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Performance and Challenges on Formal Seed System in Ethiopia

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Abstract

Generation and transfer of improved technologies are critical prerequisites for agricultural development particularly for an agrarian based economy like Ethiopia. Despite the release of several technologies, particularly of improved crop varieties, there has been limited use of improved seeds by the majority of farmers. Among others, unavailability of quality seeds at the right place and time coupled with poor promotion system, is one of the key factors accounting for limited use of improved seeds, which further contributing for low agricultural productivity. Poor availability and promotion of improved seeds is due to inefficiency of the seed systems of the country. Though, this review paper assesses mainly the status of seed system and its challenges in Ethiopian farmers.

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Seed, Formal seed, improved seed, seed demand, Seed Enterprise.

Introduction

The formal seed system is called formal because it is mainly government supported system and several public institutions are also involved on it. The major actors of the formal system are: National Agricultural Research Systems (NARS), Ministry of Agriculture (MoA), Ethiopian Seed Enterprise (ESE) and private seed companies specializing on specific crops like Pioneer. Recently, regional seed enterprises (RSE) were also established as public seed enterprises (such as Oromiya Seed Enterprise (OSE), Amhara Seed Enterprise (ASE), and Southern Nations nationalities and Peoples Region Seed Enterprise (SRSE) and entered into the formal system. (Maredia, *et al.*, 1999). It usually starts with plant breeding and promotes materials for formal

variety release and maintenance. Regulations exist in this system to maintain variety identity and purity as well as to guarantee physical, physiological and sanitary quality. Seed marketing takes place through officially recognized seed outlets, and by way of national agricultural research systems. In formal seed production, seed multiplication occurs through several generations rather than continually recycling the seed of one generation, to avoid building up physical or genetic contamination over time in the same lot of seed (Louwaars *et al.*, 2009).

One of the most important inputs in agriculture is seed. Seeds form the foundation of all agriculture. Without seeds there is no next season's crop. The genetic traits embodied within seeds reflect and determine the nature of farming systems

dependent on them. The genetic and physical characteristics of seed determine the productivity in line with the use of other agricultural inputs and improved cultural practices within the farming system. Improving the genetic and physical properties of seed can trigger yield increase and lead to improvement in the agricultural production and food security. In order for seed to act as a catalyst in agricultural transformation, however improved seed has to be made available to a broad base of farmers on continuing base. (Rohrbach *et al.*, 2009). A core goal of the Government of Ethiopia, Agricultural Development Lead to Industrialization (ADI) strategy was to raise cereal yields through a centralized and aggressive extension-based push focusing on technological packages that combined credit, fertilizers, improved seeds and better management practices (Byerlee *et al.*, 2009). Agricultural productivity depends on the use and availability of better agricultural technologies and practices. As a result of intensification (i.e., maximizing the productivity of farm land with new agricultural inputs) and extensification (i.e., extending the size of the existing farms) (Koko and Abdullahi, 2012), the demand for improved technologies, including improved seed and fertilizer, has increased in Ethiopia (Spielman *et al.*, 2010). This demand for improved technologies comes from smallholders, producer organizations, and private companies. Quality seed, in particular, is a key factor in Ethiopian agricultural production (Alemu, Rashid, and Tripp 2010). Quality seed is at the core of the “technology package” needed to increase agricultural production, food production, and rural economic development (Alemu 2011; Bradford and Bewley 2002). Its contribution is high when it is available in demanded quality and quantity at the right time and for the right price (Adetumbi, Saka, and Fato 2010; Louwaars and De Boef 2012).

To satisfy the seed demand, improved seeds are supplied particularly by public organizations: public seed enterprises, agricultural research institutes, and universities (Alemu 2011; Thijssen *et al.*, 2008). Private seed producers also supply seed to the market. However, both public and private seed producers mainly concentrate on a few cereal crops, particularly hybrid maize and bread wheat. Moreover, they supply only a small portion of the total quantity of seed demanded by

farmers. Thus, they do not satisfy the diversified seed demand of farmers (Bishaw and Louwaars 2012). Most small holders tackle the seed shortage through farmer-to-farmer seed exchange or using saved seed (Alemu 2011; Thijssen *et al.*, 2008).

To narrow the gap between seed demand and seed supply, farmers are encouraged and supported to organize themselves in seed producer cooperatives (SPCs) to produce and sell quality seed (Ayana *et al.*, 2013; Subedi and Borman 2013). The government encourages SPCs to engage in seed production and supply to the market. The SPCs are supplying quality seeds of diversified crops and varieties based on farmers’ interests. However, limited availability of and access to quality seed is regarded as one of the main obstacles to increasing agricultural productivity in Ethiopia (Ojiewo *et al.*, 2015). This paper, is therefore, aimed at providing an overview and assessing the performance and challenges of formal seed system in Ethiopia.

Review of Literature

Seed System

Seed systems are composed of set of dynamic interaction between seed supply and demand, resulting in farm level utilization of seed and thus plant genetic resource. The seed system is essentially the economic and social mechanism by which farmers’ demand for seed and various traits they provide met by various possible sources of supply (FAO, 2004). The term seed system represents the entire complex organization, individual and institution associated with the development, multiplication, processing, storage, distribution and marketing of seed in any country.

Seed system includes traditional (or informal) system and the nontraditional (or formal or commercial) systems. Legal institutions such as variety release procedures, intellectual property rights, certification programs, seed standards, contract laws, and law enforcement are also an important component of the seed system of any country. They help determine the quantity, quality, and cost of seeds passing through the seed system (Maredia, *et al.*, 1999).

Seed system participants may be relatively few or many, predominantly public or private depending upon the farmers that the system serves. In local systems of seed exchange, farmers often undertake most of the activities that define a seed system. As systems expand to national, regional, and international scales, participants will include the following: farmers, international agricultural research centers, private and public domestic seed enterprises, retailers and distributors, multinational seed companies, private research institutions, farmers associations and cooperatives, banks and credit institutions, trade associations, local governing bodies, donor agencies, national agencies and ministries, community groups (social, religious, etc.), agricultural universities, national agricultural research institutes and NGOs/PVOs. These participants may assume multiple roles in the process of seed provision, performing one or several activities (WBG, 1999).

Seed systems, formal or informal, fulfill a series of functions that are basic prerequisites for expecting the best possible productivity from a crop in a specific situation. Healthy, viable seed of the preferred variety needs to be available at the right time, under reasonable conditions, so that farmers can use their land and labor resources with the best yield expectations. The wrong variety, sown at the wrong time with infected seed of poor germination potential, will seriously limit a farmer's expectation of production and productivity. Thus, any seed system has multiple functions to fulfill for a range of farmers, farming conditions, and crops in a village, region, or country. A seed system can be assessed at any time according to how well it fulfills these functions. Conditions, situations, groups of farmers, or crops can be identified under which the specific system works well (Welfzien *et al.*, 2001). Activities undertaken to supply seeds to farmers include research and development, multiplication, processing, distribution, and uptake. Other activities that may occur in conjunction with these include transport and storage, as well as quality control (such as seed certification). Seed provision to farmers also includes activities undertaken to influence the process, such as: pricing, financial and technical support, provision of inputs, communication and coordination, as well as market research and promotion. Finally, policy formulation underpins

seed systems, defining the boundaries and opportunities for the conduct of all seed system activities (WBG, 1999).

Formal seed system

The formal seed system is a deliberately constructed and bounded system, which involves a chain of activities leading to clear products: certified seed of verified varieties (Louwaars,1994). The guiding principles of the formal seed system are: to maintain varietal identity and purity; and to produce seed of optimal physical, physiological, and sanitary quality. Seed marketing and distribution often takes place through a limited number of officially recognized seed out lets, usually for commercial sale (Louwaars,1994). Although seed may also be distributed (free or for sale) by national research programs, universities or NGOs. A central premise of the formal system is the clear distinction between seed and grain.

The formal seed system in the Ethiopian context is a system that involves a chain of activities leading to certified seed of released varieties (Louwaars 2007). The formal seed system is guided by scientific methodologies for plant breeding. Multiplication is controlled and operated by public or private sector specialists, and significant investments have been made throughout the process (Louwaars and De Boef2012). The research system or certified multipliers produce and distribute basic seed. Suppliers of basic seed are public seed enterprises and a few licensed private seed companies. Regulatory agencies, along with all actors involved in the seed chain, supervise the production and distribution of certified seed (Alemu2010).

In Ethiopia, formal seed production dates back to the opening of Jimma Agricultural College (now Jimma University) in 1942, Alemaya University of Agriculture (now Haramaya University) in 1954, Institute of Agricultural Research (now Ethiopian Institute of Agricultural Research/EIAR) in 1966, and the Chilalo Agricultural Development Unit in 1967 (Gebeyehu, Dabi, and Shaka2001; Simane2008). The Ethiopian seed program was very much ad hoc and the seed production activities were not well coordinated until the late

1970s. Institutionalized seed production, processing, distribution and quality control were started by the end of the 1970s when the National Seed Council (NSC) and the Ethiopian Seed Enterprise (ESE) (the Ethiopian Seed Corporation) were established (Bishaw, Saund Simane 2008; Gebeyehu, Dabi, and Shaka 2001). Together with ESE, other public organizations, such as agricultural research institutes, universities, ministry of agriculture, and state agricultural development corporations, gradually engaged in seed production to meet the increasing national seed demand. However, despite all these efforts, seed demand could not be satisfied (Gebeyehu, Dabi, and Shaka 2001). The ESE was the only seed producing organization responsible for supplying seed to the entire farming community through local production and/or imports from abroad until 1993, when Pioneer Hi-Bred entered in Ethiopia and later the establishment of regional seed enterprises in 2008/09. However, until 1991 the activities of ESE were highly skewed to the state farms and cooperatives (Bishaw, Sahlu, and Simane 2008). There were no private seed companies engaged in seed production when the economy was based on state-owned socialist principles. In Ethiopia, seed production in the formal seed system is highly dominated by the public sector. The ESE (accountable to the federal government) and regional government seed enterprises play dominant roles in the formal seed system. They are governed by the board of directors of their respective federal and regional governments, and responsible for production, processing and marketing of seed to meet the regional and national seed demands.

Though they are responsible for the production of seed for all crops (cereals, pulses, fruits, vegetables, and forages), their seed production is dominated by a few cereal crops, mainly hybrid maize and wheat (Bishaw and Louwaars 2012).

They produce, process, distribute, and market improved seed based on official demand projections of the Ministry of Agriculture and the respective regional bureaus of agriculture. Several small-medium private seed producers and companies, involved in the formal seed system, supply large quantities of seed to growers. They mainly focus on hybrid maize seed. According to

(Bishaw and Louwaars (2012), wheat and maize make up nearly 64% and 23%, respectively, of the total certified seed supply from the formal sector. The interest of private seed companies to engage in crops other than maize is weak because profit margin is limited. Farmers need hybrid maize seed every year, which attracts private companies. Private companies show little interest to invest in seed production of self-pollinating crops, for which, unlike maize, farmers do not have to buy seed every year. Efforts have been made to satisfy the Ethiopian seed demand through the formal seed system. However, the formal seed system could not satisfy the seed demand of the vast majority of the nation's farmers, who are smallholders and subsistence farmers, particularly in remote areas (Bishaw, Sahlu, and Simane 2008). The formal system clearly demarcates the roles and responsibilities of stakeholders in the seed chain, such as research organizations, universities, public seed enterprises, private seed companies, farmer organizations, and smallholder farmers. Each stakeholder contributes to seed development or distribution.

Table 1 contains a list of the major stakeholders and their roles in the formal seed system of Ethiopia. The Ethiopian Institute of Agricultural Research (EIAR), Regional Agricultural Research Institutes (RARIs) and universities are responsible for developing new varieties. They are also involved in basic seed production. The National Variety Release Committee (NVRC), at the federal level, is responsible for making decisions on whether or not the varieties proposed by researchers would be officially registered and released for production. The Ethiopian Seed Enterprise (ESE), Regional Seed Enterprises (RSEs), private companies, SPCs and unions engage in seed production. The Ministry of Agriculture (MoA) and regional Bureau of Agriculture (BoA) undertake regulatory activities during seed production, processing and marketing.

(EIAR- Ethiopian Institute of Agricultural Research; RARIs-Regional Agricultural Research Institutes; NVRC-National Variety Release Committee; ESE-Ethiopian Seed Enterprise; RSEs Regional Seed Enterprises; and SPCs-Seed Producer Cooperatives. MoA- Ministry of Agriculture; and BoA-Bureau of Agriculture.)

According to (FAO 2009), formal seed system as a sector comprises all seed program components, namely; plant breeding, seed production, processing, marketing, extension, quality control and certification that interact among themselves and usually regulated by law. The formal seed sector was set up and organized with the principal goal of diffusing quality seed of improved varieties developed by formal breeding programs. The principal sources of materials for formal breeding programs are the ex situ collections of gene banks. Gene banks contain materials that were originally collected from farmers' systems, that is in the case of cultivated plants materials that were developed and maintained by farmers. The formal system has been relatively successful for well-endowed, high-potential areas, but much less successful in more variable, marginal areas. This is partly explained by the fact that improved varieties tend to be poorly adapted to farmers' preferences and production environments. (Almekinders, 2009).

In the formal seed sector, seed provision covers seed production and supply mechanisms that are governed by defined methodologies, combined stages of multiplication and quality control. Stakeholders in this sector mostly invest in research and development of new varieties, registration of varieties, seed production, processing, marketing and distribution. Seed production follows all the necessary procedures of seed certification where farmers are registered and fields are inspected for certified seed production (Teddie and Grace, 2010). Seed supplied in the formal, or organized (Camargo *et al.*, 1989) seed sector is characterized by planned production, some form of processing, inclusion of only identified/notified varieties and a system of quality control.

In Ethiopia, there are five public (parastatal) seed enterprises, namely Ethiopian Seed Enterprise (ESE), Oromia Seed Enterprise (OSE), Amhara Seed Enterprise (ASE), South Seed Enterprise (SSE), and Somali Seed Enterprise (SoSE). However, ESE, OSE, ASE and SSE are all largely involved in grain crops, cereals, pulses and oilseeds seed production while Somali Seed Enterprise largely deals with forage crops seeds (Amsalu *et al.*, 2014). Thus, virtually none of

these seed enterprises is involved in vegetable seed production locally or via imports, although vegetable seed production and importation is within their mandates and business objectives. This is in spite of the fact that the seed enterprises, except for Somali Seed Enterprise, operate in favorable agro-climatic conditions known to be suitable for the production of cool season vegetable seeds (Asredie *et al.*, 2008).

Formal seed supply systems consist of seed production by National government agencies

State government agencies

Government-assisted and other cooperatives

Multinational corporations or transnational corporations

Domestic private sector companies

With their own research and development

Without their own research and development

Joint venture companies

Between Multinational corporations and domestic private company

Between two domestic companies (Ravinder *et al.*, 2007).

There are serious concerns over the appropriateness of the varieties available in the formal seed sector, the quantity and quality of seed delivered, seed production costs and prices and timeliness of supply. More importantly, rigid government policies and regulations, poor organizational linkages and in adequate infrastructure contribute to the problems of the formal system in developing countries (Ravinder *et al.*, 2007). As described by (Teddie and Grace, 2010) there are strengths and limitations in formal seed sector: these are indicated as follow:

Strengths in the formal seed sector

Well established policies and regulations for variety development and seed production and

quality control, which allows ease of participation in the seed industry.

Enhanced public-private partnerships in all the components of the seed value chain.

Well established seed distribution networks especially through agro-dealers and Agricultural

Development and Marketing Corporation markets

Limitations in the formal seed sector

Inadequate trained personnel in plant breeding and seed certification

Inadequate funding for research, variety development and demonstrations/promotions in the public sector

Poor seed handling by seed distributors

Shortage of foundation seed for certified seed production especially legumes

Lack of processing equipment in most local companies and farmer associations

Inadequate availability of credit and reluctance of multilateral organization to invest in seed production.

Challenges in formal seed system

A major challenge for formal seed supply is to produce sufficient seed of all varieties needed, and deliver it to farmers in a timely manner. This requires considerable organization, time, and space, and incurs risks due to costs and production. To start with, significant area and effort is involved in seed production, though this varies by crop according to its multiplication rate (i.e. how much usable seed is produced per seed sown (McGuire, 2010). The study made by (Baniya *et al.*, 2003) signify that, the formal system focuses more on the interests of the seed company, and has more access to biotechnology and plant breeding techniques, so this seed system generally neglects the indigenous knowledge. The

market is dominated by a few suppliers with potentially serious implications for technology choice and price fixing.

The challenges are related to: the need for strong national coordination of agricultural research and development, seed production and marketing activities for better efficiency and creation of institutional synergies; avoiding unnecessary competition among the regional seed enterprises for the same resources, such as facilities, human resources and markets; and if the regional seed enterprises are to serve only their respective regions, the role of ESE will need to be redefined as a national seed enterprise (Dawit Alemu, 2011).

In the seed industry, spatial gaps exist between the multiplication of seed and the use by farmer customers of seed. Farmers are dispersed over a large geographical area, while seed trade is usually located in towns and seed multiplication is concentrated and thus distant from many farmer customers. The availability of seed influences purchase decisions (MacRobert, 2009). In addition, a time gap exists between the multiplication of seed and the farmer customers' use of seed. Farmers require seed for planting at particular times of the year, while companies produce seed one or more seasons ahead of the selling period. The timely availability of seeds prior to planting time is considered one of the important factors influencing the farmers' buying decisions. In the seed industry, a quantity gap exists: seed companies produce large quantities of seed, while individual farmer customers only buy small package sizes. The informal seed system is dominant over the formal system because the seed offered is readily available in the farmers' villages when the seed is needed (Atilaw&Korbu, 2011). Often, the formal seed systems in Ethiopia do not supply seed at the right time and in sufficient quantity to farmer customers. The ineffectiveness of the public seed demand planning, distribution, and marketing mechanisms have been identified as major limitations (Alemu, 2010; Alemu *et al.*, 2010). The formal seed system often does not respond to demands for different package sizes (Alemu, 2010; Atilaw&Korbu, 2011; Tripp, 2006; Tripp & Rohrbach, 2001).

Table.1 Major stakeholders in the formal seed system and their roles.

Seed system Components	Involved stakeholders	Regulatory stakeholders	Regulatory Measures
Plant breeding Variety release Breeder seed production	EIAR, RARIs, universities NVRC EIAR, RARIs, Universities	MoA	Distinctiveness, uniformity, stability
Pre-basic seed Production	EIAR, RARIs Universities, ESE	MoA, regional BoA	Seed quality assurance
Basic seed Production, Certified seed Production	RSEs ESE, RSEs, private companies, SPCs ESE, RSEs, private companies, SPCs, farmers based seed production	MoA, regional BoA	Seed quality assurance unions,

Source: Adapted from (Bishaw, Sahlu, and Simane 2008).

Inadequate Seed Marketing Information and Infrastructure

Remote area farmers or furthest from cities are faced by in accessibility of seed market information and infrastructure. The fact we know that seed must reach the farmer at the right time, place, in the right amount with appropriate price and of the highest economic quality. Since seed Marketing is sensitive to so many factors, it has been considered as a high risk for seed distribution. In our country Ethiopia seed marketing remains one of the weakest links in the seed supply chain, thus limiting farmer access to good quality seed. It is also a big constraint for African countries in general. The marketing system is poor, access to market information is limited and so far, market linkage is weak or non-existent (Bezabih *et al.*, 2014). Therefore, to minimize the high-risk business nature of the seed sector, it is very crucial to implement and follow all the marketing functions and marketing principles. For this reason, it is very important to understand what are the challenges of seed marketing? Why only few farmers are participating in the seed marketing, etc.? Although so many measures have been taken to improve the service efficiency of the seed sector (public institution) for the last five decades, farmers' access to seed was hindered by technical

problems, poorly developed seed sector and rural marketing infrastructures. The formal seed sector, despite all the efforts made to improve the sector for the last five decades, it was able to supply only 10-20% of the potential demand of the country. In this respect development and promotion of different seed system at both community and private levels near by the farmers' area are a potential solution to this problem (Getachew, 2010).

Performance of formal seed system

The opportunities are related to: better research coverage of the different agro-ecologies, improved possibility of expanding the production and marketing of seed for all crops; improving the human and physical capacity at regional level, improving the possibility of producing locally demanded crop varieties, and the possibility of marketing at relatively lower cost due to reduced cost of transportation (Dawit Alemu, 2011). It is crucial that improved crop technologies reach the majority of farmers to bring about tangible results on the rural livelihoods. Hence generation of technology must be coupled with a robust and diverse seed system which provides farmers with adequate quantity and quality seed at the appropriate place, time and price. From its modest beginning in the early 1980s the formal sector

went through substantial changes in recent years. During the first decade of its operations from 1980 to 1989, the ESE was distributing on average 21,162 tons of seed annually of handful of cereal and few legume crops particularly haricot bean where the major customers were the public state farms followed by MoA and some NGOs for emergency seed relief. In the second decade (1990-1999), the average yearly seed supply dropped to 14,012 tons due to reduced demand from the public state farms where the new major customers were the regional Bureaus of Agriculture and the federal Ministry of Agriculture. In the third decade (2000-2009), formal seed supply on average reached 18,632 tons although in 2010, it was more than doubled reaching 54,000 tons.

Another important performance indicator is the degree of private sector involvement in seed delivery. The role of private sector in certified seed delivery is limited both in scope and scale of seed supplied. Pioneer Hi-bred Ltd started seed operation in 1990 and was the only private seed provider in the country until the emergence of a number of small to medium domestic private seed companies in 2000s. From 1998-2008, based on available data, the private sector on average provided about 1,388 tons of primarily maize seed which is about 21% of total maize seed supply or 9% of total formal seed supply across all crops. Pioneer Hibred is a major supplier among the private sector. Its share of hybrid sales increased from a little more than 500 tons in 1996 to nearly 3,000 tons in 2011 (Negari and Admasu, 2011).

Public and donor supported interventions in the seed system

In recent years, the interest in developing a vibrant seed system is accompanied with a growing recognition in some policy circles of (i) the existence of agricultural technologies (improved varieties and breeds) that can considerably improve productivity and (ii) the limited access of these technologies to farmers. In addition, there is a substantial improvement in the level of farmers' awareness about the use of those improved technologies (Dawit Alemu, 2010). These trends are opportunities to further look into options of improvement of the seed system in the country. Accordingly, there are different initiatives

promoted by the public and donor communities in creating strong integrated seed sector in the country. Among the most important initiatives are (i) decentralization of the seed system, (ii) promotion of the participation of private sector and licensing of public varieties, (iii) promotion of in situ and ex situ conservation, (iv) institutionalization of seed and seed technology education in HLIs

Decentralization of the seed system

Following the decentralization of the political system, the seed system has been also decentralized that give way to the emergence of regional public organizations and heterogeneous arrangements across regions. To mention some, the emergence of regional agricultural research institutes, regional seed enterprises and regional seed quality laboratories etc. (Dawit Alemu, 2011).

Promotion of in situ and ex situ conservation

Ethiopia is considered to be one of the richest centers of plant genetic resources in the world. Wide altitude and temperature ranges, high humidity and extreme forms of rainfall pattern, coupled with complex topography, make the country a major region of genetic diversity for many crop plants (Balcha et al., 2003). Cognisant of the need to sustain this diversity, considerable efforts have been in place for both ex situ and in situ conservations in the country. In the less favored areas of the world where crop production is risky and opportunities are limited for insuring against risk, many farm families still depend directly on the diversity of their crops for the food and fodder they use both in terms of inter-specific (among crops) and intra-specific diversity within a crop (Benin *et al.*, 2004). It is under this premise that in-situ conservations are promoted in Ethiopia.

From different seed systems in Ethiopia formal seed system encompasses different structures in its form of organizations and each of them are playing their roles in the system. The formal seed system at the past four decades passes its distinct performance and challenges in Ethiopia. The performances are showing the progressive stages in research-based seed production and distribution

of seed through regulatory and controlled out lets by the controlling bodies or stake holders across the country. The other performance is degree of private sector involvement in the seed delivery. The private sector exhibit considerable participation in the system especially in hybrid seed production in stitutionalization of seed and seed technology education in higher level institutions.

Challenges in Ethiopia formal seed system is in the past decades are related with gap between demand and supply differences due to information gap between producers and farmers side. Many studies show that seed production companies produce seed one or more seasons a head of the selling period. In the seed industry, a quantity gap exists' seed companies produce large quantities of seed, while individual farmer customers only buy small package sizes. The informal seed system is dominant over the formal system because the seed offered is readily available in the farmers' villages when the seed is needed. The other is farmers are dispersed over a large geographical area, while seed trade is usually located in towns and seed multiplication is concentrated and thus distant from many farmer customers. In this respect development and promotion of the seed system with quality, quantity and at the right time and for the right price at both community and private levels near by the farmers' area are potential solutions to this problem.

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