EIAR-JICA Cooperation

FRG II Project

Empowering Farmers' Innovation

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Improving Farmers' Access to Seed

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Improving Farmers' Access to Seed

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Foreword

The seed sector is of paramount importance to Ethiopia, where the state pursues an Agricultural Development Led Industrialisation (ADLI) strategy; the agricultural sector plays a dominant role in the economy, representing about 45% of GDP and 85% of export earnings, and where the livelihoods of 85% of the population of 79 million people are based on agriculture. Therefore, one can associate the growth in the agricultural sector directly or indirectly with the overall performance of the wider economy of the country.

Cognizant of the importance of seed, a seminar on **"improving farmers' access to seed"** was organized by EIAR/JICA FRG II project in collaboration with MoA/JICA Quality Seed Promotion Project and Nagoya University Research Project on 'Institutional Development for Agro-biodiversity' funded by Mitsui Co. Environmental Fund. Nine papers were presented and discussion made at the presence of representatives from federal and regional Agricultural Research institutes, Higher Learning Institutions, public Seed enterprises, NGOs, and International organizations. The presented papers covered issues related with (i) the formal and informal seed systems along with possibility of integrating the two systems, (ii) the issue of agro-biodiversity and community Seed banks, (iii) the forage seed system. Of the nine papers six were reviewed and included in the proceedings.

We would like to express our gratitude to many people and organizations that made the seminar successful. We appreciate the authors of the papers and the seminar participants whose active participation made the seminar highly professional and played an important role in bring up relevant issues pertinent to the seed sector. We would also like to thank the Ethiopian Institute of Agricultural Research, JICA Ethiopia Office and FRG II Project for all the support given to organize the seminar.

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Diversity of Frameworks for Understanding Agro-biodiversity Why seeds matter?

Keynote

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Abstract

Using the cases of genetic resources management involved by local farmer, meaning of seeds for farmers is discussed. Farmers recognize the value of seeds not only based on yield potential and profitability but also based on risk distribution and domestic use values. Hiroshima local gene bank activities to re-introduce obsolete varieties of vegetables back into the communities where genetic resources had been originally collected showed importance of collaboration among different stakeholders for effective seeds management for rural (re-)vitalization including formal research institutes and farmers. Participatory research in Burkina Faso showed the difficulty of understanding farmers' criteria for seeds and variety selection by outsiders including extension workers and researchers. Institutional building to facilitate collaboration among national and local level stakeholders is suggested for seed and food security of farmers especially in disadvantaged areas.

1. Introduction

Agro-biodiversity primarily consists of eco-system, inter-species diversity, and intra-species diversity. Within intra-species diversity, there are plant genetic resources, animal genetic resources, and micro organisms. In this short paper, however, plant genetic resources will be mainly dealt with. Importance of conservation and utilization of plant genetic resources is now widely recognized. Due to the rapid expansion of the human population and its activities, conservation of genetic resources is urgently needed. Soil, water, and genetic resources constitute the foundation upon which agriculture and world food security is based. Of these, the least understood and most undervalued are plant genetic resources. They are also the resources most dependent upon our care and safeguarding. And they are perhaps the most threatened (FAO 1996). These resources are generally recognized as seeds by farmers since they perceive the values of genetic resources as input for cultivation. However, as explained in the following section, this important message is not widely recognized by researchers.

2. Understanding Agro-biodiversity

Among the people discussing how to conserve plant genetic resources, plant biologists have been the first and dominant in the scene. The great majority of the discussions have been, therefore, devoted to technical aspects of conservation and utilization. They hardly realize what senses of values they are influenced by, what sorts of institutions they belong to, and what are the standpoints of the people who digest their ideas (Mcpherson 1985). Yet scientists tend to believe that what they discuss is objective and implies only bare facts. Another problem may be a sense of the superiority of natural science to other areas of studies and indigenous knowledge of people (Rohrer 1986). This attitude will hardly help the practitioners to formulate or to appreciate the various viable institutional structures necessary for conservation and utilization of genetic resources in farmers' fields in developing countries.

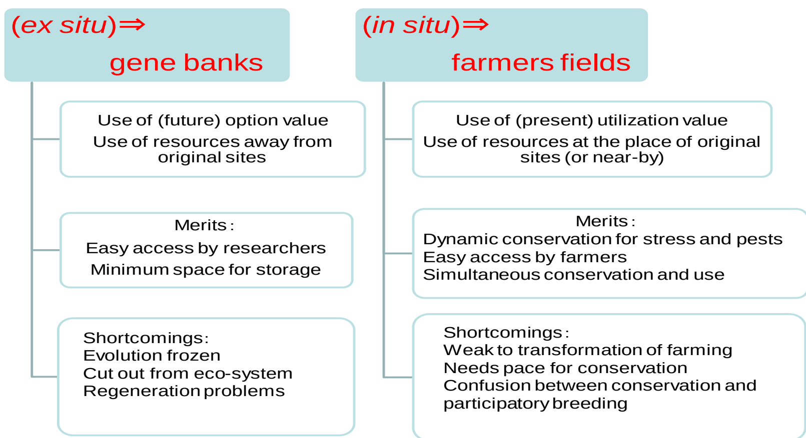

Fig.1 Where genetic resources are conserved and why

Economists may raise simple questions such as: what opportunities of advancement are foregone by allocating scarce resources for conservation; and whose interests are being served by such conservation. Since economic advancement is a strong incentive for policy making and its implementation in development, people who support conservation work have been emphasizing the importance of genetic resources in economic terms. However, these approaches are only based on the market economy and are not totally applicable to actual situation in many developing countries (Richards 1985).

Sociologists and anthropologists will object to the idea of the superiority of so called modern technology and will also object to analyses fully dependent on the market economy. From their view points, if conservation is necessary, farmers' knowledge and existing systems are the place to start (Richards 1985). It has been revealed that there exist many different institutional forms for conservation associated with many different incentives (Nishikawa 1990). Economic value in terms of option value, which is future use value extracted from breeding work, has been the main incentive for traditional off-site conservation. When this value is too much emphasized, people tend to ignore farmers' own value concepts of direct use including social, cultural, and medicinal incentives.

In order to establish viable institutional arrangement to promote conservation work in line with sustainable development, especially in agriculturally less favorable areas, coordination and harmonization on various institutions and incentives are required. The incentives need to be based on diversity of value concepts, which are in many cases different from economic point of view.

In this short paper, importance of collaboration among different stakeholders and research and development based on farmers' own concept is explained using concrete cases from both in Japan and in Africa.

3. Hiroshima Agricultural Gene Bank

Hiroshima Agricultural Gene Bank was established in 1989 as a research foundation independent of government although infrastructure was constructed and donated by the prefecture government. From its start, the Gene Bank had an objective to serve for the promotion of local agriculture in order to compete with other nearby production areas. The Gene Bank emphasized the utilization of diversity of varieties both indigenous and introduced. Necessary technologies, again both traditional and advanced, were provided by local (governmental) experiment station. Although most of the samples have been introduced from outside of the region, Hiroshima

Gene Bank has made great efforts to collect traditional local varieties which are no more cultivated commercially and only used for family use and/or ritual use. 384 indigenous varieties were collected. These crops include vegetables (turnip, radish, and squash), beans, buckwheat, and miscellaneous grains.

3.1. Re-introducing local traditional cultivars

Hiroshima Gene Bank has been successfully re-introducing traditional local varieties including vegetables into the marginal area for regional development. This aims to develop new products for local consumption, which can be taken care of by elderly farmers and at the same time marketable.

This re-introduction program at Hiroshima is called 'seed loan'. It does not mean farmers are not able to afford to buy their seeds. Simply because these obsolete varieties are not available at market. Those farmers who obtained seeds from gene bank are expected to return the same amount of seed in the next year.

This system has a few unique characters to be successful. They are:

- strong commitment of the institute as a local gene bank to regional development. Primary objective of the gene bank is not the research activities within the institute but selection of new varieties for the region which will be adopted by local farmers;
- existence of infrastructure for genetic resources activities. Re-introduction is managed by the gene bank operated by an independent foundation, but infrastructure was originally constructed by government;
- close and functional links between gene bank and farmers. Farmers have access to gene bank for provision of seeds and technical information;
- involvement of extension officers. Exploration and collection of local varieties were made by retired extension officers who knew the details of traditional farming and had trusting relations with farmers. Re-introduction is processed through extension offices which are located close to farmers' place;
- innovation of products cooking methods. In order to promote marketing, cooking demonstration was organized by the gene bank with the help of local dietitians; and
- Finally, participation of local female farmers by their own initiative. Local old female farmers took initiative for re-introduction of vegetables hoping that it would be good produce for their morning open market nearby.

3.2. Provisional evaluation of the program

Local aspect

The most successful example of this re-introduction is local turnip called 'Ota Kabu Turnip' (*Brassica rapa* L.). Traditionally, people used this vegetable mainly for pickles and sometimes ate root as snack. Since Ota kabu turnip is almost wild type leafy vegetable, it does not need much care during its cultivation. It can survive under snow and provide precious food materials as the source of vitamins during winter. It does not need chemicals. Furthermore, farmers utilize the nature of traditional varieties which produce buds at scattered period. Farmers harvest small amount of buds every morning for a long duration during early spring. This means that labor is not too intensive for those old farmers and consumers can enjoy the produce for long time during early spring.

Global aspect

This initiative can also provide global genetic resources system with an alternative cycle of conservation and utilization of genetic resources, and this enables farmers in marginal area may equally share the benefits of formal genetic resource conservation system with other stakeholders such as breeders and commercial farmers.(Figure 2.)

3.3. Lessons learnt

Utilization of traditional varieties with some marketing value will be one of the most possible ways of effective conservation and utilization of local genetic resources. The example, although from different region, may be applicable in marginal agriculture in various regions in development and utilization of new incentives for local genetic resources. I hope this case continues to show a success, both in conservation of local varieties and in income generation for small scale farmers.

A. Gene Flow in Traditional Farming

seeding→on farm diversity→harvest→storage→(exchange)→seeding

↓

consumption as food

B. Gene Flow in Orthodox Gene Bank

On farm diversity→collection→evaluation→conservation→exchange→*

(Marginal area)

*→formal breeding→release of advanced variety→use by farmers

(Favorable area)

C. Gene flow of traditional varieties in Hiroshima Gene Bank Case

On farm diversity→collection →multiplication → evaluation → conservation→formal breeding→(same as B)

(Marginal area)

↓(seed loan) ↑partial return

re-introduction→use by farmer (→ continued use)

(Marginal area)

□□ shows activities within formal gene banks

Figure 2. Conceptual Sketch of an Alternative Cycle of Conservation and Utilization of Genetic Diversity of Traditional Crops

Modified from Almekinders(2001) and Iwanaga et al (2000)

4. Mother-Baby Trials as Participatory Learning and Action-Oriented Research in Burkina Faso

Mother-baby trials were conducted in Burkina Faso, where rapid introduction of improved varieties are promoted by government after enactment of new seed law, with interview survey for farmers on perception of their criteria to evaluate varieties.

4-1. Preliminary surveys

Two villages, one with long experience of participatory research with Research Organization (referred as INERA village), and one with non experience (referred as Non-INERA village) respectively in three different agro-ecological regions were chosen.

From the preliminary study, different functions of traditional varieties were expressed by many farmers. Although there was no significant difference found between two villages in each region in terms of perception on criteria on varieties, some information was obtained that villages with experiences working with INERA has more positive acceptance of improved varieties. Also, it has been found that influences of extension activities to farmers by technicians in baby trials may have changed their behavior.

From the interview with technicians, it has also been found that 'dissemination of knowledge' approach is common as an attitude of technicians rather than communication to extract farmers' knowledge. Simultaneously, farmers are also inclined to accept external input rather than carrying our trials and errors when external projects were introduced.

4-2. Summary of participatory research

However, more detailed investigation revealed that different farmers groups have also different preferences. Farmers in INERA village who have also been exposed our experiments for more than one year has more variable selections including both Improved Varieties (IVs) and Local Varieties (LVs). Within LVs, different varieties were chosen by farmers of different villages although these villages are located nearby each other. Earliness and productivities are most frequent answers for selection; other traits such as tastes, tolerance to wet weather, applicability for mixed cropping were also reported. Farmers with more information might have tendency of choosing more varieties. If shown IVs with fertilizer application, farmers with less experiences of intervention from technicians tended to choose IVs.

Importance of managing more than one variety was also recognized. For IVs, necessity of irrigation and other input including fertilizer were also recognized and farmers chose these varieties on condition that such input are available.

Most of the participating farmers answered that improved varieties are better than traditional varieties, which may have been due to the instruction of technicians involved. Triangulation by group workshop has suggested this bias; therefore, further methods need to be established to mitigate the influence of such guidance from technicians on perception of improved and traditional varieties by farmers. The more farmers are exposed to formal extension systems and development projects, the deeper they tend to depend on external input. Integration of farmers' own practices and introduced input and technologies is critical to manage agro-biodiversity existing in the villages effectively. If farmers are influenced by external actors for direction, different intervention may lead more participatory approach.

4.3 Lessons learnt and further research

In many developing countries, agricultural and rural development has been implemented through introduction of Improved Varieties (IVs). In Burkina Faso, Ministry of Agriculture has a clear policy of introducing certified seeds of IVs through market mechanism especially after recent enactment of new seed law. However, problems such as non availability of suitable varieties for farmers and enough seeds in time are found commonly. One way of solving these problems is to establish a formal seed provision system of IVs from basic seeds to multiplication and marketing. Another way is to improve the existing system of seed provision and procurement within rural communities including Local Varieties (LVs). For both ways, it is necessary to understand the farmers' perception of crop varieties and seed security.

In this research, the authors try to find farmers' perception of criteria for preferences among varieties and distinguishing varieties including both Improved and Local Varieties.

In order to capture and integrate farmers strategies for variety management into crop improvement and extension, visits to crop fields by researchers at different stages of crop growth are prerequisite. Compared with interview methods during dry season, workshop with Mother-baby trials at fields may bring more precise information of farmers' reality. However, considering the resource scarcity, efficient methods need to be developed.

Table 1 Examples of farmers' statements for selection criteria

Var	F/G	#	Statements
A4	VI	P16	It has a better productivity but requires treatment. Its cycle is early but longer than L3. The pods are large and the grains more provided than in L3. It is better for fodder. (6)
		P18	Produces three times in addition to its sweetened taste. It has a better productivity if ever it is treated. It needs pumping to produce well. (8)
L1	III	P14	Good productivity with long pods. The stem is drawn up with the result that the pods do not rot whatever the rain that falls. The grains are solid and easy to cook. It is a short cycle variety. The productivity which is concrete influenced the change of choice this time.(7)
		P15	Better productivity, short-cycle, and good taste. It does not need seasoning for consumption. The grains are small but very dense. I prefer it for the next production in addition to other varieties. A producer should not be satisfied with only one variety even if it is better.(10)
L3	VI	P14	It is a much known traditional variety with the best productivity. Only she does not like the soils soaked with water because it produces less and rots at this moment. (9)
		P19	It is a traditional variety and can be mixed with the sorghum. Its leaves are edible and are a good fodder It has the best productivity but its cycle is average.(8)

Notes: Var= variety number, F/G= farmer group number, #= farmer number.

5. Participatory Seed Management and Distribution within Global Context

From the above two cases, we may be able to learn the importance of participation of local stakeholders as well as outside stakeholders such as national and international research organizations. However, actual collaboration among such different stakeholders is quite difficult to realize. Framework such as International Treaty for Plant Genetic Resources for Food and Agriculture will have functions of facilitating such collaboration using both monetary and non-monetary distribution of benefit derived from sustainable and participatory management of local genetic resources. By this way, genetic resources can be effectively utilized both in the areas where industrialized agriculture is implemented usually far from the origin of such resources and in the areas where those resources were originally maintained. Figure 4 shows this idea in schematic manner. In order for this framework to work, attitude of extension and research staff both in government and non-government sectors towards farmers is critical. Leaning from farmers is a starting point for any activity concerning sustainable management.

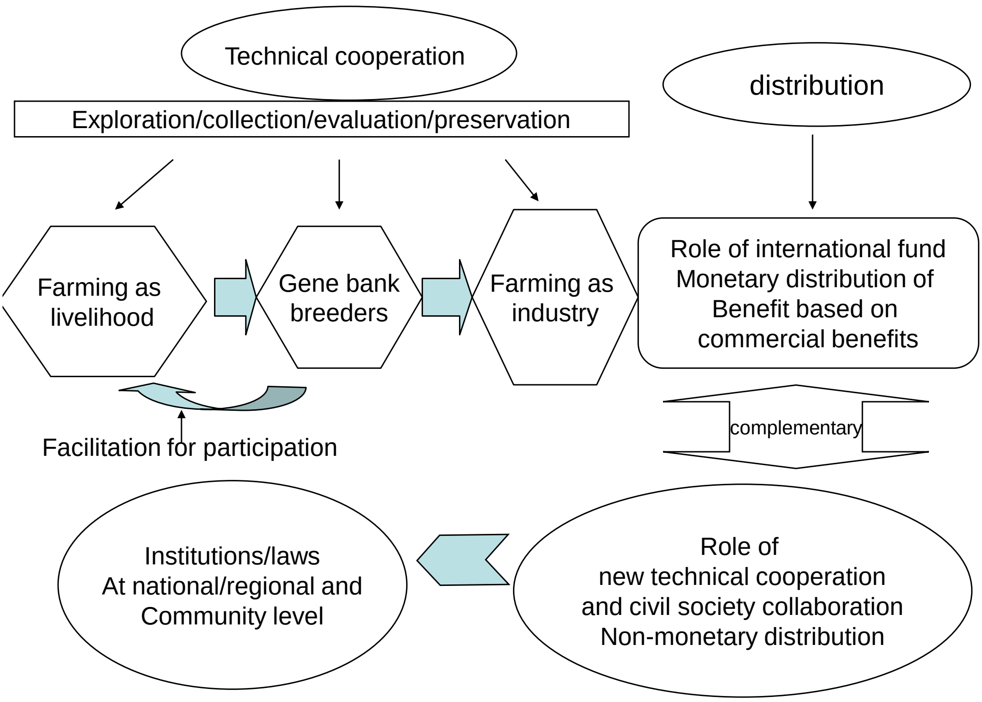

Fig.4 Possibility of participatory seed development and production within global system

6. Conclusion

Two cases revealed that there is diversity of frameworks to understand the importance of agro-diversity, especially crop varieties, by farmers. History of genetic resources study showed that the most important stakeholders in management were not considered thoroughly in the argument.

Based on this background and lessons learned from two cases, rather fundamental questions to be asked are why governments in developing countries are inclined to introduce formal system of production and distribution of certified seeds although scientific data supporting the merits of this approach have not been established yet. Socio-economic findings clearly suggest the high capacity of farmers on maintenance of genetic integrity, thus improvement of systems based on farmer harvested seeds in local areas need to be enhanced for sustainable agro-biodiversity management for development.

Further international collaboration is suggested in the area of research-extension synergy especially through integrating learning process of researchers and extension workers from farmers. Together with conventional international cooperation on improved varieties and industrialized agriculture, this alternative approach will enable agriculture in developing counties such as Ethiopia more diverse and give farmers more opportunities for endogenous development by farmers themselves.

Note: Research in Burkina Faso was carried out by JICA Project Research with K. Nemoto, D. Makihara, and D. Balma, partly funded by JSPS grant No. 19510044 and Mitsui & Co., Ltd. Environment Fund.
Parts of the data were collected by Mr. H. Inaba, Ms. M. Nagai, and Ms. N. Tamura, JOCV members together with INERA technicians.

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Recent Development in Seed Systems of Ethiopia

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Abstract

On average, 12 million hectares of land is cultivated by major food crops over the last five years in Ethiopia, of which 10,979,645 hectares was covered by non-improved local seeds. Of the total annual arable land coverage by major food crops, 96.5% is covered by local seed and 3.5% is by improved seeds. The annual average seed requirement for cereals, pulses and oil crops is estimated to be over 400,000 tons. Demand for improved seed is still increasing rapidly from time to time over the last seven years. The establishment of several private and public seed enterprises in the regional governments has increased the number of actors involved in the seed sector. Besides, due to some special initiatives of the government such as crush seed production programs, scaling up/out of best crop technologies and shift from rain fed to use of irrigation, there have been tremendous contributions to the formal sector and the huge gap between demand and supply has been narrowed down. To this effect, basic seed supply of hybrid maize increased from 44% in the 2006/07 cropping season to 115% in 2009/10, showing seed supply exceeded the demand in the history of the country's seed system. Certified seed supply for both hybrid and non-hybrid crops also increased from 28% and 33% to 58% and 60%, respectively in the same period. Demands of farmers often change over the changing condition that calls for demand re-vision during planning phase based on the dynamic condition of farmers' situation.

1.Introduction

Seed is a key input for improving crop production and productivity. Increasing the quality of seeds can increase the yield potential of the crop by significant folds and thus, is one of the most economical and efficient inputs to agricultural development (FAO, 2006).

Generation and transfer of improved technologies are critical prerequisites for agricultural development particularly for an agrarian based economy such as of Ethiopian. Despite the release of several technologies, particularly of improved crop varieties, there has been limited use of improved seeds by the majority of farmers (CSA, 2010). 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.

This paper, is therefore, aimed at providing an overview and assessing the current seed systems operating in the country and reviewing initiatives in the area and documenting best approaches.

2. Seed Systems in Ethiopia

Seed system in Ethiopia represents the entire complex organizational, institutional, and individual operations associated with the development, multiplication, processing, storage, distribution, and marketing of seed in the country. Farmers, particularly smallholder ones, are involved in multiple kinds of seed systems, which can guarantee them in obtaining the quantity and quality of seeds they need and to market their produce.

Seed systems in Ethiopia can be divided into two broad types: the formal system and the informal system (sometimes called local or farmers seed system). Both systems are operating simultaneously in the country and difficult to demarcate between the two. There is however, a fact that the formal system is the original source of improved seeds in the informal system. There is also a system referred to as integrated seed system. Other forms of seed systems operating in both systems also exist such as Community-Based Seed System (CBSS). Though not well developed, few commercial seed systems, as part of the formal system, are also operating in the country.

2.1. Formal Seed System

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. All actors have inter-dependent roles in the system and inefficiency of one actor will automatically affect negatively the performances of the rest of the actors. NARS (EIAR & RARIs) is responsible for variety development and supply of initial seed, and ESE and RSEs are playing key roles in mass production of improved seeds. MoA is also involved in variety release, multiplication, certification, and distribution of seeds in the country. Private seed growers and other farmer institutions such as unions and cooperatives are also playing key roles in multiplication and distribution of different classes of seeds. 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 formal seed system of any country. They help determine the quantity, quality, and cost of seeds passing through the seed system (Maredia, *et al.,* 1999).

The Ethiopian government has enabling policy framework for agricultural research and technology generation and is fully supporting the research system by allocating appropriate resources. Therefore, the country's agricultural research system (NARS) has developed and released more than 664 varieties of 50 different crop types (MoA, 2010). ESE has only been able to produce 111 different seeds of just 26 different crop varieties in 2009 cropping season. Seed multiplication by ESE focused mainly on two cereal crops (wheat and maize) and annual supply of certified seed by the enterprise doesn't exceed 20,000 tons (Marja H. *et al.*, 2008). Wheat and hybrid maize constitute about 85% of the total output of the enterprise.

2.2. Informal Seed System

The informal seed system, also known as local system or sometimes as "farmers" system, is called informal because it operates under non-law regulated and characterized by farmer-to-farmer seed exchange. According to Cromwell, Friis-Hansen, and Turner (1992), five key features distinguish the informal from the formal system. These are, the informal system is traditional, semi-structured, operate at the individual community level, uses a wide range of exchange mechanisms, and usually deal with small quantities of seeds often demanded by farmers.

In the context of some countries like Ethiopia, the informal system is extremely important for seed security. The bulk of seed supply is provided through the informal system, implying its importance in national seed security. About 60-70% of seed used by Ethiopian smallholder farmers is saved on-farm and exchanged among farmers, and the remaining 20-30% is borrowed or purchased locally. The informal seed system (either self-saved seed or farmer-to-farmer seed exchange) accounts for 90% of the seed used by smallholder farmers (Belay, 2004), while the share of improved seed is less than 10% (Tables 2 and 3). The majority of Ethiopian farmers show a tendency of depending on the informal system due to the following key reasons

- It is relatively cheaper and readily available in the farmer's villages just at the time of seed is needed.
- It allows use of seeds after testing on primary adopter farmers.
- It is more reliable and its sustainability is more guaranteed than the formal system.

As depicted in Table 1, on average more than 12 million hectare of land are cultivated by the major food crops over the last five years (2005-2010). These are: cereals, legumes, oilseeds, root crops and horticultural crops. In 2009/10 cropping season, out of 10,979,645 hectares (84.75%) were covered by local seeds (Table 2). Moreover, about 71.3% of the total cultivated area is covered by major cereals: tef, maize, barley, wheat and sorghum, followed by legumes (11.5%) and oil seeds (6%). In the same cropping season, the annual area coverage of tef, maize, sorghum, wheat, and barley are 2.59, 1.77, 1.62, 1.68, 1.13 million hectares, respectively. Major pulses (faba bean, field peas, beans, chickpeas, grass pea, and lentil) occupy 14.9 million hectares, and oilseed crops: noug, linseed, rapeseed, peanut, sunflower, sesame, and castor bean is about 0.78 million hectares (Table 1).

Table 1. Area cultivated (ha) by major crops over the last five years (2005/06-2009/10) Cropping season

Crop category	2005/06	2006/07	2007/08	2008/09	2009/10
Cereals	8,072,561	8,463,080	8,730,001	8,770,118	9,233,025
Pulses	1,292,063	1,378,939	1,517,662	1,585,236	1,489,308
Oil crops	796,397	740,847	707,059	855,147	780,916
Vegetables	117,578	95,194	119,091	162,125	138,393
Root crops	168,836	188,917	184,329	145,742	212,208
Other temporary	77,554	97,677	84,977	69,103	63,418
Permanent crops	767,582	823,121	1,039,313	906,518	53,086
Total	11,292,571	11,787,775	12,382,432	12,493,989	11,970,354

Source: CSA, 2006-2010

Table 2. Area covered (ha) by informal seeds over the last five years (2005/06-2009/10)

Crop	Cropping season				
	2005/06	2006/07	2007/08	2008/09	2009/10
Cereals	7,636,935	8,127,710	8,309,899	8,333,097	7,660,560
Pulses	1,283,564	1,373,914	1,509,394	1,568,457	1,358,379
Oil crops	790,471	736,791	702,518	851,626	706,361
Vegetables	116,298	94,636	118,026	159,626	122,832
Root crops	167,189	186,804	180,624	143,761	183,254
Other annuals	77,000	97,575	83,041	68,048	56,431
Permanent	750,353	810,364	1,023,591	885,427	48,927
Total	10,821,810	11,427,794	11,927,093	12,010,042	10,136,744

Source: CSA, 2006-2010

The total area covered by improved seeds in 2009/10 (2002 E.C) cropping season was about 361,231 hectares. In the same season, the largest volume of improved seeds used was that of maize and wheat, which amounted to about 5,720 and 4,690 tons, which has covered the largest area under improved seeds cultivation estimated to be about 210,000 and 38,000 hectares, respectively (Table 3).

Table 3. Area covered (ha) by improved seeds (formal) during 2005/06 to 2009/10

Crop	Cropping season				
	2005/06	2006/07	2007/08	2008/09	2009/10
Cereals	429,536	335,369	412,629	430,937	322,819
Pulses	5,224	5,025	6,309	14,918	12,912
Oil crops	1,833	4,056	2,273	2,328	9,139
Vegetables	779	559	501	1,899	2,788
Root crops	813	2,114	2,251	799	3,721
Other annuals	70	102	-	-	-
Permanent	9,681	11,742	5,828	13,120	9,852
Total	447,936	358,967	429,791	464,001	361,231

Source: CSA, 2006-2010

Table 4. Comparison of area coverage (ha) by the informal and formal seed system during 2005/06 to 2009/10

Total	2005/06	2006/07	2007/08	2008/09	2009/10
Informal	10,821,810	11,427,794	11,927,093	12,010,042	10,136,744
Formal	447,936	358,967	429,791	464,001	361,231
% informal	96.03	96.95	96.52	96.28	96.56
% formal	3.97	3.05	3.48	3.72	3.44

2.3. Integrated Seed System

The line between the formal and informal seed sectors can become somewhat blurred, as seeds of improved varieties can be saved by farmers and eventually considered as "local variety" or "local seed" after some years of usage. In addition, in Ethiopia there have been attempts made by the government and NGOs to promote quality seed production and distribution through market channels for landrace varieties, although until now the volume they represent is quite small (Lipper *et al.*,2005). Thus, the formal and local seed systems are not always as distinct or separated as the two labels may imply something to integrate and synergize both systems.

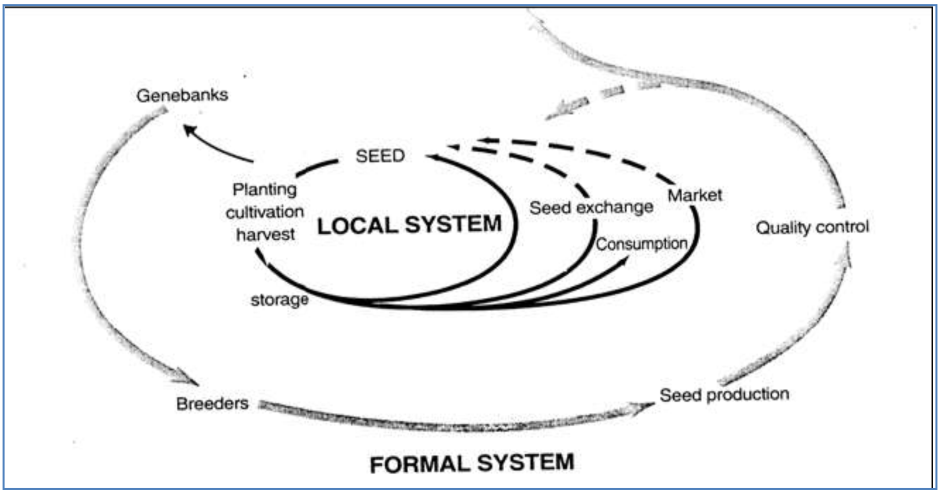

Figure 1. The formal seed system and the local system of farmers' seed supply *(Adapted from Almekinders and Louwaars, 1999)*

As one can see from figure 1, the formal and local seed systems are the two major systems serving as sources of farmers' seed supply, having interactions to each other. Three aspects of the integration between the systems are of notes:

- Materials themselves flow between the two systems, creating integration.
- Farmers themselves often draw seed from both systems for different kinds of seeds.

- Furthermore, farmers sometimes use different channels for the same crop.

It is obvious that the two systems are interacting in many ways and this interaction is found to be beneficial. Integrating the formal and local systems is, therefore, important to exploit benefits of the synergetic impacts as a result of integration on addressing seed security and sustainability in the country.

3. Current Situation in Ethiopian Seed Systems

Ethiopian seed system has been confronted with several challenges. During intervention activities made so far, the following were identified as major challenges of the general seed system of the country:

- Lack of proper linkage between different actors involved in seed systems;
- Inadequate supply of good quality seed at affordable prices;
- Focus on few crops (maize & wheat) in the formal system and other beneficial crops (such as pulses & oilseeds) remain orphans;
- Low level of private sector involvement in the formal system;
- Inefficient seed promotion, distribution and marketing mechanisms;
- Weak variety release and seed quality assurance system.

A core goal of the government of Ethiopia within the framework of ADLI strategy is to raise crop yields through a centralized and aggressive extension-based push focusing on technology packages combining improved seeds, fertilizers, credit and better management practices. The main objective of scaling-up/out of best practices is to increase agricultural production and productivity thereby improves household income and livelihoods. In the recent years, agricultural GDP grew at levels close to double figure, a pattern confirmed by just looking at cereal production growth rate. The success was registered through scaling-up/out of best practices through the use of improved seed, fertilizer and agronomic practices and by producing two to three times a year using irrigation.

Based on reports from Central Statistics Authority (CSA, 2005-2009), cereal production over the period increased by more than 4% per year (Table 1). At the same time, area under cultivation and production had also increased at a rate of 2.5% and 2% per year, respectively. Among cereals, the largest increases in all dimensions were registered in tef, wheat and sorghum in that order.

According to reports from Central Statistics Authority (CSA, 2010), fertilizer was applied on 4,734,474 ha of land which is 39.38% of the total area cultivated in 2010 cropping season. The demand and use of inputs by smallholder farmers have been increased tremendously. As a result, the amount of fertilizers (DAP and urea) supplied to regional states had increased from 375,717 tons in 2006 to 595,261 tons in 2010. Including the leftover amount of 231,303 tons in the previous season, an additional 595,261 tons of fertilizers were imported during 2010 cropping season, and a total of 826,564 tons was distributed in 2010 season. This figure is 40% more than the volume imported in the previous season (Table 5).

Table 5. Fertilizer distribution (in tons) to farmers during (2005/06-2009/10)

Year	DAP	Urea	Total
2006	251,156	124,561	375,717
2007	259,020	129,121	388,141
2008	265,768	138,988	404,756
2009	289,446	158,075	447,521
2010	394,029	201,232	595,261
Total	1,459,419	751,977	2,211,396

Source: MoARD, 2010

Table 6. Comparison of total amount of fertilizer imported, supplied to regions and used by farmers in 2010/11 (tones)

Description	DAP	Urea	Total	% used *vs* purchased & supplied
Leftover from 2009 season	204,412	96,874	301,286	
Imported in 2010 season	324,792	200,485	525,278	
Total supply by 2010/11 season	529,204	297,359	826,564	
Transported to regional states	394,027	201,232	595,261	72.00
Amounts used by farmers	337,950	177,224	515,175	62.33

Source: MoARD, 2010

There is, however, discrepancy between total amount of fertilizer supplied to regions and used by farmers. Of the total amount of fertilizers collected by regions, 62% was used by the farmers for 2010 '*Meher*' (major rainy) season (Table 6). The reason why farmers couldn't use the amount of fertilizers provided may be associated with little working capital, uncertain access to credit and often cannot afford the cost of improved seed and the fertilizer. Thus, one can understand that most farmers use less amount of fertilizer per hectare than the recommended rate. This in turn has negative effect on yield potential of different crops; thereby reducing productivity and total annual production. Farmers opt to apply the majority of fertilizers they have to cereal crops and this can be witnessed by ever increasing productivity and production of cereal crops in the last five years period (Table 7).

Table 7. Area covered (ha), crop production (q) and average productivity (q/ha) over the last five years

Crop category	Parameter	2005/06	2006/07	2007/08	2008/9	2009/10
Cereals	Area	8,463,615	8,730,001	9,019,054	8,770,117	9,233,024
	Production	128,660,941	137,169,908	146,800,700	144,964,059	155,342,280
	Productivity	15.2	15.71	16.28	16.61	17.00
Pulses	Area	1,228,564	1,344,091	1,446,730	1,391,731	1,328,618
	Production	13,661,202	15,806,944	17,445,197	17,452,634	16,451,467
	Productivity	11.12	11.76	12.06	13.04	10.72
Oil crops	Area	740922	707059	875855	855147.41	780915.89
	Production	4968294	5406849	7454594	6557044	6436144
	Productivity	6.71	7.65	8.51	8.96	9.81

Source: CSA, 2006-2010

3.1. Seed Demand *vs* Supply

Since the establishment of Ethiopian Seed Enterprise as the first public and formal seed sector, the enterprise has remained the sole producer and supplier of improved seeds for over three decades. The enterprise is also playing the leading role for the advent of organized seed production and supply system in the country. Despite the better capacity ESE has, seed supply remained far behind the demand in those years. The huge gap between the demand and supply has existed in the history of the enterprise. Stimulated by the fast agricultural development growth over the last seven years, demand for improved seed is still increasing rapidly from time to time in the country. The overall annual average seed requirement for cereals, pulses and oil crops is estimated to be over 400,000 tons (Marja H. *et al.*, 2008). However; the average yearly supply of improved seed doesn't exceed 20,000 tons since the establishment of ESE.

In the recent years, following the establishment of several private and public seed enterprises by the regional governments increased the number of actors involved in the seed sector. The Ethiopian government took the initiatives of organizing and bringing together those actors and combining their efforts to increase improved seed supply in the country. As a result of shift in seed multiplication strategy, production and supply of improved seeds particularly that of hybrid maize and wheat was considerably improved since the last three years. Determination of farmers' seed demand followed by demand-oriented seed multiplication and supply is one of the strategies undertaken. Besides, increasing the number of actors involved in the seed businesses is another key initiative of the government in support of the seed system. Among others, establishment of regional public seed enterprises and offering special supports to the private seed sector can be mentioned as typical examples. The majority of actors, however, often involved in seeds of crops that can offer them profit margins and some of useful crop varieties demanded by farmers were remain neglected. In order to avoid this limitation and fill seed supply gaps the government has also launched a program called "crush seed multiplication" since the last three years. The program has been executed by the coordination of Ethiopian Institute of Agricultural Research (EIAR), ESE & MoARD on three strategic crops, namely: maize, wheat, and rice. As a result of this initiative, there have been tremendous contributions to the formal sector and the huge gap between demand and supply of initial seed has been narrowed down. To this effect, basic seed supply of hybrid maize exceeded the demand by 2010/11 production year in the history of seed supply in the country (Table 8). The program, however, has limitations in terms of long-term ownership and sustainability as it is undertaken by a 'Technical Committee" (TC) containing experts from the three organizations. Thus, in order to sustain the program and undertake other similar initiatives, the input supply system, which has currently been operated by the TC, should be institutionalized and strengthened in such a way that it could take the entire ownership.

Table 8. Demand and supply of hybrid maize basic seed over the last five years (2005/06-2009/10)

Production year	Demand (t)	Supply (t)	% Supply
2006/07	1,179	515	43.68
2007/08	2,427	1,023	42.15
2008/09	2,224	1,145	51.48
2009/10	2,755	1,509	54.77
2010/11	5,606	6,450	115.05

Source: MoARD, 2010

Despite the aforementioned several efforts undertaken by the government, there is often shortage of source seed, which limits commercial seed production in the country, mainly due to mismatches between seed demand and supply (Table 9). One of the reasons for the mismatch is that there is limited capacity to supply as much source seed as demanded and multiplication of initial seed, which subsequently delivered to mass producers, is not supported by irrigation and almost totally depend on main season rainfall. The other main reason is that demands of farmers often become volatile, indicating problems related with demand assessment and forecast during planning process, suggesting demand re-vision based on the dynamic condition of farmers' situation has paramount importance. Moreover, seed production supply system in the country has focused only on hybrid maize and wheat varieties that limited farmers' option to other beneficial crops. This makes farmers merely depend on farm-saved varieties which are genetically low productive. As depicted in Table 8, the overall seed supply of all crops is 28%, and the maximum supply of 31% was for cereals out of all crops grown in Ethiopia

Table 8. Comparison between improved seed demand and supply over the last three years (2008/09 to 2009/10)

Crop category	Demand (t)	Supply (t)	% supply
Cereal crops	2,056,469	638,856	31.07
Pulse crops	312,155	33,159	10.62
Oil crops	34,341	3,435	10.00
Total	2,402,965	675,450	28.11

Source: MoARD, 2010

Although the gap still exists in the case of certified seed supply for both hybrid and non-hybrid crops, there is also an increasing trend over the last four years in fulfilling the demand (Table 10).

Table 10. Demand vs supply of certified seeds of hybrid and non-hybrid (in qt) over four years

Production year	Hybrid seed			Non-hybrid seed		
	Demand	Supply	% Supply	Demand	Supply	% Supply
2007/08	123,777	35,244	28.47	62,9422	205,680	32.68
2008/09	143,847	86,787	60.33	841,458	246,051	29.24
2009/10	193,079	95,735	49.58	737,992	278,353	37.71
2010/11	333,249	193,123	57.65	723,588	433,049	59.85

Source: MoARD, 2010

Another intervention was scaling-up of proven technologies available in the research system, a strategy initiated and undertaken by EIAR. The main objective of technology scaling-up was stretching to potential technology application ecologies in Oromia, Amhara, South, and Tigray regions, and in four emerging regions mainly pastorals and agro-pastorals (such as Somali, Afar & Benishangul Gumuz regions) with appropriate technologies best fitting to their respective situation. This initiative has contributed significantly to productivity, production, and benefits. The strategy is focusing on creating integration among all actors mainly research, extension and farmers with the support of administrative organs and NGOs. This approach has played a significant role in putting huge amount of seeds in the hands of small scale farmers, which potentially enhance the informal system. In 2009/10 cropping season, about 67,393 quintals of seeds were produced in the above mentioned regions through scaling up program (Asnake F. *et al.* 2010: unpublished data.The 2009/10 cropping season seed multiplication and distribution data shows that from 360,272 quintals of seeds allotted to regions only 264,039 quintals (73.29%) had reached to farmers and finally planted. This indicates that ESE and RSEs have significant amount of carry-over seed stock every year, while several farmers are not getting access to improved seeds. This problem was attributed to poor seed marketing (promotion and sales outlets) for reaching end users and/or the inabilities of the enterprises to meet the farmers need in terms of varietal choice and product quality (Table 11).

Table 11. Amount of improved non hybrid seeds (in qt) collected and planted by regions during 2010/11 cropping season

Crops	Amount of Seed		
	Allocated	Collected	Planted
Wheat	307,012.12	224,412.85	206,577.03
Barely	18,872.33	16,370.00	13,209.30
Tef	18,210.50	20,358.84	17,868.50
Sorghum	197.00	928.87	874.92
Rice	0.00	54.35	26.80
Faba bean	2,748.00	2,489.60	2,101.80
Linseed	469.39	279.00	708.10
Lentil	1,121.00	2,448.90	2,133.60
Haricot bean	3,285.00	12,857.70	10,584.00
Chick pea	6,586.00	1,522.32	871.82
Field pea	195.00	2,512.04	2,497.04
Soya bean	823.09	0.00	0.00
Sesame	0.00	52.25	52.25
Ground nut	0.00	1,819.00	1,819.00
Rape seed	0.00	19.00	1.00
Forage	0.00	4,683.00	4,683.00
Pepper	20.00	30.41	30.41
Others	732.98	0.00	0.00
Total	360,272	290,838	264,039

Source: MoARD, 2010

3.2. Seeds Supply by ESE

The majority of commercial seed production in Ethiopia is in the hands of ESE for several years since its establishment. Currently, however, three regional seed enterprises: Oromiya seed enterprise (OSE), Amhara seed enterprise (ASE), and Southern seed enterprise (SSE) have emerged with the aim to supply improved seeds for their respective region. In addition, the number of private farms involved in seed production is increasing particularly in Amhara and SNNP regions that have an important role in national seed supply.

Most of ESE seed production has been taking place on its own farms, state farms and contractual farmers' fields. Over the past decades, annual seed sell of ESE was between 7,000 to 22,000 metric tones (ESE, 2010). Most recently, the enterprise has been taking shift in strategy and as a result of crush seed production programs undertaken in 2009/10 cropping season, ESE alone produced about 54,326 tons of certified seeds, of which 52,430 tons (96.51%) is for cereals (Table 12). This shows that there is a 61% increase in supply as compared to what was supplied in the preceding year (2008/09 cropping season). As indicated in the table, from cereals, about 78% of the produce was the share of wheat seed.

Table 12. Annual certified seed supply by ESE over the last five years (in tons)

Crop category	2005/06	2006/07	2007/08	2008/09	2009/10
Cereals	18,153	19,573	22,695	30,288	52,430
Pulses	1,678	1,977	1,969	2,841	1,485
Oil seeds	882	621	579	596	298
Horticultural crops	0.2	3	4.5	1.8	2.9
Fiber crops	24	-	3.3	-	100
forage crops	8.9	10.3	-	1.8	9.3
Total	20,746	22,184	25,251	33,729	54,326

Source: ESE, 2006-2010

3.3. Seed Supply by the Research System (NARS)

Once a new variety is developed and released from the national agricultural research system (NARS), be it at the federal or regional level, it is mandatory that the variety should be put into the seed production system. This requires a sequence of seed multiplication over several seasons as several classes of seed: as nucleus, breeder, pre-basic, and basic in order to get adequate amount for commercial seed production (certified seed). Since the first three seed classes are mainly produced in the research stations, seed supply by the national agricultural research system (NARS) is focusing mainly on these seed classes which often provided to seed producers to further multiplication as basic seed followed by certified seed.

There has been chronic shortage of initial seeds and the research system couldn't satisfy the demand of commercial seed producers. On the other hand, since the seed system of the country is not well developed, the little amount of seed produced hasn't been channeled into the appropriate seed system. After the development of the five years strategic plan, however, there has been development in the NARS seed system mainly of EIAR, which has changed its direction towards client-driven quality seed production in required quantity using supplemental irrigation. As discussed in the earlier sessions, the strategic plan also makes use of special approaches such as crush seed multiplication in order to augment seed production under normal season (rain fed) conditions, thereby fill the initial seed shortage.

Table 13. Seeds of different classes produced by EIAR during 2009/10 cropping season

Crop category	Amount of seeds (tons)				
	Breeder	Pre-basic	Basic seed	Certified	Total
Cereals	113	323	398	13	847
Pulses	33	41	76	-	150
Oil seeds	5	41	3	-	49
Potato	27	-	-	-	27
Cotton	0.1	2	24	-	26.1
Total	178.1	407	501	13	1,099.1

Source: EIAR, 2010

Table 14. Performance of breeder, pre-basic and basic seed production by EIAR and ESE during 2009/10production year

Seed class	ESE		EIAR		Total		Supply (%)	
	Plan	Supply	Plan	Supply	Plan	Supply	EIAR	ESE
Basic	47,903	34,613	8,161	4,996	90,677	39,609	81.05	38.00
Pre-basic	4,779	3,137	4,000	3,356	11,916	6,496	84.00	54.50
Breeder	-	-	1,136.0	1,769	1,136	1,769	156.00	-
Total	52,682	37,750	13,297	10,117	103,729	47,867	-	-

Source: EIAR, 2009/10

4. Lessons Learnt and way Forward

The aforementioned two seed systems (the formal and informal) were operating for several decades in the country and playing the lions share in supplying seeds for the entire crop production. Smallholder farmers are involved in either of the systems that can guarantee them with the quantity and quality of seeds they need. The government is committing necessary resources and technical support to the formal system to tackle the problem associated with seed shortage. Despite the all-round support provided by the government, the formal seed system is not yet developed to the level it should attain. On the other hand, the informal (farmers') seed system is operating with limited resources from the farmers without significant support from the government. It is well known that almost the entire seed supply in the country is based on rain fed seed production system. These are the key factors contributing for quality seed supply shortage in the country.

The major actor in the formal system, the Ethiopian Seed Enterprise, was remained the sole seed producer for years. Seed production by the enterprise is focusing mainly on two cereal crops, wheat, and maize; seeds of other crops are entirely supplied by the informal system (farmer-to-farmer seed exchange) and the research systems. The enterprise is trying to produce as much quantity of seeds as possible, but reports indicating that it was continuously facing inefficiencies particularly with respect to collecting seeds multiplied under farmers fields. One of the several reasons the enterprise has failed to collect contractual seed production is due to problems related to its pricing policy and capacity in terms of human and capital. The pricing policy of the enterprise is usually failed to respond to the ever changing local market situations. The price (particularly time of price adjustment) offered to farmers couldn't attract the interests of several farmers. As a result, most of the contractual farmers are insisting to give back what has been produced, and the seed is sold as grain in any local markets. The government understood that a single enterprise couldn't meet the huge demand of seeds in the whole country. As a result, took the initiatives to establish regional seed enterprises with the objective of supplying seeds demanded in the respective regions. Thus far, three high-level public seed enterprises are already established in the three major regions of the country (Oromiya, Amhara, and SNNP) and are playing significant roles in quality seed supply in their regions. Parallel to this initiatives, the government should also give due attention to the private seed sector in providing similar supports.

In countries like Ethiopia where the formal seed supply is inefficient, the informal system is extremely important for seed security of the nation. The majority of Ethiopian smallholder farmers are largely dependent on this system mainly through farm-saved seed exchange. The system is providing cheaper and readily available in the farmers' village at the right time of seed is needed. As a result, the majority of Ethiopian farmers show a tendency of depending on the informal system. The informal seed system is more reliable and sustainable, and thus need to be strengthened with special emphasis of formalizing the system through integration with the law-regulated formal system.

For one reason or another, the private seed sector is still undeveloped in the country. Special attention and support should be offered by the government particularly in making the working environment more encouraging to the private sector. Other farmer organizations involving in seed sector such as unions and cooperatives are also playing key roles in multiplication and distribution of different classes of seeds and other farm inputs. Such organizations, however, couldn't get capacity building supports so far from the government. Hence, necessary support, particularly with respect to training and important facilities should be provided to these organizations.

Legal issues, such as variety release procedures, intellectual property rights, seed certification programs, seed standard authorization and contract laws enforcement are also important components of seed systems determining the quality and costs of seeds passing through the seed systems in the country. These legal issues need to be strengthened.

Studies indicated that ESE and RSEs maintain significant amount of carry-over seed stock every year due to the fact that seed enterprises fail to meet farmers need in terms of varietal choice and timing of seed supply. Immature marketing system of the enterprises can also be considered as one of the key factors. Thus, coordination and linkages among all actors and pertinent stockholders is paramount importance that needs strengthening. Technology promotion and seed marketing should also be enhanced.

The current developments and initiatives in the national seed system have revealed the following key issues that need special attention:

- effective seed demand assessment mechanisms and genuine involvement of farmers/users during planning phase is crucially important;
- as seed is an expensive product, every seeds produced must be channeled into the seed system. Thus, appropriate systems which can strictly control seed outlets should be in place;
- demand-driven seed multiplication strategy and supply with value addition in the seed chain (with respect to quality, time and place of supply and fair pricing) should be looked into;
- two-to-three times seed production per year is needed to fill the huge gap between seed demand and supply. Thus, development of irrigation capacity particularly in the NARS seed system should be given the utmost priority;
- provide opportunities for consolidation of investments on capacity building, basic facilities, infrastructure and training activities on variety maintenance and initial (breeder) seed production at national and regional levels;
- establish clear and simple institutional and functional linkages between research and seed producing institutions;

- formulation and implementation of clear seed policies in the country and establishment of executing institutions is highly important;
- capacitate experts and extension agents that can strengthen the entire integrated seed system; and
- as the involvement of the private seed sector is largely motivated by profit making, seed policies and ethics of seed production and marketing should be maintained so that seed quality shouldn’t be compromised.

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Agro-biodiversity in Ethiopia: a Case study of Community Seed Bank and Seed Producing Farmers

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Abstract

The research is a case study based on experiences of Ethio-Organic Seed Action, an NGO, MARC supported farmers based seed multiplication, and Sasakawa Global 2000 supported farmers based hybrid maize seed production. The required data was generated using a questionnaire in 2010. The result shows that both approaches can contribute in ensuring seed security and better income to the farmers especially for farmers involved in hybrid maize seed production. However, the farmers based seed production forces farmers to take high risk of input use in case of climatic shocks. Community seed banks have shown considerable contribute both to Agro-biodiversity management and Seed security for farmers. Thus, it is important that these approaches are promoted widely for improved accessibility of seed at local level and also to sustain agro-biodiversity in the country.

1. Introduction

The 10th meeting of the Conference of the Parties (COP10) to the Convention on Biological Diversity (CBD) was held in Nagoya, Japan, from 18 to 29 October in the 2010 International Year of Biodiversity. Agro biodiversity is one of the elements in a larger whole Biodiversity; it is an important resource for agricultural productivity next to land and water in rural development (FAO 1996). Also, management of plant genetic resources, crop species, and variety, as Agro biodiversity are indispensable factor to solve the problem of world food security and agriculture development (FAO 2010).

In addition, indigenous crop and variety, wild spices as landraces have been brought to international attention in recent years as resources for sustainable rural and agriculture development in Africa. For example, International Symposium "Underutilized Plant Species for Food, Nutrition, Income, and Sustainable Development" was held in Arusha, Tanzania on 3-7 March 2008 (GFU 2008).

Furthermore, a conference on biodiversity held during the Forum for Agricultural Research in Africa (FARA) Science Week on July 2010 in Burkina Faso, culminated in the establishment of the FARA-led Agricultural Biodiversity Initiative for Africa (ABIA). ABIA will support the efforts of sub-regional organizations, national agricultural research systems, and partners on agricultural biodiversity research and development in Africa; it will build partnerships for action, seek resources, and commission research; and it will engage in policy intervention, advocacy and public awareness to promote proper management and sustainable use of genetic resources in Africa (Mahider 2010) Biodiversity International will be a technical partner with FARA in the technical implementation of ABIA.

On the other hand, seed aid has occurred in many country, particularly in sub-Sahara Africa, include wide range of donors, implementers (both government and nongovernmental organization-NGOs), and approaches. Also, in Ethiopia, a lot of project has been carried out and incurring significant costs (USD 500million for Ethiopia alone) since 1974 (Sperling *et al.,* 2007). At the rural area in Ethiopia, over 85% farmers rely on rainfall. Therefore, seed security is most important factor for food security, also lack of seed and high risk agriculture production are considered to be the top priority (Regassa 2006)

However, seed industry in Ethiopia was substantial monopolized by Seed Enterprise which mainly selling improved and hybrid varieties and has limitation for seed production. Therefore, it is difficult for formal seed sector to meet framers' demand. There are serious needs for accessibility of demanded seed at local level, not only improved and hybrid varieties but also local variety (McGuire 2007).

In this study, the author tries to clarify the importance of the role of organization to Agro biodiversity management by Farmers for Rural Development in Ethiopia through a case study of Community Seed Bank (CSB) which supported by NGO, and seed production by farmers. In addition, a questionnaire survey was conducted to investigate factors influencing farmers' crop variety, seed source, and strategy for seed security.

2. Statement of the Problem and Question

In Ethiopia, over 80% farmers have no access to the improved seed.

Q.1. How is the seed security for farmer in the rural areas?
Farmers' interest might be high income and productivity. Therefore, local variety has replaced by hybrid and improved variety.

Q.2. Is it difficult to keep the Agro-Biodiversity by farmers through the community seed bank?
Some of Farmers started Hybrid seed production with some technology transfer by Government and SG2000.

Q.3. Is it possible to produce Hybrid variety Seed by farmers?

BOX1 Ethio-Organic Seed Action Project (EOSA)

Organized support to In-situ conservation in Ethiopia started in 1988 following several years of ex-situ maintenance of landraces with a farmer-based program implemented by the Seeds of Survival Program / Ethiopia and Institute of Biodiversity Conservation and Research Institute. Building on this, the UN Global Environment Facility launched a $2.5 million program in 1994 focusing on indigenous crop varieties maintained by farmers in dynamic agro-ecosystems. The program ran until 2002 and included institutional strengthening; community-based activities; and identifying incentives for in-situ landrace conservation. One of the greatest achievements of the program was that it brought all relevant sectors together.

The Ethio-Organic Seed Action Program (EOSA) was formed as a result of this earlier work. It is an NGO promoting integrated conservation, use and management of agro-biodiversity. With a guiding principle of "conservation through use", the program works with community groups, government, researchers, other NGOs and industry to promote greater integration, and especially the integration of producers with the market. The program works at local, regional, national levels.

The case study focused on EOSA's work with farmers around "Ejere", 105 km from the capital, Addis Ababa, which aims to help develop mechanisms to support small-scale farmers' ability to manage their resources-base; community-based seed networks; building linkages between farmers and industry through local markets; and the promotion of organic agriculture.

It appears that the project has been successful at promoting agro-biodiversity conservation and increasing the diversity of durum wheat and other crops in the program areas. The multiplication of the durum wheat was started in 1995 by the GEF project with only 4 spikes of durum wheat (400 gm. seed). EOSA has a vision to consider other indigenous crops in the future of its program of promoting organic products. The EOSA focus on organic production methods has also increased on-farm biodiversity through the promotion of Integrated Pest Management (IPM) instead of pesticides. It has also managed to develop market orientated mechanisms 'which support and encourage small-scale farmers' efforts in managing their natural diversity and on-farm resource-base.

Tamiru Mulualem and Joanne Manda

http://www.africanfarmdiversity.net/Case_Study_EOSA.html

3. Research Methodology

3.1 Study areas

The study areas were identified based on the intervention areas of the case organizations. Thus, for MARC farmers based seed multiplication, two sites namely Adama FRG site nearby the research center and Kacheama, which is 11 km from the district MoA office. For Ethiopia Organic Seed Action (EOSA), the sites were (i) Ejere CSB, Oromiya, East Shewa, Lume, Ejere, 230 HHs (F:24) and (ii) Cheffe CSB, Oromiya, East Shewa, Gimbichu, Cheffe Donsa, 564 HHs (F:69). Similarly, for Sasagawa Grobal 2000 (SG2000), the sites selected were (iii) Bure, "Marwelad West Goshama for hybrid maize seed grower's farmer and (ii) "Wogedad" West Goshama for wheat and hot pepper seed grower farmers in Amhara Region.

3.2 Data analysis

The study used secondary and primary data. Primary data were generated by individual interviews from selected target farmers using a questionnaire in Oromiya and Amhara Regions. The collected data was synthesized using qualitative and quantitative descriptive statistics.

3.3 Contents of Interview for Farmers

- Part 1. Household information
- Part2. About crop diversity (variety, area, production, price, consumption, seed amount)
- Part3. How to obtain seed (self seed, free form RC./Bought from SE/ MoA, price of seeds)
- Part4. About change before and after (income: sell to market, input: seed/fertilizer/labor)
- Part5. How to access to modern technology information
- MoA (FTC/DAs), research center, NGO, cooperative

3.4. Field work

Field work was conducted from 6th March 2010 to 22nd March 2010 and 7th June 2010 to 30th June 2010 for 6weeks. There were 3 survey sites and each site had 6 farmers for questionnaires (total 36 farmers).

Table1: Research sites and the number of respondents, gender, and average of year

Organization	Region	Zone	Woreda	Kebele	No of respondents
Far from MARC	Oromia	East Shewa	Adama	Kachama	M: 6, F: 0 (Ave 42.2 years)
Near MARC (FRG)	Oromia	East Shewa	Adama	MARC	M: 3, F: 3 (Ave 37.6 years)
EOSA Ejere CSB	Oromia	East Shewa	Lume	Ejere	M: 4, F: 2 (Ave 53.8 years)
EOSA Chefe CSB	Oromia	East Shewa	Gimbichie	Chefe Donsa	M: 5, F: 1 (Ave 48.0 year)
SG2000 Maize	Amhara	West Goshama	Bure	Marwelad	M: 5, F: 1 (Ave 47.0 years)
SG2000 Wheat Pepper	Amhara	West Goshama	Bure	Wogedad	M: 6, F: 0 (Ave 32.2 years)

4. Result and Analysis

4.1 How farmers obtain seeds

There was no seed exchange among the farmers at the MARC and SG2000 sites (Table 2). If farmers were thinking “We don’t need to exchange anymore because of everyone has same varieties and crops.” They might had already lost their crop/ variety diversity which lead to more Agro-biodiversity on their field.

On the other hand, Community Seed Banks (EOSA) is keeping traditional style how to obtain seed, but farmers have more choices for seed source (Table 2). In other words, farmers can choose and plant the seed, whichever improved variety and local variety, which they want to plant on their own field every year.

Table2: Farmers' seed source (How farmers obtain seeds

	Self Seed	Excha Nge	MoA /RC.	Market	Input Shop	ESE /ASE	Union Coop.	C.S.B.	F.R.G.
Farfrom MARC	◎	◎	△	×	×	×	×	×	×
Near MARC	△	×	◎	○	○	×	×	×	◎
CSB Ejere	◎	○	○	△	×	×	×	◎	×
CBS Cheffe	◎	○	○	△	×	×	△	◎	×
SG2000 (hybrid maize)	○	×	×	△	×	◎	×	×	×
SG2000 (Wheat, hot pepper)	○	×	×	△	×	◎	○	×	×

◎= Very often ○= Often △= only Few × = No

4.2 Agro-biodiversity and seed production

The perceived number of crops and varieties grown by farmers showed the positive contribution of Community Seed Banks (EOSA) in managing Agro-biodiversity at the community level in Ethiopia.

Near MARC (3.7) < SG2000 (4.2, 5.4) < Far from MARC (6.0) < EOSA C.S.B. (10.0)

*It shows perceived average number of crops or varieties grown by 36 farmers.

4.3 Seed production and Income

In Near MARC site and SG2000 site were included free seed from MARC from Amhara Seed Enterprise. Free seed was not included but in CSB seed purchase were only 828 Birr and 933Birr (Table 3). It shows that farmers don't need to buy seed since CSB usually contribute to local seed security for farmers.

Balance chart shows not significant difference among Cheffe CSB (20,422 Birr) and SG2000 Hybrid Maize and seed grower's farmer (25,735 Birr). It means that if we conduct more large scale survey or questioner it might show no difference in farmers' income balance between CSB (low input low income scenario) and SG2000 Hybrid Maize (high input high income scenario).

Table 3: Chart of Farmer's average income, seed purchase, input, and balance

Farmer	Average income	Seed purchase	Input (fertilizer, labor)	Balance (Birr)
Far from MARC	6,045	1,767	4,568	−290
Near MARC*	56,479	2,100	15,957	38,422
CSB Ejere	14,597	**828**	5,958	7,811
CBS Cheffe	27,831	**933**	6,476	**20,422**
SG2000* Maize hybrid	38,040	834	11,471	**25,735**
SG2000*Wheat, pepper	62,467	485	7,977	54,004

**Near MARC and SG2000 (from Amhara Seed Enterprise);*
Free seeds included

5. Conclusion and Discussion

In this study, it was shown that farmers obtain seed for their own field through informal seed sector in such a way that seed exchange among farmers and which are available as local seed sources.

Also, it was shown that some farmers can manage seed hybrid and improved seed production, and this will enable farmers to obtain high income, but also they have to take a risk of high input. (e.g. climate change shocks). Therefore, it was suggested that when researcher and extension workers introduce new technology for seed management, especially for hybrid and improved seed, they should aware importance of Agro biodiversity management aspect. It is one of the key points to take an integrated and balanced approach for agriculture development.

In a contrasting situation, the Community Seed Bank can contribute both to Agro-biodiversity management and seed security for farmers. In the short term, seed security for every farmer, and in the mid-long term, sustainable Agro-biodiversity management as local resources in the Rural Development should be the focus in Ethiopia.

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Open Pollinated Maize Seed Systems Linkages through Farmer Research Group in Central Rift Valley of Ethiopia

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Abstract

Though both systems have their own peculiarities and deficiencies, the informal seed sub-system is dominant over the formal seed sub-system. The informal one has a competence to serve local community; while it is relatively restricted in access to improved varieties and larger markets. Conversely, the formal sub-system is in better access to wide range of varieties, but fails to serve small-scale farming community. So, there is a need to ameliorate this situation by linking the two. In this respect, Farmer Research Group in open pollinated maize seed production and dissemination in the Central Rift Valley of Ethiopia is a point in case. Farmers evaluated and selected better yielding, drought tolerant, or nutritionally enhanced varieties. Subsequently selected farmers produced seed of the chosen varieties in close follow ups of researchers and seed experts. The seed shared on: sale, exchange, gift, and credit. Besides, Oromia Seed Enterprise purchased and disseminated to distant places. High rate, 90%, of farmer produced seed was dispatched. Personal contacts, farmers' field days, research, and agricultural development workers were the sources of information. Intensive dissemination took place 5.4 km radius from seed producers. Informal seed production is found socially beneficial and economically paying. Reasonable number of farmers accessed the seed on exchange, credit, and gift. The cost benefit ratio for the business was 20% to 80% over good and bad, respectively.

1. Introduction

Seed is a fundamental and the single most important input that affects the maximum output of other inputs as well in crop production (Almekinders and Louwaars 1999; Jaffe and Srivastava, 1992). Seed has special values to different stakeholders in the seed sector. For resource poor farmers, seed is the most precious of all resources. Famers including those living under complex and uncertain conditions carefully selected, stored, and passed seeds from generation to generation. It is, therefore, the result of continual adaptation and innovation in the face of ever challenges for survival. On the other hand, seed is an investment for large corporation that attracts advanced biotechnological research and sophisticated marketing techniques (Tripp, 1998). For researchers, seed is an output of years of hard work and the subject of job satisfaction, confidence, and a landmark of innovation.

The seed forms it own system at different levels. This system can be divided into two broad categories of formal and informal sub-systems at national level. The formal seed system can be explained as a hierarchically organized and conditioned by explicit laws and regulations. This sub-system comprises variety development/improvement, production, regulation, quality control, processing, storage and transportation units or services. It is largely well functioning in developed countries some commercial crops such as hybrid maize in developing countries. On the other hand, in the informal seed sub-system seed production and exchange are integrated into crop production and their socio-economic process of farming (Tripp, 1998). In the informal sub-system farmers save, select, exchange seed through social networks and market. In this paper the informal sub-system deals with the seed produced under farmers' condition from research released varieties and certain technical supports as well. So, the approach is a blend between the formal and informal sub-system functions.

The informal seed production is still dominant (80%) worldwide (Almekinders and Louwaars 1999; Almekinders et al., 1994; Jaffe and Srivastava, 1992). In Ethiopia most of the farmers (80 to 90%) use their own saved seeds or seeds obtained from their locals (Sahlu et al., 2006). In Ethiopia, annually less than 5% of crop area is covered with new seeds of certified seeds of cereals and pulses (for example it was only 3.2% in 2005/6, and 4.7% in 2007/8) (CSA, 2007 and 2008). By the same token, in one of the central zones of Ethiopia, East Shewa, the area annually planted to seeds of improved variety was only 6.2% of the annually required seed on average for eight major crops: including wheat, maize, tef, and common beans over 2004 to 2008 (Ibrahim et al., 2008). In East Shewa, maize, tef, and wheat are the most important food crops in terms of area and production while common bean is main cash crop for farmers of drought prone districts.

Maize is an essential food crop in Ethiopia in general and the Central Rift Valley in particular. The area is characterized by erratic rainfall that hampers crop production. In the East-Shewa zone, maize is a principal food crop in five districts out of the ten districts totally claiming 44% of the crop area (CSA, 2008). The crop is also leading in terms of productivity where open pollinated maize varieties are dominantly grown. Research has been working in the improvement of maize for drought prone area quite recently. Over the last one decade and so eight Open Pollinated varieties (OPV) were released both under conventional and farmer participatory research approaches by Melkassa Agricultural Research Center under the name "Melkassa-n_s". A series of Melkassa-1 to Melkassa-8 were released over a period of 1999 to 2005.

Farmer participatory research approach in maize breeding came into action by CIMMYT (International Maize and Wheat Improvement Center) under mother -and-baby trial (Abebe et al., 2005). On the other hand, Farmers' Research Group approach for different commodities including maize has been under way for the past nearly on decade by the financial supports of The World Bank and JICA. However, farmer participatory research approach in the area has fine tuned through FRG project. The FRG approach has been intensively tested and used in EIAR-OARI-JICA (Ethiopian Institute of Agricultural Research-Oromia Agricultural Research Institute-Japan International Cooperation Agency) join pilot project over 2004 to 2009 periods. The approach enhanced the release and dissemination of OPV maize, at least in the project sites. In the seed dissemination farmer research group and informal seed production approaches are the primary instruments. The Farmer

Research Group members and social institution (such as church) were involved in seed production and dissemination processes typically in their area through existing social networks and linkage developed with formal seed system (research and seed enterprise).

In the informal seed dissemination of OPV maize farmers shared the seed in sale, exchange, credit, and gift with their fellow friends, neighbors, and relatives. This horizon of dissemination would be satisfied (as there was such tendency in Anano-Shisho area ATJK district, for example) in short period while still the demand falls in short of the supply in some nearby (neighboring) and distant places in the same agro-ecologies. Anano-Shisho is a kebele where intensive FRG works have been done and seed producers' area well established. Formal Seed enterprises have not actively involved in OPV seed production and dissemination of those varieties in drought prone areas. This is due to formal seed enterprises are more interested in hybrid maize. This typically true for private seed enterprises (personal communications). This tendency is widely narrated (Jaffe and Srivastava, 1992; Langyintuo, 2010). Besides, cost of production and distribution and demand creation or identification of the demand takes longer time for seed enterprises.

The two seed systems have their own merits and deficiencies. In the informal seed sub-system the seed dissemination would be restricted to limited area. It was observed that geographic and ethnic boundaries do reduce seed diffusion in farmer seed (Almekinders et al., 1994). Besides, local seed system can be highly affected by natural disasters such as drought, insect, or disease outbreak. In the formal seed system there might be a cyclical constraint of supply and demand (Almekinders et al., 1994). That is, the cost of seed production is usually high to make enough bulk through several cycles from breeder seed to high quality commercial seed in the first place. Second, costs for labor, expensive infrastructure, and logistics (for certification, processing, and distribution) escalate seed price. In Ethiopia, Yonas et al (2008) documented that high production and transportation costs, low effective demand, production of less preferred varieties by smaller farmer and inconsistent seed quality in the seed enterprise as recurrent problem. On the other hand, it has been long witnessed that farmers can produce adapted varieties of good quality seed at a reasonable cost. This has a demonstration effect at local level and enhances seed availability. Nevertheless, the formal system has access to new germplasm and it is in a better position to reach wider clients of similar agro-ecology to that of seed producer farmers. Thus, it has potential and capacity to avail basic seed, do quality control, and disseminate beyond the local (narrow) area. In this way linkage between formal and informal seed system plays a complementary role in the local seed system and contribute to the national seed system.

Alemu et al (2008) studied maize seed system in the Central Rift Valley of Ethiopia and identified a limited dissemination of modern varieties as a consequence of seed shortage. They further argued that public sector dominance restricted the seed market competition and resulted in low modern maize variety seed supply implicitly suggested for more involvement of private seed enterprises. However, the private sector is not well developed in the country. Moreover, a few existing private seed enterprises are less interested in OPV and focused on hybrid maize seed (Langyintuo et al., 2010).

In cognizant of shortage of adapted open pollinated varieties and their seeds shortage farmers group based informal seed production has been launched and the group linked to research and seed enterprise- the formal system. The linkage is aimed to maintain flow of seeds (genetic materials), share knowledge, experience, and resources, develop mutual understanding and the combination of these.

2. Methodology and Approach

A series of consultation meetings and group discussions were held among farmers, researchers, and experts from the East Shewa Zone and District Agricultural and Rural Development Offices, Farmers Cooperatives Unions, and Oromia Seed Enterprise on how to improve availability of the OPV drought tolerant and quality protein maize (Melkassa-2 and Melkassa-6Q) seeds, their multiplication and dissemination. During the consultation on -farm seed production and scaling up approaches of the new varieties were taken as the main approach for execution.
Then, sites for seed production and seed producer farmers were

identified. The selection was done on consensus and suitability of the location for seed production meeting the criteria of isolation distance, relative reasonable size (half hectare and above) and host farmers experience and interest. Subsequently, the farmers and development agents were trained on the techniques of improved maize seed field management, basic differences between seed and grain, required isolation distances mainly in theory. This was followed by practical trainings and field selection and monitoring. Researchers, seed experts, and Agricultural development workers visited the selected sites and confirmed the fulfillment of the minimum required isolation distances of 200 m in all directions. For cooperative member seed producer farmers the training included cooperative management principles, practices and record keeping in collaboration with experts from ATJK district cooperative management beyond the technical matters in seed production.

The basic seed was provided by Melkassa Research Center to the seed producers. The seed was planted under a close supervision of technicians from research and respective agricultural and rural development offices.

To ensure the minimum field isolation distance of 200 m where maize is predominantly grown seed of the target variety (i.e. Melkassa-2 or Melkassa-6Q) was shared with the neighboring farmers and planted to avoid contamination and assure the seed genetic purity. The plot for isolation demanded more seed than area allocated to seed production (Table 1), 60% area planted for isolation purpose). The fields were periodically monitored by experts from research and or seed enterprises to make sure the field level quality maintenance of the farmers produced seed. Off types and diseased planted were roughed out before and immediately after flowering. The harvest was done at full physiological maturity of about 12% seed moisture content. Shelling was done by threshers and the seeds were stored separately to avoid contaminations.

Seed producing communities were established at four locations in Adama, Adami Tulu Jido Kombolcha (ATJK), Doddota, and Boset districts from 2007 to 2009 cropping seasons.

Table 1: Description of farmers participated in OPV maize seed production, 2007-2009
Source: Field data of 2007 to 2009.

Year	Kebele[1] (Village)	Area allocated to seed (ha)	Area planted for isolation (ha)	Total area (ha)
2007	Anano-Shisho (Tora)	0.875	4.5	5.375
	Anano-Shisho kebele-(Tabo)	0.5	2.375	2.875
	Wakie Mia Tiyo kebele-(Tiyo)	0.25	5	5.25
	Dongoye Tiyo	1	1	2
2008	Anano-Shisho (Shisho Tora)	1.5	6	7.5
	Melkassa St Michael Church	4.25	0	4.25
2009	Kenenisa & Anano-Shisho farmers' Cooperative[2]	11.5	13.8	25.3
	Malima Bari Village	2	0	2
Total		21.875	32.675	54.55

Besides individual and group of farmers, a church (Awash Bishola St. Michael) also took part in 2008. At Anano-Shisho, two cooperative societies established in 2009 from both farmer research group members and non- members based on experience gained in previous years from FRG activities. Among the cooperatives, one group has organized as sole seed producer; while the second is a multi-purpose cooperative including seed production activity.

To facilitate seed sale, the cooperative entered into contract agreement with a public seed enterprise- Oromia Seed Enterprise (OSE). The parties signed agreements prior to planting by checking adherence to isolation distance and assessing the field cropping history. OSE and Melkassa RC controlled the quality of seeds produced by the cooperatives. Then collect the seed at a premium price of 10% over the existing market price.

3. Result and Discussions

3.1. Production and dissemination of OPV maize seed

Reasonable amount of quality improved OPV maize (Melkassa-2)

[1] *Kebele* is the smallest administrative unit in Ethiopia

[2] The cooperative Produced Melkassa-6Q while all others involved in Melkassa-2 seed production. That is partly because of the varietal age; Melkassa-2 release before Melkassa-6Q.

seed was produced on farm (Table 2). The produced seed was shared on sale, exchange, and gift. The dissemination among farmers is high (90%) in terms of percentage of volume dispatch in most of the locations by the FRG members. At Bishola St. Michael church was sold the seed immediately after harvest in December and the volume sold as a seed is relatively less (22%) as compared to individual and group of farmers who sold at planting or close to planting time when the seed price is remunerative. The church did so because it had no store for seed.

Table 2: On farm Drought Tolerant Maize (M-2) Seed Production and Dissemination Efficiency, 2007-2009/10

Location/ village	Year	Total seed produced (ton)	Sale (ton)	Exchange (ton)	Gift (ton)	% seed dissemination
Anano-Shisho	2007- 8	15.70	13.30(85%)	1.17(7%)	0.116(1%)	94
Dongore	2007	3.50	2.05(59%)	0.23(6%)	0.10(3%)	68
Wakie	2007	2.00	0.50(25%)	0.61(30.5%)	0.00	56
Malima Bari	2009	10.00	10.00(100%)	0	0.00	100
Sub-total	*2007-9*	*31.20*	*25.98(83%)*	*2.005(6%)*	*0.216(1)*	*90*
Bishola st Michael Church	2008	32.40	7.2(22%)	0	0.00	22
Grand total		*63.6*	*33.18(52%)*	*2.005(3%)*	*0.21(.3%)*	*56*

Figure in parenthesis indicate percentage. The number of sale, exchange, and gift may not add up to 100% since some amount of was not reported to be used for seed.
Source: Field data 2007-2009/10

3.2. Mode of Informal Seed Dissemination

The dissemination of seed was happened mainly through the existing traditional modes. In the process sale claims the lion share followed by exchange and gift. These three modes were observed in the first two years (2007 and 2008). However, credit, which is paid in cash, come into view in 2009/10 for 2010 planting since there was a significant harvest failure from area planted to local varieties and other long maturing. Seed lending as a seed dissemination mechanism was not noticed in this study. Lending was reported to constitute 50% of the cases in secondary informal seed multiplication activity for the same crop in the late 1990s and beginning of 2000 in the Central Rift Valley (Deressa et al., 2002).

The seed was shared among farmers and other clients (NGOs) primarily on sale. The sale makes up 88% by volume and 70% by number of buyers followed by exchange and gift (Fig 1). Some part of the seed purchased from seed producers re-sold to others farmers which in turn would boost the actual number of users.

Such case was observed in a kebele of ATJK district (Negalign) where a farmer re-sold the seed to ten other farmers. This is may be the reason why the average seed purchase is high as compared to land holding size of the farmers.

On average each buyer purchased 90 kg (STD 140 kg, mode 50 kg) in 2008. This is because there were farmers/individuals that purchased large volume (up to 1t) of seed for redistribution. However, the majority of the farmers purchased less than 50 kg. For instance, two-third of the seed buyers purchased up to 50 kg seed per buyer. The dissemination largely took place in nearby distance from the seed producer farmers' residence. For example, 67% of the seed buyers live within 5.35 km radius, which is about an hour walking distance. The information source for the seed buyers is primarily the seed producer farmers, field days and friends largely obtained on personal relation or social networks.

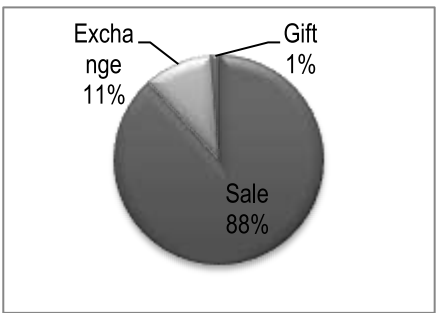

Chart 1a: Seed Dissemination by per cent Volume

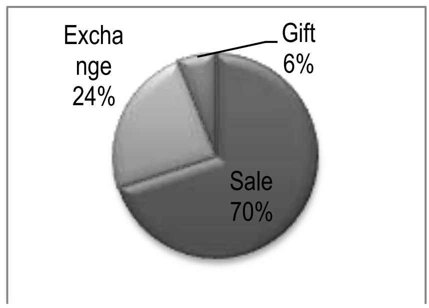

Chart 1b: Seed Dissemination by per cent Clients

Fig 1: Mode of on farm produced seed exchange between farmers at Anano- Shisho, ATJK, 2007/8 (N=86)

Source: Field Data, August 2008

In addition to the three seed producing kebeles, 26 more kebeles were benefited reaching a total of 29 *kebeles* over 2007 to 2009. The larger majority were reached in 2007/8 followed by few *kebeles* (three) included in 2009 largely within 30 km distance though there are few cases where farmer seed transported long distance (up to 800 km to Gambella and few hundred kilometers to Southern Region, example, Siltie and Wolaita zones).

The informal seed production has enhanced dissemination of improved maize. This is can be evidenced by area planted to Melkassa-2 maize in selected *kebeles* of Adama and ATJK districts as compared to old varieties which were released before two decades. In short period (two years) Melkassa-2 stood third position in five kebeles of ATJK and Adama in terms of area (Table 3). The dissemination of the variety is relatively high in FRG kebeles (Adulala-Hate-Haroreti, Awash Melkassa and Anano-Shisho) as compared to Non-FRG ones. In ATJK the dissemination is mostly likely enhanced by the informal seed production and dissemination.

Grain and seed price changes

As indicted in table4, when the price of maize grain increases towards the beginning of the rainy season the seed price shoots up at an alarming rate in March and April compare as compared to Jan and Feb. These two years are typical ones in terms of price change. In the normal years the price does not change this much over those months for the crop. For instance, in 2009/10 the price of maize grain price change was about 15% increase as compared to harvest time which is an indicator for price of local seed.

Table 3: Area (ha) planted to different maize varieties in selected kebeles of East Shewa zone, 2008

District	Kebele	Hawassa- 511	BH 540	Melkassa-1	Melkassa-2	Katumani	Local maize	Pioneer HB
Adama	Adulala Hatie Haroreti	11.5	0	5	13.8	0	87.3	0
	Awash Melkassa	30	9	16	15	0	0	0
	Subtotal (rank)	*41.5(2)*	*9(2)*	*21(4)*	*28.8(3)*	*0(6)*	*87.3(1)*	*0(6)*
ATJK	Anano-Shisho	250	50	2	700	0	172	0
	Habule Gutumuma	0	320	0	2.5	1	1093.5	0
	Hurufa Lole	13	75	2.5	23	0	886.5	0
	Negalign	0	115	0	114	0	0	20
	Oda Anshura	0	493	0	2.5	0	849.5	0
	Subtotal(rank)	*263(4)*	*1053(2)*	*4.5(6)*	*842(3)*	*1(7)*	*3001.5(1)*	*20(5)*
Grand Total and Rank		*304.5 (4)*	*10629(2)*	*25.5 (5)*	*870.8 (3)*	*1 (7)*	*3088.8 (1)*	*20 (6)*

Source: Data Collected in collaboration with Respective Kebele Development Agents, Aug 2008
NB: Figures in the parenthesis indicate rank

Table 4: Average maize seed and grain prices (Birr) in ATJK area

		Maize seed and grain price in Adami Tulu area		
Year	Month	Average grain price	Farmer seed price	Price difference Seed price over grain price
2007	Jan	210	300	+43%
	Feb	240	350	+46%
	Mar-Apr.	270	505	+87%
2008	Dec	222	255	+15%
	Mar-Apr.	278	500	+80%

Source: Field data, August 2008 for farmer seed price and unpublished data collected by FRG project on market price

Melkassa-6Q seed production and dissemination

Melkassa-6Q seed production is relatively recent. The seed production started under irrigation in off season of 2008/9 at Melka-Oba Kebele, Adama (Table 5). A total of 5 ton of seed was produced and 4.2 ton collected by Oromia Seed Enterprise. The balance was not used for the same year planting due to harvest delay to use in the same season.

In 2009 farmers' cooperative societies produced Melkassa-6Q in the main rainy season. Relatively small part seed produced collected by OSE while the remaining sold locally. This time, other than on cash seed sale cooperative societies distributed the seed on credit bases (to be paid in cash at harvest). The seed was used by the cooperative members and the neighboring farmers in the production area - Anano-Shisho. In this way one cooperative distributed 10 ton seed at 350 birr per quintal price while the grain price was 300 birr expecting a 16.7% premium price at as compared to 10% signed agreement.

Table 5: On farm Melkassa-6Q seed produced and disseminated, 2008-2009/10

District	Location/village	Total produce (q)	Sale (q)	Seed disseminated (%)
ATJK	Anano-Shisho	113	100	88.5
Adama	Melka-Oba	50	42	84
Total		163	142	87

Source: Field data 2009/10

Cost-benefit Analysis of Informal Maize Seed Production

The major costs for maize seed production are the field operations and input costs. The operation costs include land preparation, cultivation, weeding, harvesting, transporting, and shelling. The input costs are fertilizer, seed, and fumigating chemical. The average production cost for a hectare of maize seed at Anano-Shisho kebele in 2008 was 5070 birr with net-benefit of

11,728 birr per ha and cost benefit ratio of 20%; that is for every 0.20 birr investment the farmer earned one birr. This was the case when the farmers directly sold to other farmers in 2008 a good year. At this time the farmers were not created agreement with seed enterprise. This year was special: first it was during grain price jumping period secondly it was in the beginning of the variety (M-2) seed and a kind of window fall benefit.

In the second scenario and different year when farmers sold their seed to seed enterprise at 10% premium price over market price typically in 2010. In this scenario still the farmers earn net benefit of 830 birr per hectare and cost benefit ratio 80% for the small amount sold to Seed Enterprise since the seed is needed in the area in 2010. However, farmer would benefit from the linkage since they would have continued access to seed market and the enterprise is working to establish linkage though infrastructural development for example store. For the seed distributed on loan the net benefit is 1,599 birr per hectare and cost benefit ratio is 81% (that is for 81 birr investments 100 birr gained). In the two later scenarios the benefit is so shrunk mainly due to low production in year 2009 as a result of poor moisture at especially which was encountered flowering time. And large proportion of the harvest failed from lands planted to local and other long maturing varieties. This last scenario had served the local community by giving seed on credit to farmers lost their seed to the 2009 drought.

3.3. Characteristics of Maize Seed Buyers

Seed buyers are middle aged farmers of about 40 years (Table 6). They have high family size (9.4) which would supply ample labor for relatively intensive work required in improved variety production. The farm size was 3.57 ha (higher than regional average 1.63 ha per household) of which 62% allocated to maize.

Table 6: Farmer produced seed buyers characteristics, ATJK, 2008 (N=26)

Character	Seed buyer	
	Mean	STD
Age (year)	39.4	14.3
family size (n)	9.4	5.5
Land allocated to maize (Per cent holding)	61.4%	20.6%
Land holding size(ha)	3.57	2.7

Source: own survey, August 2008

3.4. Reasons for buying on farm produced maize, farmers opinion on the seed quality and challenges of informal seed production

Modern variety maize seed were purchased for high yield, earliness, and drought tolerance. The farmers also appreciated the seed physical purity at first step then good germination and viability on field. In 2008, Anano-Shisho area farmers purchased Melkassa-2 seed for high yield (42.3%), earliness (38.5%), and drought tolerance (19.2%) as their number one criteria. Besides, the buyers indicated that quality of the seed is of very good or excellent. Concerning seed physical purity about 85% indicated very good or excellent quality. All of them witnessed complete germination while 77% the farmer indicated drought tolerance of the variety is very good or excel as compared to the local (Table 7).

Table 7: Seed buyer farmers' opinion (%) about farmer produced modern variety maize seed quality (M-2), 2008 (N=26)

Reasons for purchasing	Excellent	Very good	Good
Seed purity (compared to local)	7.6	77	15.4
Viability (germination and establishment)	14.4	84.6	-
Drought tolerance	3.8	73	23.2

Source: own survey, August 2008

The local seed production has its own advantages and challenges. The primary advantage is its easy accessibility at walking distance. Secondly, the farmers do trust the seed and each other since they observe the performance of the seed plot on different occasions such field days and personal businesses for work and easily access information. Moreover, the social relations provide security and trust on the seed quality thereby enhances the seed dissemination. Concerning social network considerable number of the farmers are friends, relatives and/or have marital relationships; a plus for the informal seed diffusion.

The informal seed production has its own technical and managerial paucity. In the Central Rift Valley area maize farm fields are located in the same places at the lower valley bottoms or more 'fertile' land and maintaining the isolation distance pose a challenge. The other constraint is storage and marketing of the seed beyond the locality since the local market is easily saturated in few years. Again it might have hampered by long standing farmers' experience of a variety seed recycling behavior for extended years. Besides, access to basic seed supply need attention since the seed provision is done on ad-hoc or temporary project basis of institutions such research centers. Thus sustained access to seed and other inputs put is a challenge at present and in the near future.

4. Conclusion and suggestions

Informal improved maize seed production has shown enhanced seed dissemination efficiency. Nearly all of the seed produced disseminated in the adjoining of seed producing farmers' areas and beyond. The seed production and marketing is a remunerative business as shown at pilot level which is promising to build-up on it. Still, there are technical and organizational constraints in informal seed production of maintaining isolation distance and reaching beyond local community. Hence, informal seed production needs the formal system for sustained basic seed supply, quality control, and wider seed dissemination. This would simultaneously benefit the formal seed sector from the seed marketing and 'technology' dissemination. Hence, there is call for searching for optimum mode and level of collaboration between formal and farmers' seed sub-systems for effective and sustained linkages. Further, farmer seed security which can be explained in access to modern variety seed in such drought prone area, preferred seed supply sources; institutional linkage among research and farmer in the generation, dissemination and adoption of new variety seeds food and cash crops needs in depth scrutiny.

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Decentralized Common Bean Seed Production and Delivery System

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Abstract

In Ethiopia, the formal seed sector meets only less than 10% of the total seed demand of our farmers. Given such a huge difference between supply and demand, the development of alternative seed sources such as farmer based seed production in addition to existing formal seed sector cannot be considered optional. This paper summarizes the experience of impact oriented decentralized seed system and farmer based seed production and dissemination The experiences include demand creation for improved bean varieties, multiplication of farmer preferred varieties, initiating localized seed production and decentralized recovery and redistribution of seed to wider seed beneficiaries. Partnership, monitoring and evaluation and capacity development were the cornerstones of all the activities designed in these projects.. The strengthening of farmers' association/union is indispensible in providing conducive marketing environment for informal seed sector and ensuring localized as well as sustainable seed supply. To maximize out of their complementarities, the need to integrate the informal with the formal seed sector cannot be over emphasized. Proper training of farmers on quality seed production, market information network, coordination and linkage among important stakeholders as research, agricultural offices, local administrative bodies, formal seed sector and unions/farmers association are also necessities.

1. Introduction

Despite the presence of extensively operating formal seed sector in Ethiopia, with no exception, its capacity to satisfy the demand of millions of farmers is far below satisfactory. Nearly half of the farmers in the Central Rift Valley (CRV), where most of the physical, market, institutional and technological infrastructures are relatively better off, for example, use own maize seed and 15% percent purchased seed from traders (Dawit et al 2007). During the 2004/05 season, the supply of seed through the Ethiopian Seed Enterprise (ESE) was 304 000 q, i.e., 73% short of official demand for seed based on estimates developed by woreda and regional bureaus of agriculture. In particular, the supply from the same source and season for haricot bean was 79% less the official demand (Ibid). This simply underlines the fact that, given the infrastructural and resource limitation, the country cannot fully rely on the formal sector alone.

Analyzing the contribution of the formal and informal seed system Zewdie et al (2008) indicated that out of potential annual seed requirement (estimated 150, 000 tons), the share of formal seed system is estimated to be about 10-20% while the rest (80-90%) is covered by the informal seed system. The Ethiopian Seed Enterprise (ESE) takes the lion share (80-90%) of the amount supplied by the formal sector. The experiences and empirical evidences to date, by and large, clearly justify the need to strengthen the informal seed sector. In recognition to such need to revitalize informal seed supply for local crops and varieties, ESE has made a move to improve the seed supply by working with farmers through contractual seed production with Farmers' Producers Cooperatives and through Farmer-Based Seed Production and Marketing Scheme (FBSPMS) (Yonas et al., 2008). The move helped in improving the seed supply of less profitable crops both in terms of local availability and access by resource poor farmers. Accordingly, of the certified seed produced by ESE, the FBSPMS accounted for 25% (in 2005) and 35% in 2006. Whoever initiates a farmer participatory decentralized seed production, the fact that the opportunity can simultaneously be used to introduce improved management practices which can contribute to improved productivity of small famers is real double advantage (Endeshaw et al., 2009).

Looking into the diversity of the seed supply during 2000-2007, Yonas et al., (2008) showed that wheat and maize accounted for more than 90% of the total seed sales of ESE demonstrating that the informal sector remains a major supplier of improved and local land races of diverse crops grown by small farmers. They also indicated that of the total seed being circulated by the informal seed sector, the share of improved seed is only about 10%.

The concentration of the formal seed sector, ESE in particular, mainly on production of certain cereals has generally devoid the potential attention the bean farmers' require, among others, in terms of availability and access to improved seeds. Though there existed a number of varietal options (more than 30) with food and market class, most bean farmers had little, if any, or no access to seeds of improved varieties. Hence, unavailability of quality seeds of improved bean varieties in time, space, and required quantities is among the major factors that contributed to low access to improved bean varieties/technologies thereby remained as limiting factor for production and productivity. For instance, the national average productivity of the crop is estimated at 1.04 t ha^{-1} (CSA 2008) against the potential 2.7 t ha^{-1}. Small scale poor farmers in drought prone areas of the country have, particularly, much lower access to seeds of improved varieties.

Not all farmers cultivate crops that are commercially important and thus, hardly attract the interest of formal seed sector. Even when, seeds of interest to the small farmers in the hard to reach areas are being produced by the formal seed sector, access and affordability becomes another face of the problem. Generally speaking, public supported commercial seed enterprises have not provided options attractive for poor farmers. By implication there is a need for new avenues to provide access to seeds of improved varieties that respond to the choice and demands of poorer farmers. Therefore, the development of the informal sector (decentralized seed production and delivery) as an alternative and reliable seed source, in such cases, cannot be optional. Towards this argument, various projects targeted to address the needs of poor farmers with little or no access to improved seeds through partnership with key actors have been implemented in order to stimulate policy attention and thereby ensure a formal support to the informal seed system.

This paper presents the experience of two distinct projects (Impact Oriented Decentralized Seed System in Tropical Legumes II project (TL II) and Farmer Based Seed Production and Dissemination in Strengthening Technology Development, Verification, Transfer and Adoption through Farmers Research Groups Project (FRG) on decentralized bean seed production and delivery with farmers and other important partners in bean growing region of Ethiopia. The prime purpose of the projects were identifying farmers preferred (adapted, stress tolerant and good yielder) common bean varieties and improve availability and access to those farmers preferred varieties by poor farmers through decentralized seed production and distribution approach. The challenges as well as important lessons drawn from these experiences are also summarized.

Structure and Evolution of Seed Systems

The formal and informal seed systems are differentiated based on who is responsible for conservation of genetic resource, breeding/improvement and seed supply as well as in terms of level of integration in the seed system (Table 1). While the formal seed system has a specialized actor for each component as gene bank for genetic resource conservation, research institutions for breeding/improvement, and seed parastatals/seed companies for seed supply, in the informal seed system all are carried out by the farmers who do all the maintaining of the genetic resource, selection in combination with natural processes such as genetic mutation and serve as seed source for self and others. Obviously, the latter is highly integrated than the former. Of course, the current position of the two systems evolved over time as a result of policy directives and actions taken in responding to varying scenarios in the last four decades (Table 2).

Table 1 Distinction between formal and informal seed system

	Formal seed system	Informal seed system
Conservation of genetic resource	Gene bank	Farmer
Improvement	Breeding programs in research institutions	Farmer
Seed supply	Parastatals/ private companies	Farmer through exchange in the local system
Operation level	National (potential areas)	Community
Integration	Less	More

Adapted from Walter et al., (2008)

Nowadays, in addition to farmers, many other actors (such as NGOs, research institutions, seed parastatals) have taken interest in the informal seed system mainly because it is a low-cost source of seed, reliable, efficient and accessible channel to provide resource-poor farmers with seeds of improved varieties (which are of less interest to the commercial sector). Such an interest in the informal seed sector was triggered by the limitation of the formal seed sector to deliver seeds of different crop varieties to the diverse farming community.

2. Approach and Methods

The first most important step in the seed production activity was creation of awareness as well as potential demand for particular variety. Once farmer preferred variety is identified the mechanism to satisfy the demand was designed in such a way that reasonable access to seed is ensured through localized/ decentralized/ farmer based seed production and delivery endeavors. Though, in terms of the methods used at different levels (Table 3) and in the design, there was certain distinctions between the two projects, there were four important stages common to both (Fig 1). Nevertheless, capacity development on seed production practices was an important common denominator in these projects.

Table 2 Evolution of the formal and informal seed sector

Decades	***Directions and Developments***	***Actions pursued***	***Issues***
1970	Significance of quality seed recognized by African governments and donors	Establishment of highly subsidized formal seed sector-seed parastatals	• Limited financial sustainability • Limited involvement of small-farmers in variety development and seed supply chain
1980	Recognition of the significance of private sector role	A policy shift to disbanding parastatals and encouraging private sector development	• Focus limited to hybrid maize, high value crops, high potential area • Minor crops and hard to reach community were marginalized
1990	Interest in seed sector by NGOs and Rural development agencies	Support to community -based seed production and supply	• Access to seed in remote areas and to poor farmers improved • Transforming community seed producers into producers of high quality seed
2000	Renewed effort to improve seed access	Focus on supporting the private sector (small & medium agro-dealers); establish seed business friendly regulations	• Companies focus on more profitable crops/varieties rather than wide range of crop species which determine the resource-poor farmers' food security

Adapted from Rubiyogo et al., (2009)

Demand creation

The target community/farmers are exposed to new varieties with management practices. This stage adopts variety of methods including participatory variety selection (PVS), participatory evaluation and demonstration, field days, training, sales of new varieties via small packs for farmers to try themselves in small plot of land and use of promotional materials. Consequently, the varieties for which farmers show preference would be identified jointly.

Multiplication of preferred varieties

Once the preferred variety is identified, this is a preparation stage where the variety (basic seed) is being multiplied on research station in proportion to targeted seed producers in selected weredas.

Localized seed production

The basic seed produced is distributed to seed producing farmers through respective weredas, farmers' cooperative unions, NGOs, and private firms. The selected seed producers shall produce a certified seed that can be made available to the local farmers through local networks or farmers' association. This activity engages a number of partners in monitoring and evaluation of the production activity.

Decentralized recovery and redistribution of seed

The seed produced by selected farmers is partly recovered either in kind (same size of seed provided to the farmer) and/or through sales to the partners involved, usually farmers cooperative unions. The same seed recovered is redistributed to new batch of farmers as seed and the cycle continues with introduction of new varieties. This is expected to build the capacity of partners in dealing with seed business.

Though both share important similarities, the two projects had distinctness in terms of the scale and purpose pursued in bean seed production. The seed production in the FRG project is an activity that is embedded in the testing of different management practices for farmer preferred varieties. It is carried out simultaneously with the on farm evaluation of improved and local management practices (for instance, land preparation and planting method, weeding techniques and so on) which help in identifying the best management option that ensures maximum gain from the variety. The purpose of farmer based seed production, here, was to respond to the demand of the farmers in the wereda who developed interest to the varieties due to exposure during field days and information from neighbors and extension workers. The starting/foundation seed is provided from the research center both to the FRG farmers directly (with the knowledge of the Woreda Agricultural and Rural Development offices-WARDO) and to the WARDO who in turn distribute to other non FRG potential seed producing farmers. Whereas the decentralized impact oriented bean seed production and delivery project (TL II) tries to identify and establish a decentralized seed production and delivery modes that are tailored to various clients thereby generate information on the ideal model for different scenario of seed production and delivery. Accordingly, it was framed in such a way that the research centre plays the role of capacity building on seed production and provides foundation seed in different pack sizes to primary partners whose main role was distributing the same to selected individual/group of farmers through collaborative partners (WARDOs and NGOs). Private farms directly receive seed from research centre and produce seed themselves as per the agreement.

Table 3 Similarities and differences in methods used between the two projects (FRG and TL II) in decentralized seed production

	FRG (2005-2007)	TL II (2008-2009)
Demand creation for new varieties	Group based participatory planning, evaluation and demonstration, training, field day, promotional materials	Participatory Variety Selection (PVS), training, demonstrations, using small packs, promotional materials
Multiplication of basic/ certified seed	On research station	On research station, in addition, the seed is packed in to different sizes (5, 12.5 and 25 kg) customized to the capacities of seed producers with the end to stimulate development of agro seed enterprises
Seed distribution to seed producers	Planning with FRG member farmers and respective Weredas Agricultural and Rural Development Offices (WARDO); seed production embedded in field demonstrations of crop management practices; respective WARDOs does distribution to FRGs and copy farmers	Decentralized planning with all partners (*Primary partners*: Farmers cooperative unions (FCU), NGOs and *Collaborative partners*: Farmers, Extension experts, NGOs, private farms)and distribution is done through FCU, WARDO and NGOs
Seed recovery and redistribution	Recovered in kind by weredas and distributed to other farmers; Redistribution is mainly left for local networks (cash or non cash based exchange)	Recovered in kind and via cash through primary partners (FC Unions + NGOs) and redistributed by the same and through local networks (cash or non cash based exchange)
Scale	Selected weredas in Central Rift Valley (CRV)	Bean growing areas in the country
Actors engaged	Research, WARDOs, farmers	Research, WARDOs, FC Unions, NGOs, private farms, farmers

In the impact oriented bean seed production and delivery project (TL II), joint review is organized annually, and the roles of partners are redefined in response to meeting emerging challenges. This was found useful in modifying the models to fit the purpose of effective seed production and delivery.

3. Result and discussion

3.1. Demand Creation

The creation of demand for new improved bean varieties is one of the core activities in the decentralized seed production. The projects introduced different varieties of bean to farmers in a range of bean growing weredas. Various promotional materials (posters, leaflets, clip charts) and tools were also utilized in stimulating interest in new varieties as well as evaluating and demonstrating the varieties with participating farmers (Table 4).

Table 4 Varieties, target sites and promotional materials and tools used in creating demand

The projects	Varieties used	Number of Weredas	Promotional materials (types)	Tools
FRG (2005-2007)	15	3	2	• Participatory evaluation and demonstration with FRGs • Field days • Training • Promotional materials (*Clip charts, leaflets*)
TL II (2008-2009)	12	34	3	• Participatory Variety Selection (PVS) • Demonstrations • Small packs (8562 packets of different sizes and varieties) • Promotional materials (*posters, seed production manuals, leaflets*)

In addition to joint evaluation and demonstration of new varieties, capacity development (training) on the production of quality seed of preferred bean varieties were carried out side by side with development of promotional materials as a reinforcement to continue production and improve localized access to the varieties (Table 5).

Table 5 Capacity building (training) activities on seed production

	Number of participants	Target districts	Types of Participants	Remark
FRG (2005-2007)	36	3	Farmers, Extension workers	Farmer to farmer experience sharing
TLII (2008-2009)	136	21	Extension workers (DAs + Experts)	ToT who in turn trains farmers

As indicated earlier, introduction of the new varieties was not a standalone activity. It was accompanied by a decentralized seed production and dissemination of the varieties for which the target community exhibited special preference. Various actors/partners were organized along the production and distribution chain to ensure better access to the new technologies.

3.2. Local Availability of Demanded Seeds

Once farmers' preferred varieties are identified, a decentralized seed production and distribution is effected with keen involvement of partners. Simultaneously, introduction of new varieties continued to unreached production areas. As it can be observed from Table 6 quite a number of partners were engaged in the production and distribution activity. The seeds of varieties already introduced and preferred by the farmers (popular varieties) were packed into bigger pack sizes (50, 100 kg) in 2008 and later modified to commercial pack sizes (5, 12.5, 25 kg) in 2009 were distributed to 1609 and 2740 seed farmers in respective years through the primary partners. The packaging was done at the research center after agreement was reached with partners on the ranges of pack sizes, particularly in 2009. Of the total seed distributed to farmers a total harvest of 377 and 126 tons seed of different varieties in respective years, was reported. This data was not complete because it refers to only the harvest from part of the total seed planted by seed producers. However, with all its limitation, so much seed was produced and made available to local farmers as well as others from surrounding/neighboring districts, zones, and regions. Side by side new varieties were also demonstrated on farmers' field as well as distributed through small pack sizes of 0.2, 0.5, 1.0, and 2.0 kg to stimulate new demands and trigger the supply of the same using the most suitable mode of localized delivery by partners.

In the FRG project as well, in three districts both FRG farmers in 2006 and non FRG ones in 2007 were involved in production of seeds of five varieties (Table 7). In addition to the farmers, the actors actively engaged in the community based seed production were district agricultural and rural development offices as well as Melkassa research center. The former, besides distributing the seed to participant farmers, played the role of revolving the seed produced to new batch of farmers by recovering (after harvest) the amount they distributed in kind and providing information for other farmers about who and where the seed is available.

Table 6 Decentralized seed production, distribution, and introduction of new varieties by TL II project

		Year >>	2008	2009	Remark
Number of Primary partners (FC Unions, NGO, Pvt farms)			17	14	4.
Number of Districts involved			27	34	5.
Quantity of popular varieties	In bigger pack size (50, 100kg)	Distributed (ton)	44.6	45.15*	Out of the total distributed few tones were left undistributed to farmers, hence, not planted
		Planted (ton)	40.2	41.9	
	Distributed using commercial packs size (5, 12.5, 25kg)(ton)		-	34.55	6.
Quantity of new varieties	Distributed in small pack size (0.2, 0.5, 1.0, 2.0 kg) (ton)		-	5.50	7 varieties; 8562 packs distributed through 9 Primary partners
	Distributed for demonstration (ton)		1.32	-	13 varieties on 1316 demo plots in 30 districts
Number of farm HH (participant)			1609	2740	More than 18500 farmers got access to seed from seed producing farmers as a spill over to other areas
Total harvest (ton)			377	126	The total harvest data is only from part of the total planted in the respective year. Remaining was not reported from partners

*N.B. *The seed distributed in 2009 includes the seed that is recovered from 2008 by partners (4 t) and the one provided by MARC (41.5 t)*

***Partners involved: Central Rift Valley (CRV)**: Agriculture and Rural Development Offices (ARDO) (6 Zonal and 20 Woreda), CRS (HQ and two churches: Wonji and, Meki), ELFORA Agro Industry PLC, Farmers Cooperative Unions (Lume Adama, Uta Wayu , Hitosa, Silte Melik), IPMS-ILRI (Alaba and Dale), ACOS Ethiopia, CIAT , Ethiopian and Oromiya Seed Enterprise.*

***West Haraghe:** CARE, WARDO (Chiro, Gemechis and Goro Gutu), EIAR-MARC*

***East Hararghe:** HCS, WARDO (Kersa, Meta and Goro Gutu), EIAR-MARC, FCU (Afran Qallo), Haramaya University*

Table 7 Decentralized seed production and distribution by FRG project

Years	Districts	Varieties	No participant farmers	Basic/ certified seed in tone (source) @	Quantity produced (ton)
2006	3	5	30	(Farmers' Own)*	12.1
2007	3	5	135	6.5 (MARC+Own)	92.2

** The trial on variety selection was in progress from 2005 that the seed farmers used for 2006 seed production activity was the one harvested from the trial plots*

@ Refers to the seed used for seed production the original source being the research center and partly the distribution to farmers was taken care by respective WARDOs (Shala, Adamitulu-Jido-Kombolcha, and Bora)

6.1. Decentralized Recovery and Re-distribution of Seed

The seed produced by the farmers in both projects was recovered and redistributed either in kind or through different forms of exchange (through gift, seed credit, and exchange in kind and, cash sale). It was attempted to trace the fate of the farmer produced seed in the case of TL II project. The result from the recovery and post harvest utilization of seed by participant farmers implied that farmers' hardly return the seed given in kind, and in contrast the recovery through purchase looked better. However, there was no consistency from 2008 to 2009. The slipping of quite sizeable quantity (21-22%) of the seed produced to the grain market sounds absence of attractive seed price that can justify the investment on seed production (Table 8). If seed price is not well differentiated from that of grain, farmers would definitely lose interest in seed production for lack of incentive for the higher cost requirement compared to grain production.

In the FRG project, on the other hand, it was simply assumed that the seed shall reach to the target community in the weredas through local seed networks (exchanges, sales, gifts) in addition to what is being resolved through the facilitation of respective weredas, that is, agreement was reached with participant farmers to return the same amount of seed they were given at the beginning in kind to the weredas and the same is to be redistributed to new farmers in the wereda. Accordingly, it was recorded in two of the districts out of the

92 tons of seed produced in 2007, only 2.7 tons was reported to be recovered in kind and distributed to 57 new farmers. With no exception, in this project too, recovering the seed in kind from farmers was not that satisfactory. With all the irregularities in recording as well as returning the seed in kind, it was somehow recognized that localized access to seeds of farmer preferred bean seed varieties was created. Given the increased popularity of the farmer preferred improved bean varieties in the respective weredas, it is also believed that the farmer produced seed reached other farmers through exchange of seed (in different form) mainly as a result of frequent field day events that arose keen interest among visiting as well as informed farmers from different kebeles of those weredas.

Table 8 Recovery and post harvest utilization of seed produced by farmers (TL II)

	Years >>	*2008*	*2009*	*Remark*
Total seed distributed from MARC through primary partners (ton)		40.6	41.5	The same amount is expected to be returned in kind to primary partners
Total seed produced (as reported) (ton)		377	126	At least 30% of the total produce is expected to be sold to primary partners
Recovered by primary partners (%)	Kind	3	9	**7.**
	Purchase	29	7	
Temporarily stocked by farmers (%)		15	17.8	**8.**
Sold/given to Other farmers /kept for self sowing as seed (%)		9	17.9	**9.**
Consumed (%)		6	1.2	**10.**
To grain market (traders + farmers) (%)		21	22	**11.**

Source: National Bean Research Project M & E data, 2009

In general, the two projects which depended on the engagement of range of partners in the decentralized seed production and distribution have been instrumental in both gaining practical experiences of producing seed with farmers and narrowing the potential supply gap that comes out of the wider demand created in the process. The fact that beans are hardly produced by the seed parastatals justifies the later. The experience was not all smooth. There were challenges, many ups and downs which left valuable lessons for setting up a successful decentralized seed production and delivery.

11.1. Challenges in the Decentralized Seed Production and Delivery

The following were some of the challenges encountered during the implementation of the two projects in general

Inputs availability and affordability

There were no clearly stated criteria used to select farmers who would participate in the production of seed. Thus, the foundation seed was provided to those farmers (picked by the extension workers) who had different level of access and purchasing power to necessary inputs. Therefore, it was not possible both to ensure the availability and/or affordability of input, particularly fertilizer, for the participant farmers. Some of the farmers' did not have either access or capacity to purchase the required fertilizer.

Management practices

At times farmers tend to manage the seed multiplication plot no differently from the normal grain production activity due to competition for limited resource (labor/capital) and/or reluctance by sticking to the traditional practices where beans field are hardly weeded. This affected not only the yield but also the seed quality

Monitoring and evaluation

It was found difficult, particularly after harvest, to trace the fate of the seed produced. This is because once farmers' threshed and the seed is ready, how much will be retained, exchanged, consumed, sold as grain/seed does not take place at a specific time. In addition, with the intention of not returning the seed given in kind farmers sometimes manipulate the actual harvest data that will undermine the total seed produced. On the other side, the small seed packs which were distributed on cheaper (affordable) price with the end of introducing new varieties, basically, require the registration of buyers with their profile for tracing where the seed went and what was the farmers' experience. Collection of buyers' profile was difficult because the buyers were rushing in number and the selling was done by research staff and there was hardly any support from some partners who were supposed to play this role. Over and above this, the incidence of frequent transfer as well as work over load of extension staff coupled with poor information sharing tradition created information gap and weakened the monitoring and evaluation activities.

Partners' commitment

Though there was a memorandum of understanding signed with partners, commitment was totally dependent on good will and understanding. There was no any enforcement/incentive mechanism to ensure commitment. Some partners had hard time owning the activity. This was reflected both in M & E as well as timeliness in distribution and recovery of the seed. The risk behind this could be that it can create the impression that partnership oriented decentralized seed production and delivery is hard to realize

Seed recovery

There was both delay in recovery of seed as well as less attractive seed price which forces farmers to send the seed to the grain market, and on the other hand farmers have hard time returning the seed provided in kind. When they do, they may do it with poor seed quality or do not return at all. They tend to confuse it with free offer/aid.

Storage problem

Farmers do not have appropriate storage facility/technology that can maintain the seed quality up to the next season. Since many farmers hardly purchase seed early enough before planting, the farmers who produced the seed had little option to extend the storage life and were forced to sell it as a grain. Moreover, the fact that beans mature early before other crops, makes it to be marketed early to fill the cash shortage that will be needed to pay for the labor cost of harvesting and threshing other crops. Coupled with storage the later is a real challenge in beans seed production. There is a critical need to work on development of appropriate bean seed storage technology to ensure local seed production and supply of best preferred varieties

Cash and marketing problems

Farmers are tempted to sell the seed as a grain when the grain market gets even more attractive than the seed price early before following planting season. Some siphon all to the market and do not even maintain seed assuming they would again receive the same seed. This, despite the potential demand, also limits the dissemination/ availability of the seed to other farmers in need just because they lack the cash in time to secure the seed.

12. Lessons Learnt

The decentralized/farmer based seed production and delivery, through the two projects, had left important lessons that should be considered in establishing and improving informal seed production with partners:

- Seed production is an investment. It requires higher level of management compared to grain. Accordingly, farmers who would be engaged in seed production need to be food secured, capable to efficiently manage the seed production plot and absorb some shocks related capital. Or they will be tempted to poorly manage the crop and siphon the seed into the grain market to fill their cash requirement. Small and poor farmers in drought prone areas need to be beneficiaries of decentralized seed production than being a seed producers

- Unless there exist a differentiated price between seed and grain (which was a bit abnormal during the project period), it may force seed producing farmers to lose interest in seed production. There must be a price reward for seed.
- The quality of seed produced by participant farmers was variable. This suggested that there should be a mechanism to measure the quality level and set the price accordingly. Constant and organized engagement in ensuring as well as rewarding good quality seed produced by farmers is necessary. It can stimulate other interested farmers to be sensitive to quality.
- Farmer based seed production scheme demand some basic institutional arrangement beyond getting quality seed produced locally. There should be: involvement of local/community leaders, service cooperatives as well as administrative bodies; input and credit arrangement, market information network and incentive for quality, and storage facility which can be managed by collectively owned institutions as farmers' association/union
- The dissemination of low quality seed, through revolving or whatsoever, may check the adoption of well performing variety and can damage trust between farmers and other stakeholders involved. Hence, caution must be taken not to revolve seeds of lower quality.
- Potential connection of seed producing farmers with the formal seed sector as well as strengthening the link with projects/institutions working on seed business can enhance their complementarities and provide for exchange of experience and building of local capacities towards developing seed business. Furthermore, systematic and strategic integration of the informal and formal seed sector would be instrumental in enhancing and sustaining the production and delivery of quality seed.
- Seed multiplication activity can be a very good opportunity to evaluate and introduce/demonstrate various improved management practices with farmers
- Packaging of seeds- commercial pack for popular and small pack for new varieties- in to different sizes proved their worth in providing access to /introduction of new varieties and maximizing the option to acquire seeds of popular varieties by small farmers with low purchasing power. It encouraged them to acquire new varieties, take

modest risk, and even to pay for small seed packs. Similar marketing strategy can be, even beyond this, applied to other inputs such as fertilizer.

- Capacity development both technical and institutional is crucial if farmer based seed production has to thrive and sustainably address the demand for seed. Farmers' and extension workers' need to be equipped with all the necessary knowledge and skill for production of quality seed. Besides, farmers' association/unions and other small scale entrepreneurs' capacity to deal with marketing of farmer produced seed including storage facility should also be developed. Establishing important quality parameters and sharing the same with farmers through developing their technical capacity and setting seed quality standards together with corresponding premium is crucial to ensure availability and sustainability of quality seed. Besides, this may facilitate the growth of small scale entrepreneurs in the informal seed sector. The interest developed with some institutions, particularly NGOs, with regard to enhancement of small scale entrepreneurs in the informal seed sector need to be exploited as an opportunity.
- While planning decentralized seed production and delivery business with partners, it is important to give equal emphasis to both the production and marketing aspects. Particularly, setting up clear seed distribution procedure/system and creating shared understanding of the same early enough in the planning stage would be useful to reduce the tension at the end.

13. Conclusion

Given the present huge difference between supply and demand, the development of alternative seed sources such as farmer based seed production in addition to existing formal seed sector cannot be considered optional. Yet, even establishment of informal seed multiplication capacity does not just happen; proper training of farmers, market information network, incentive mechanism, linkage among important stakeholders as research, agricultural offices, local administrative bodies, formal seed sector and unions/farmers association are requisites. It is also necessary to set up a clear distribution procedure as well as mechanisms to control the quality and accordingly sustain the supply. In general, the experience in these projects suggested that beans seed multiplication, among other, demands a storage facility to ensure its availability at planting time with acceptable quality; coordination among key partners and proper institutional arrangements to avoid sales of seed as a grain. The strengthening of farmers' association/union is indispensible in providing conducive marketing environment for informal seed sector and ensuring localized as well as sustainable seed supply. To maximize out of their complementarities, the need to integrate the informal with the formal seed sector cannot be over emphasized. Last but not least, use of buyers' friendly packaging both for commercial and new varieties has significant role in improving access to seed as well as awareness to new varieties to a range of small farmers with variable purchasing power.

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Forage Seed Production and Multiplication through Farmers' Research Group in Adami Tulu and Arsi-Negelle Districts

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Abstract

In Ethiopia, forage seeds are mainly supplied to farmers by government and non-government organizations (NGOs) in unsustainable manner. As an alternative option to this, the Adami Tulu agricultural research centre in collaboration with JICA undertook participatory community based forage seed production study using farmer research group approach for two years (2008 main growing season and 2009 main growing season and using irrigation) in Adami Tulu and Arsi-Negelle districts. Generally, 10-13 farmers at Arsi-Negelle and 9-14 farmers in Adami Tulu were involved in the project and the main forage species used were Lablab, Napier grass, Alfalfa, Cowpea, Cajanus and Vetch (Arsi-Negelle). It was learned that farmers are capable of producing forage seeds and sold the forage seeds at a price of 40 birr/kg (2008) and 25-40 birr/kg (2009) which contributed substantially to their income. With the money they got, some farmers bought water pumps, constructed houses, bought household equipments like radios. It is recommended that farmers better organize themselves in the form of cooperatives, have a shop in the town, reduce the prices of forge seeds for larger dissemination among the farming community, and have dual purpose in forage production (increased livestock production and seed production).

1. Introduction

One of the bottlenecks to increase livestock production in Ethiopia is the shortage of feed for different animal species. In order to improve the shortage of livestock feed in crop livestock production system, it is important for farmers to integrate forage production in the farming system. Establishing reliable forage production depends on the availability of reliable supplies of quality forage seeds/cuttings (Alemayehu, 1997; FRG, 2008) and locally producing forage seed ensures sustainability and it is economical. Many different organizations are requesting seeds of different forage species from Adami Tulu research centre. Nevertheless, the centre is unable to produce the seed that meets the demand for forage seeds. Even at a national scale, despite the presence of high demand, there is a critical shortage of forage seeds (MOARD, 2006; Kedir, 2008). One option could be the involvement of the community in the production of forage seeds with the support of government and non-government organizations with an ultimate goal of establishing a forage user group within the community. By linking community based seed production with a reliable market, it can be possible to sustain the production of different forage seeds. To this effect, production of forage seeds on a contractual agreement base had been tried by the fourth Livestock Development Project and was found to be successful (Alemayehu, 1997). However, it could not be sustainable in that it only provided basic seeds and technical support and then back collect seeds produced by farmers and sell to others and eventually the effort stopped when the project phased out. The principle of participatory community based forage seed production is taken from such concept in that producing forage seed at community level on farmers' participatory base (FRG, 2007) where the identification of the problem, evaluation and both linking market potential and/or local use as animal feed source.

Therefore, the objectives of this study are to assess the forage seed/cuttings production capability of farmers and develop the mechanisms of establishing community based forage seed/cuttings production

2. Approaches and Methodology

The approach we used in our study had three phases. The first phase which focused on assessing the demand for forage seeds had 3 sub-phases with different methodologies while the second phase which dealt with forage development strategy had two sub-phases. The last phase focused on ensuring sustainable back up forage seed supply and the methodologies for each are given below.

2.1. Phase 1: Assessing demand for seeds

Consultation with senior forage agronomists and expertise

A consultation and discussion with the objectives of enriching the concept of community based seed production and the way forward was undertaken with senior forage agronomists and concerned expertise from the Ethiopian Institute of Agricultural Research (EIAR), Oromiya Agricultural Research Institute (OARI), and International Livestock Research Institute (ILRI). The outcomes of the consultation were:

- The entry point of forage production better be as soil conservation, animal feed and integrated with crop production.
- Regarding the forge seed demand, it was said that the demand and price is high whereas the supply is very low **(Table 1)**. This was mainly attributed to the coverage of the forage seed needs of the country by only International Livestock Research Institute (ILRI) where the supply is limited in quantity, timely not available and the price is high, which is unaffordable at small scale farmers.
- Regarding the strategy how to start, it was suggested to start with a few farmers on small lands with high competitive forage crops particularly with those engaged in dairy and beef production.
- The group was advised to have a collaboration work with MOA for forage seed quality seed certification. It was also indicated that as there is an emerging private investors engaging themselves in forage leaves and seed pack and export which is indicative in forage seed market availability.

Table 1 Forage seed request to ATARC from 2007-09 (ATARC)

Forage type	Organization	Amount(kg)
Rhodes grass	Mension fur Mension	10
	ATJK MOA	105
	Akaki development coordinator	55
	Boset ARD	30
	Dire Dawa Catholic Relief	100
	Jijiga Pastoral Development	164
	Private	2
	Oromia Pastoralist Areas Development Commission	30
Lablab	Mension fur Mension	5
	ATJK MOA	106
	Mechara Research Center	>0.5
	Boset ARD	80
	Debrebirhan ARC	2
	Dire Dawa Catholic Relief	30
	Jijiga pastoral development	7200
	Private	1
	Somali ARD	150
	Oromia pastoralist Area development commission	43
Cow pea	Mension for Mension	5
	Mechara Research Center	>0.5
	ATJK MOA	105
	Diredewa catholic relief	50
	Private	1
	Somali ARD	100
	Gambella ARD	1
	ILRI- FAP	100
Citaria	Akaki development Coordinator	65
philaris	Akaki development coordinator	65
Stylosanthes	Mechara Research Center	>0.5
vetch	Mechara Research Center	>0.5
	Lome ARD	
	Jijiga Pastoral Development	820
	Somali ARD	47

Desmodium	Mechara Research Center	>0.5
Panicum	Boset ARD	50
Ciratro	Boset ARD	45
Cajanus cajan	Debrebirhan ARC	2
Elephant grass cuttings	Woliso Development coordinator	15000
	Mariam dairy farm	18000
	Meki catholic relief	20000
	Jijiga Pastoral Development	76800
	ATPSc	3000
Pigeon pea	Dire Dawa Catholic Relief	25
	Jijiga Pastoral Development	820
Leucnea pallidea	Jijiga Pastoral Development	1025
Sesbania sesban	Jijiga Pastoral Development	1025
All types	Debrezeit Research Center	
Alfalfa	Lome ARD	

Source : *Archive of Adami Tulu Research Center for the years 2007, 2008 and 2009*

Discussion with ARD offices

A discussion was held with Arsi Negelle and Shashemene Agriculture and Rural Development (ARD) staffs as what their present forage production and development activities look like. It was found that they had forage seed multiplication program at Farmer Training Centre (FTC) sites for distributing it to farmers. In their forage production and development, the bottleneck problem is seed and budget shortage to quench the great seed demand by farmers.

The constraints indicated above with regard to forage development had an implication on the approaches to be followed to achieve what is desired. Accordingly, the study team followed an approach that in one way solves the problem of shortage of forage seed by making the farmers the actual producer of the needed forage seeds and on the other hand an approach that can contribute to increase the income of the farmers by directly selling the forage seeds and improving the productivity of his animals through better livestock feeding.

Farmers' interest in forage seed production

In the first year, to understand and realize farmers' interest in forage production and development in particular to forage seed production, a PRA was conducted in two sites at Arsi Negelle PA called Gambiltu (rainfed) and Adami Tulu (irrigation), PAs of Abine and Bochesa. In the meeting, sixteen and nine farmers participated from Arsi Negelle and Adami Tulu districts, respectively. In Arsi Negelle, maize is the major cereal crop produced in the area followed by wheat since the rainfall pattern in the area is bimodal, the same land used for wheat production again used for vegetable production mainly potato whereas the land used for maize is only used for maize production throughout the year of production whereas maize, haricot bean, tef, barley and wheat are the common cereal crops produced in their order of importance in the Adami Tulu area during the main rainy season and vegetables like onion, pepper, and tomato using irrigation.

It was observed from the PRA that the number one problem in livestock raising was feed shortage and almost all of the respondents replied as forage seed supply is a serious problem not to go for forage production and development as a strategy of feed problem alleviation. From the discussion held, it was realized that farmers were obtaining forage seed from ARD and they were not advised or trained how to produce forage seed for use in the subsequent growing farming seasons or for marketing purpose. The ARD cannot supply forage seed regularly due to budget shortage, seed unavailability both in quantity and timely. Because of the serious feed shortage, the farmers responded as they can allocate land ranging from 0.125-0.25 ha for forage both for seed and animal feed.

2.2. Phase II Forage development strategy

Looking for forage seed buyers

In an attempt made to look for potential seed buyers, one private investor interested in buying forage seed in the country was found and a discussion was held and the interest on the type of forge seed that farmers can produce was identified in the mean time. But, when the forage seeds were produced, the farmers obtained a better price for the seed produced and the seeds were sold to government and non-government organizations in both years.

Workshop and training supplied

A workshop and training was organized in the first year at the beginning of the study and the objectives were to technically equip the farmers how they can produce forage seeds primarily to use for themselves in subsequent growing season, for their animal feed and sell the rest as other cereal crops to generate additional income and to bring the buyers and producer at front. In the year 2008, ten farmers from Arsi Negelle (rain-fed) and twelve framers from Adami Tulu (from Edeokontola, Abine and Bochesa using irrigation that are dairy beneficiary of SEDA) willing, dairy cattle keepers were purposely selected, private seed buyer, NGO (SEDA), development agents, senior forage agronomists from previous staff of ILRI (Ato Abate Tedla) as guest and trainer and Adami Tulu researchers as trainers (economics, extensionist and forage agronomists) participated in the workshop and training. The training was provided on most promising productive species and to the interest of the buyer, a group discussion was held and each stakeholder shared their responsibilities. At the end of the discussion, two committees from farmer side representing the two sites were formed who would deal and fix the seed price that would be produced and to make a negotiation at the end with the forage seed buyer. As indicated above, because of the better price the farmers obtained during the first year, the idea of linking the community with the private investor was left out.

The various plantation strategies and improved forage species were raised and discussed with the farmers as source of animal feed and for the purpose soil fertility improvement. The strategy used was in soil erosion protection, soil fertility improvement, and integration with the main crop. In the Arsi Negelle, Napier was planted around water harvest pond to protect soil erosion, intercropping of lablab with maize, cowpea with sorghum and vetch with maize/sole crop whereas in Adami Tulu (using irrigation) Napier along the ridge of canal/intercropped with alfalfa, alfalfa sole cropping, lablab with maize/sole cropping.

At the end of the workshop, each stakeholder shared responsibilities in that the farmers will provide land, make the necessary land preparation and management and plantation and research center, technically support the farmers , distribute basic forage seed and undertake monitoring, the DAs follow up the actual plantation and regular monitoring, NGO and ARD buy forage seed to support farmers initiation.

2.3. Phase III: Ensuring sustainable back up seed supply

To ensure sustainable forage seed supply for the community based forage seed production trial and for practically training of farmers at Adami Tulu Agricultural Research, the centre established those forage crops that are pertinent for the intended community.

3. Results and Discussions

Promote Group Action and FRG

In order to improve the linkage among research, extension and farmers, and thereby help them function synergistically with an aim to bring significant change/transformation in the lives and livelihoods of resource poor farmers, there is a need to promote group action and formation of FRG. Accordingly, in the first year, two FRGs were formed containing ten farmers from Arsi Negelle (rain-fed) and twelve framers from Adami Tulu districts (Edeokontola, Abine and Bochesa PAs using irrigation and dairy beneficiary of SEDA) that were willing and dairy cattle keepers were purposely selected. In the second year, ten farmers from Arsi-Negelle and eight farmers from Adami Tulu participated in forage seed production

Seed production and marketing

Lablab yield more seeds in Adami Tulu area than in Arsi Negelle. This is because of enough light or temperature for flower to set seed whereas in Arsi Negelle there was a continuous high rainfall that enabled the plant to have a more herbage yield (dry matter per ha). The establishment of Alfalfa was possible in both districts during the rainy season, however, failed to collect seed in the first year as it inherently needs deprivation of water after the onset of flower.

Nevertheless, in the second year, one farmer at Adami Tulu was able to produce two kg of Alfalfa. Similarly, a higher herbage yield was recorded in Arsi Negelle district because of the high rainfall. Concerning the growth of elephant grass the growth was noticed to be slow in Arsi Negelle. In all of the species selected and established in both districts, a lower seed yield and herbage was recorded as compared to the findings in literatures (Alemayehu, 1997).This could be due to absence of fertilizer application before the establishment to support its emergency and its subsequent growth.

Table 2. Seed production and marketing at Adami Tulu

Parameters	2008 (Rain-fed)		2009 (Irrigation)		2009 (Rain-fed)			
	Lablab	Alfalfa	Lablab	Cowpea	Lablab	Cowpea	Alfalfa	Cajanus
Seed Produced (kg)	230	No	100	392	411	324	2	16
Amount of seed sold (kg)	230	-	100	392	358	324	2	16
Unit price (Birr) /kg	40	-	40	40	25-40	25-40	40	30-40
Total price (Birr)	9200	-	4000	15680	13820	9720	80	480
Average land allocated (ha)	0.22	0.02						

Table 3. Seed production and marketing at Adami Tulu

Parameters	2008 rain season	2009 rain season		
	Vetch	Lablab	Cowpea	Vetch
Seed yield(kg/ha)	160	120	20	25
Amount of seed sold	160	-	20	25
Unit price	40	-	25-40	40
Total price	6400	-	500	1000
Average land allocated (ha)	0.1	0.25	0.04	

All the forage seeds produced in the first year using rain-fed and irrigation were sold at 40 Birr/kg but in the second year the price varied between 25 and 40 Birr with more of the produce sold at a price of 40 Birr (Tables 2 and 3).

Feeding improvement and economic impact implication

The land allocation for the aforementioned forage species ranges from 0.125 to 0.75 of a hectare where 75 % of the FRG farmers allocated on average 0.25 ha. This indicated that for the annual species (lablab & vetch), it was possible to obtain lablab residue of 3722.5 kg for farmers in Adami Tulu and 760 kg in Arsi Negelle, respectively. This can support 745 TLU (Tropical livestock unit) for a farmer in Adami Tulu and 152 TLU in Arsi Negelle district. Whereas for Alfalfa it can support 4512 TLU and 3648 TLU in Adami Tulu and Arsi Negelle districts, respectively (where the cutting frequencies were two times in a month and once in a month for Adami Tulu and Arsi Negelle districts, respectively). The FRG farmers engaged in the community based forage seed production by feeding their cows with green feed (alfalfa) and the residue the milk yield of their cows increased by 1- 2 liters /head.

4. Lessons Learnt

- Additional efforts are required to organize farmers in one form as the sale of forage seed does not have a regular market place as food crops
- For a proper sale of forage seed the establishment of market places in the town is important
- The start of forage production should have different utilities not only seed production for sale. But, increased quantity and quality of livestock feed need emphasis particularly for those who have crossbred dairy cows.
- Doing research with participation of farmers at all stages, different stakeholders, policy makers, etc are key indicators for successfulness and sustainability of certain technology.
- Farmers who have been trained for other activity, observed the ATARC forage demonstration site and impressed much and repeatedly asked to do as the centre does and they were

unfortunately selected as one of the farmer forage seed producers and are eventually found performing better.

- Choice of forage species that have high demand in the market must be made (For instance Cowpea is more preferred in the market than Lablab)

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About FRG II

THE PROJECT FOR Enhancing Development and Dissemination of Agricultural Innovations through Farmer Research Groups (FRG II Project) is to enhance the capacity of researchers to take part in innovations through farmer research group approach (FRG approach). Implemented by a technical cooperation between Ethiopian Institute of Agricultural Research (EIAR) and Japan International Cooperation Agency (JICA), the FRG II covers all the agricultural research institutions in the country through training on the approach, financing FRG based research projects in selected priority research areas and filling gaps and enhance linkages between research and extension by delivery of technical information. For more information, visit

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