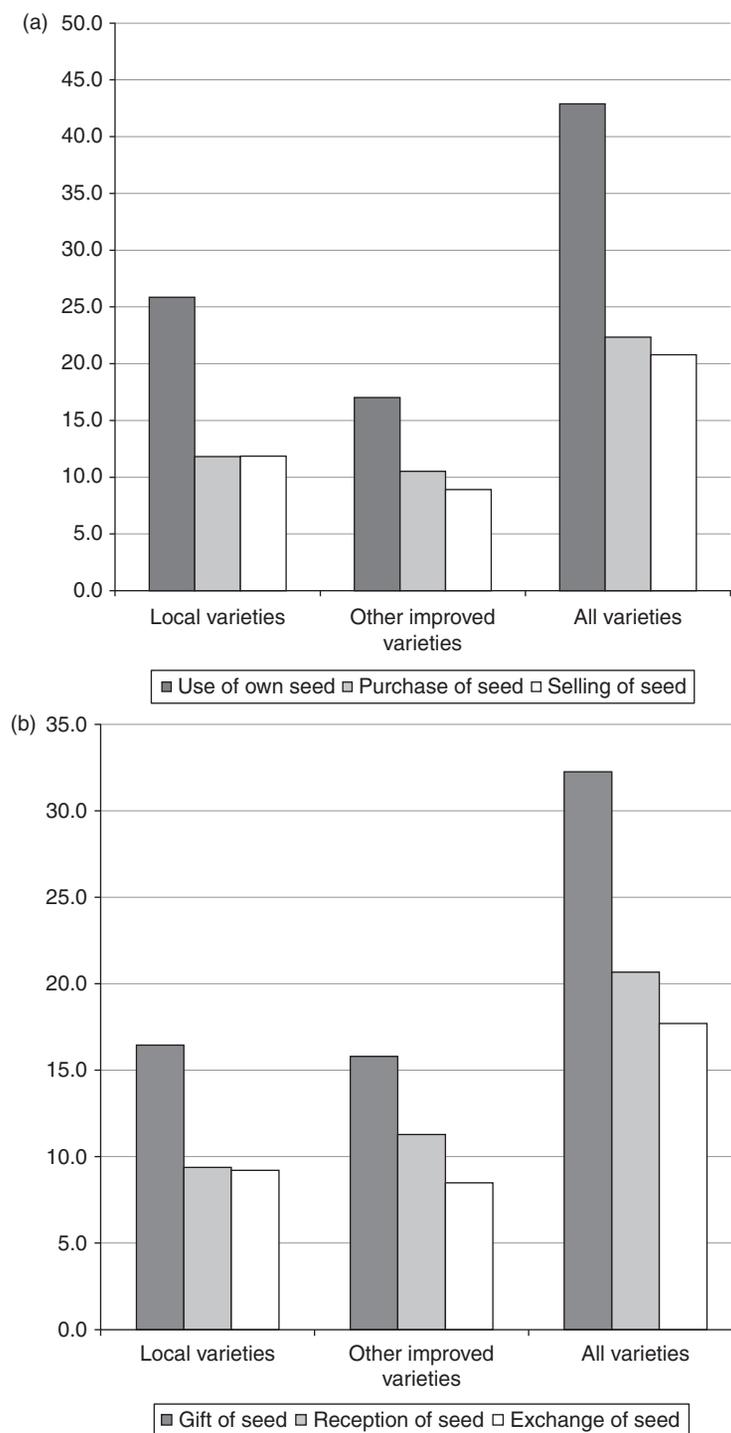


Fig. 14.2. Levels of farmer involvement in market and non-market seed transactions. (Adapted from Bonou *et al.*, 2012.)

Table 14.1. Key issues for rice seed sector development in Africa. (Adapted from Remington *et al.*, 2002.)

Issue	Description
Availability	The supply of seed from all sources is adequate to meet the demand and needs of rice farmers
Access	Farmers as seed customers are able to acquire the seed they want through cash transactions or barter
Seed quality	Seed is of good quality in terms of cleanliness (analytical purity) and viability (germination and emergence)
Varietal quality and purity	The seed is of the varieties preferred by farmer customers and of adequate purity to meet production and marketing requirements
Resilience	There are diverse seed sources available to farmers to meet their needs after shocks such as drought, flood or conflict

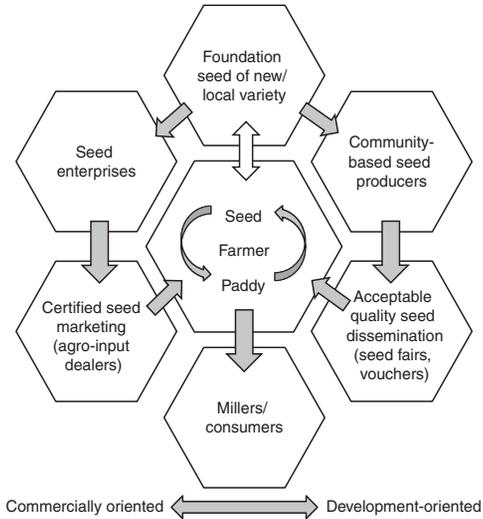


Fig. 14.3. Integrated rice seed sector development framework.

of time to ensure that sufficient amounts of seed of the right varieties are available in the markets.

systems often need development-oriented seed value chains to get access to new varieties. The public, development-oriented chain focuses on seed production to meet national targets, whereas the private, commercially oriented value chain focuses on profits and predictions (Louwaars and De Boef, 2012).

Breeder or foundation seed of new or widely grown local varieties provides the starting point of the proposed framework (Fig. 14.3), as this is the source for commercial- and development-oriented value chains. In some countries, foundation-seed production has already been devolved to the private sector. The delivery of breeder seed is assured by the national research systems. In the past, AfricaRice has often assisted with the production of breeder and foundation seed, especially following disasters, both natural and conflict (e.g. Liberia and Sierra Leone in 1999 and 2000). In general, to ensure seed security, there is a need to have sufficient stocks of foundation seed of major rice varieties at hand, either at country or regional level.

National and local government authorities in collaboration with private sector and development partners need to plan seed needs well ahead

Strengthening Farmer Seed Systems

The informal or farmer rice seed systems are the main source of seed for the majority of farmers in the rainfed lowland and upland rice systems in Africa. The farmer seed system is an efficient way of delivering seed to farmers because of its low transaction costs. 'Once farmers have the variety, the economic gains from using certified seed of the self-pollinated crops usually does not justify the investment. Moreover, certified seed is not always of better quality than the seed reproduced by a farmer' (Almekinders and Louwaars, 1999).

It is widely expected that farmer-saved seed and farmer-to-farmer seed exchange will continue to be the primary source of seed supply for the majority of farmers for a long time. Farm-saved seed is a common feature of agricultural systems worldwide, particularly in self-pollinated crops and in systems where hybrids are not used (Bay, 1998). Bay (1998) estimates that, in the mid-1980s, some 75% of seeds of self-pollinated crops in the USA (e.g. wheat, barley and oats) were farm-saved; similar figures might be found in Europe.

Important aspects in upgrading the quality and the diversity of seed produced on-farm

include (Bèye *et al.*, 2011): (i) sensitization for local quality control; (ii) training on maintenance of varietal purity; (iii) information sharing on existing market opportunities; and (iv) promotion of hermetic rice seed storage. A study in Uganda showed that farmers with training were able to maintain seed purity comparable to that of certified seed (J. Lamo, Saint-Louis, Senegal, 2012, personal communication).

Strengthening Commercially Oriented Seed Value Chains

Investments in commercially oriented seed systems in Africa have focused mainly on hybrid maize and vegetable production, where farmer value addition is high. The focus on maize hybrids has greater prospects for seed enterprise profitability (Scoones and Thompson, 2011). The 'hybrid maize model', however, is not directly applicable to rice, which is self-pollinated and farmers are able to retain seeds from harvest for subsequent crops without a significant loss in performance. Nevertheless, farmers may purchase certified seed to gain access to a new variety or to overcome loss of varietal purity, problems with seed storage, and insufficient farmer-saved seed due to poor harvest.

National seed legislation regulates varietal release, seed production, certification and seed commercialization, including seed marketing, packaging and labelling. The Food and Agriculture Organization of the United Nations (FAO) in collaboration with the African Seed Trade Association (AFSTA) and CGIAR centres, sub-regional organizations (SADC, ASARECA, CORAF/WECARD³), European, US (USDA³) and Japanese governments (JICA³) and organizations such as West Africa Seed Alliance (WASA) and Alliance for a Green Revolution in Africa (AGRA) have helped most African countries in West, Central, East and Southern Africa to develop national legislations, train inspectors and laboratory technicians, and establish commercial seed companies.

In addition, harmonized regulatory frameworks and regional varietal catalogues have been adopted at regional levels. Nevertheless, the harmonized procedures remain difficult to implement for two main reasons. First, statutory seed standards, derived from international legislation,

appear to be too strict. Consequently, the standards are difficult for most small-scale seed producers to meet. Second, most countries do not have operational national seed boards and seed-control infrastructures as they lack funding and trained personnel. As a result, current seed legislation and regulations do not facilitate field inspections and seed certification, and often acts as barriers to the entry of small commercial seed companies and to informal seed production by farmers and farmer groups rather than as a support and encouragement.

Major challenges also exist for commercial seed enterprises at both institutional and infrastructure levels. Entrepreneurs face cumbersome seed legislation and out-dated infrastructure, and they lack training and access to inventory credit and business support services.

In their book *African Seed Enterprises*, Van Mele *et al.* (2011) discuss conditions under which seed enterprises can perform best:

- Equipment and infrastructure: enterprises should have seed-conditioning facilities, storage and market access.
- Policy environment: support should be given to assist new seed enterprises to start small and grow.
- Inventory and operating capital: seed producers require capital to invest in equipment, operate a seed business and also inventory credit to be able to store seed for later sale.
- Diversity of product: seed enterprises are advised to produce and sell diverse crop seed in addition to rice seed. This increases possibilities for income generation while diminishing risks. Often it will be a more profitable product like hybrid maize seed that will serve as the foundation for the enterprise to build on by adding new products over time. The potential of hybrid rice seed playing that role is discussed by El-Namaky and Demont (Chapter 13, this volume).
- Management: train and retain staff along with investment in new product research and market development.
- Quality control: enterprises need to build trust and reputation for quality products with their farmer customers. For this, it is important to build up strong internal support for in-house quality-control systems.

- Seed certification: certification is useful if it improves quality control, but costs need to be controlled. 'Quality Declared' and 'Truthfully Labelled' seed may be a more feasible way forward with more emphasis on branding.
- Marketing strategies: seed enterprises need to use diverse and innovative marketing strategies, including radio campaigns and TV adverts, demonstrations, seed fairs, billboards and field days, appropriate pricing, packaging of small quantities and attractive labelling.
- Enterprise cooperation: smaller seed enterprises can strengthen themselves by joining together in associations, federations or unions to achieve economies of scale, protect the market from counterfeiters, and share equipment with each other (including inter-enterprise hiring).

In East and Southern Africa, where the maize-seed industry is well-developed, there is a trend towards a deregulation of formal seed system regulations. These can be considered as 'emerging formal' systems (Louwaars and De Boef, 2012). In Tanzania and Zambia, for example, Quality Declared Seed (QDS) is largely used instead of certified seed. This has enabled farmers to access seeds of relatively good quality without the constraints and expense of formal seed certification. The QDS was developed by FAO, which looks for 'softer' seed legislations for countries that are not able to meet the standards of ISTA. Seed controls are conducted in 10% of seed-producing areas. Other countries in East and Southern Africa have similar systems referred to as Guaranteed Seed (Mozambique), Standard Seed (Botswana), Commercial Seed (Kenya and Uganda) and Approved Seed (Malawi). In addition there is 'Truthfully Labelled Seed', where certification is made voluntary and seed producers are allowed to attach their own 'truthful' label on the supplied seed bags or packets.

A promising development in terms of linking seed producers with potential buyers through the internet is being tested in Côte d'Ivoire under the responsibility of the NSS through a central website ('cyber seed', www.ci-semence.org). This involves accredited technicians and quality-control farmers trained in quality-control techniques, who monitor seed-production activities within a specific zone. They organize seed-production

activities, including planning, control of seed-production fields, management of seed stocks, and support to seed commercialization. Quality-control farmers are farmers selected by their colleagues to monitor seed activities. They are trained in quality-control techniques and are monitored by the accredited technicians. They control seed-production activities in their respective cooperatives or associations, monitoring seed moisture content, germination rate and physical purity. Information on seed-production activities (seed producers, quantities, prices, etc.) are communicated to the central website for wide diffusion by mobile (cell) phone and other mass-media tools. Through this system, traceability is ensured and the required information about seed quality is available for each seed lot.

The cyber-seed concept was tested successfully in Daloa, Côte d'Ivoire, in 2006 by Coopérative de Commercialisation des Produits Vivriers de Daloa (COPROCOVIDA) and the Ministry of Agriculture. In 2007, four additional centres were created in Issia (Centre), Korhogo (North), Zouan-Hounien (West) and N'Zécérézessou (East). These centres helped farmers sell increasing amounts of seed: from about 300 tonnes of rice seed in 2007 to 863 tonnes in 2010.

Strengthening Development-oriented Seed Value Chains

Development-oriented seed value chains are more important in rainfed systems, than they are in irrigated systems, as the former usually have difficult market access. In these systems, there is a need to build capacity among farmers on how best to manage and save their own seed to maintain varietal purity and seed quality because they may only sporadically get access to new varieties or new 'clean' sources of a particular variety through development-oriented seed value chains. Gradually, with farmers gaining access to markets, such systems may evolve towards commercially oriented seed systems, where seed quality is becoming an increasingly important issue.

The community-based seed system (CBSS) approach, extensively used by AfricaRice in many of its seed projects, is an example of an integrated seed system that aims to integrate the strengths and opportunities in both the formal (for the

production of breeder and foundation seeds) and the informal seed systems (for diffusion of improved as well as traditional varieties) (Bèye *et al.*, 2011). CBSS is designed to enable smallholders to meet their seed requirements by improving their know-how in basic seed production and quality constraints. This decentralized system relies on individual entrepreneurial farmers and farmers' groups, who are trained to produce seed of acceptable quality that is disseminated through development projects, seed fairs and vouchers.

Successful examples of functional CBSS for rice can be found in many sub-Saharan African countries, including: Cameroon, Chad, Côte d'Ivoire, Ethiopia, Gambia, Guinea, Kenya, Madagascar, Mali, Nigeria and Tanzania. In Côte d'Ivoire, more emphasis is being placed on professionalization of farmers' groups/associations through the development of online commercialization of rice seed with traceable information about available seed stocks and their characteristics (germination rate, moisture content, physical purity and the presence of weed seeds), the proposed prices, production trends by variety, etc. This new orientation opens new areas of collaboration among farmers' groups, agro-dealers and private seed companies. In addition, it helps to drive the production of quality seed with the objective of generating more revenue, and moves CBSS from a development orientation towards a commercial orientation.

The involvement of NGOs in seed systems is often under-appreciated as they tend to operate independently, especially in situations of seed insecurity due to natural disaster or conflict (all too common in Africa). Depending on the NGO and the context, they may support community seed production or carry out direct purchase and distribution of seed. NGOs are increasingly using vouchers to facilitate farmer access to seed rather than intervening directly in the seed supply chain. This could be via 'cash' vouchers that recipients can redeem at special fairs for a wide range of seeds, or 'commodity' vouchers or coupons that can only be redeemed for certified or quality-declared seed.

Conclusions

A viable and sustainable integrated rice seed sector requires integration of the formal and

informal systems, with knowledgeable and empowered farmer seed customers and managers. Tripp (2003) describes this need eloquently:

Finally, it is worth repeating that the development of a commercial seed sector is not in competition with, or an alternative to, the strengthening of farm-level seed management capacities. Indeed, the emergence of a commercial seed sector will occur only where farmer seed systems are strong, where farmers know a great deal about what varieties are available, are engaged in widespread seed and information exchange and are confident and knowledgeable consumers. Any aspirations for commercial seed sector development need to begin with attention to farmers.

There is no blueprint solution for seed system development in Africa, and the best possible approaches are likely to be specific to rice agro-ecosystems and value chain, and will evolve over time – for example, with emerging formal systems become 'more formal', catering to specific market niches. Governments need to strengthen both commercially and development-oriented rice value chains and support farmer seed systems. This will require supporting different kinds of entrepreneurship, such as small- to medium-scale seed companies producing certified inbred and hybrid rice seed for commercial purposes, possibly with some level of time-bound exclusivity; local seed businesses of groups of farmers that produce seed of 'acceptable quality' as part of development projects enabling farmers to get access to new varieties (eventually moving to a more commercial type of operation); local or community-based initiatives targeting the promotion of biodiversity conservation and utilization; and local seed businesses that evolve around rice mills and agro-industries, requiring strict control of seed to deliver specific products.

At the regional level, seed legislation needs to be harmonized or complemented by workable implementation guidelines to facilitate seed flows across borders and to stimulate the emergence of large-scale seed companies that can operate internationally. Adequate rice seed security stocks must be maintained to respond to emergency situations. At both national and regional levels, there is a need to adopt an integrated rice seed sector development approach, aiming to promote diversified seed systems, meeting the seed needs of all of Africa's rice farmers.

Notes

¹ The processing industry enables seeds to be calibrated, so that they are of uniform size and weight, and the delivery of disease-free seeds.

² DUS, Distinctness Uniformity and Stability; VCU, Value for Cultivation and Use.

³ SADC, Southern African Development Community; ASARECA, Association for Strengthening Agricultural Research in Eastern and Central Africa; CORAF/WECARD, West and Central African Council for Agricultural Research and Development; USDA, United States Department of Agriculture; JICA, Japan International Cooperation Agency.

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