**ETHIOPIA STRATEGY SUPPORT PROGRAM**

**(ESSP)**


# The Ethiopian Seed System:
## Regulations, Institutions and Stakeholders

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# 1 INTRODUCTION

Any discussion about agriculture and rural development leads inevitably to the subject of seed. The simple facts of plant reproduction make for remarkable abundance in agriculture from the almost costless effort of saving seed from harvest, agrarian agents can cultivate successive generations of crops and reap the benefits of income and subsistence. The application of modern science, by enhancing the productive powers of the seed, has the ability to multiply these benefits further.[1]

But seed systems are complex. They are often characterized by market and institutional failures that pose challenges for their growth in developing countries. Problematic property rights result from fact that improved seeds can, in many cases, be reproduced by the farmer, thus reducing the ability of breeders to appropriate the gains from their innovative activities and investments. Second, information asymmetries result from the inability of farmers to make *ex ante* assessments of seed quality, since such knowledge is held only by the seller in the absence of certain types of regulation. Third, coordination problems result from difficulties relating to the enforcement or monitoring of contracts for seed use. Finally, inelastic supply responses result from the inability of breeders to respond effectively to demand for seed that changes with expectations of market prices, household incomes, rainfall, and other determinants of farmers' planting decisions. These challenges hold true for seed systems where private agents are the primary actors in the seed system (as in many industrialized countries), where public organizations play the central role (as in many developing countries), or in countries that are transitioning from a public-led system to one that incorporates a more complex set of agents.

Many of these issues are becoming increasingly contentious in Ethiopia. Commercialization of smallholder farming, privatization of formerly public enterprises, adoptions of new technologies, and introduction of new policy regimes are changing not only the supply and demand for seed, but the workings of the entire seed system itself. Issues such as plant breeders' rights, protection of farmers' rights to save seed, introduction of genetically-modified organisms, and biosafety regulations to protect human and environmental health, are all on the table at this moment.

These issues are a fairly new point for consideration in Ethiopia, where the formal seed system is still very young. While the system was developed more than 50 years ago to increase agricultural productivity and improve food security with improved seed, its penetration is relatively weak. Like much of sub-Saharan Africa, there is evidence to suggest that 95 percent of seed planted is saved, selected, and exchanged among farmers themselves (Menini, 1999). While this continued reliance on local, informal seed systems is critical to preserving biodiversity and cultivar improvement, it often precludes farmers from accessing modern improvements.

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[1] In the present context, the term "seed" in used to denote organic material produced or used for the sexual or asexual reproduction of plants. Conventionally, however, only organic materials for sexual reproduction are referred to as seed, while materials for asexual reproduction are referred to as other planting materials, e.g., cuttings, buddings, roots, stems, or any other vegetative plants part that can be used for propagation. However, the term "seed" is used throughout the present research to mean planting material because seed comprises the largest portion of all planting material used by farmers worldwide, and because it is a convention used for the sake of brevity throughout the literature.

Ethiopia's formal seed system has experienced several transformations since inception. The beginning of a formal system dates back to the 1950s with the establishment of breeding programs at the Jimma and Alemaya Agricultural Colleges. However, breeding and multiplication activities remained ad hoc until the 1970s. In 1976, the National Seed Council (NSC) was set up by the National Crop Improvement Committee (NCIC) to formulate recommendations for seed production and supply of released varieties from the national research programs (Belay, 2002). As a result, the Ethiopian Seed Corporation was established in 1979 to undertake seed production, processing, distribution and quality control in the country.

Although extensive research conducted in Ethiopia over the years has generated many improved cultivars, seed supply remains limited in Ethiopia, especially for small-scale, resource-poor farmers. And even where supply is commonly regarded as adequate—as in the case of hybrid maize—the number of varieties that are suitable for different agroecological conditions and farming systems remains limited. This study attempts to examine these issues more closely.

## 2 STUDY GOALS AND METHODS

The overall goal of this study is to evaluate the seed production and distribution systems in Ethiopia, assess the roles of various players in the system, and suggest policy options to strengthen the system's relevance with respect to small-scale, resource-poor farmers. The key research questions underlying this study are as follows:

- What is the magnitude of demand for and supply of quality seed in Ethiopia? Are demand and supply growing in response to new opportunities in agricultural markets and, if so, what is the long-term potential of Ethiopia's seed market?

- What incentives need to be put into place to encourage the development of markets for quality seed in Ethiopia? What are the technical and policy constraints to encouraging seed market growth in Ethiopia?

- Can the growth of seed markets in Ethiopia respond to the needs of small-scale, resource-poor farmers? What specific policies can encourage pro-poor development of seed markets?

The study was conducted in 2005 using rapid appraisal methods that relied primarily on (a) data collection using pre-prepared checklists; (b) semi-structured interviews and focus group discussions with key informants; (c) direct observation of agents within the seed system; and (c) document analysis.
The paper first discusses about the structure of the seed system taking into consideration the agro-ecological aspect, the key stakeholders and the regulatory framework. The second part focuses on the production and marketing of seed under the existing system and finally conclusions and recommendations are drawn for further improvement the sector.

# 3 STRUCTURE OF THE ETHIOPIAN SEED SYSTEM

## 3.1 Organization of the formal seed system

The organization of the formal seed system in Ethiopia is depicted in figure 1. The system works mainly for major cereal and pulse crops like maize, wheat, teff, and beans. The story is quite different for vegetable seeds, which are mainly imported.

The National Research System, which made up of the EIAR, the 6 Regional Research Institutes and Higher learning Institutions, involves in the seed system through provision of basic seed to seed producers. The MoARD plays the regulatory role through licensing and certification of seed production. The national demand and supply is matched by ESE by collecting the demanded amount for the Regional Bureaus of Agriculture and contracting out the same to seed producers, which can be state farms, private farms and small-scale farmers. It also produced seed on its farms. Then the produced seed is cleaned and treated in its warehouses for distribution through farmers' unions to farmers. The role of each actor in the system and their relationships are detailed in subsequent part of the paper.

## 3.2 The agro-ecological context

Among the many priorities for an effective seed system is the ability to produce, multiply, and distribute seed that are bred for optimal performance under different agroecological conditions. This is of critical importance to Ethiopia, host to 18 major agro-ecological zones and 49 sub-zones, according to the Ministry of Agriculture and Rural Development (MoARD). The zonation is based primarily on two indicators: length of growing period (proxied by the number of days with sufficient moisture for plant growth) and thermal zones (proxied by the combination of temperature and elevation). The names of the 18 major agro-ecologies are set forth in Table 1, which also includes references to breeding strategies and varieties available for maize as an illustration of the relationship between agroecology and seed systems.

For the most part, however, the seed system in Ethiopia (discussed in detail below), provides improved varieties for three groups of these agro-ecological zones: low, medium and high altitude crop-growing areas; four durations to maturation: extra-early, early, intermediate, and long maturing varieties; and other context-specific attributes such as yield, drought tolerance, and disease resistance.

**Figure 1 Organization of the formal seed system in Ethiopia**

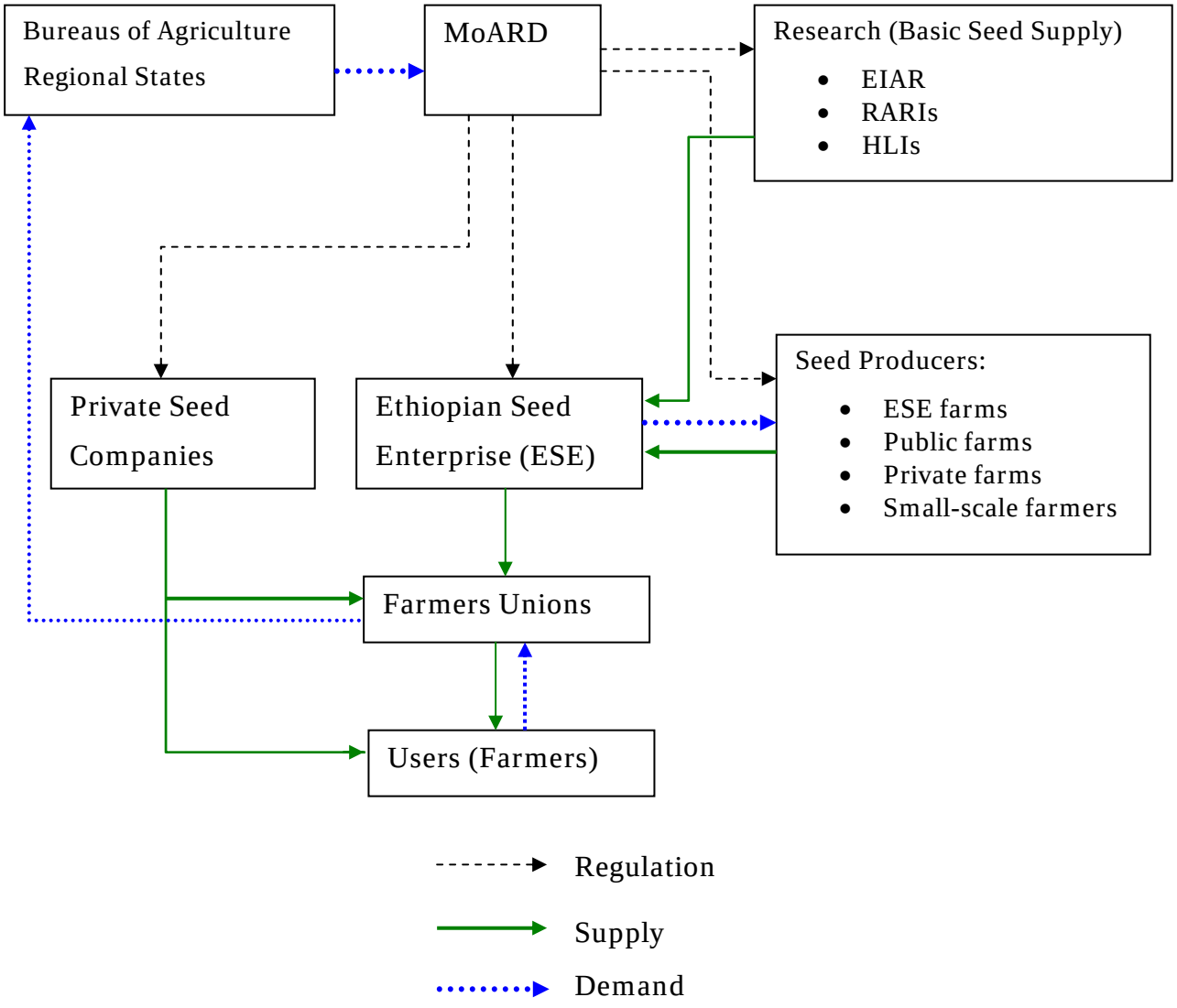

**Table 1. Agro-ecological targets of maize research in Ethiopia**

| Agro-ecology | Growing area/region | Breeding strategy | Currently available maize variety (s) |
|---|---|---|---|
| A1 | Afar region, Dire Dawa, Alemaya (partly), Negele Borena (partly | For irrigation | BH 140 |
| SA1 | Humera, Metema, Abderafi (N. Gonder), Omorate | | |
| SA2 | Rift Valley (Zway, Alemtena, Shashemene, Wonji and Koka) | Earliness; drought tolerance | Katumani; Melkassa I |
| SM1 | North Wollo (Kobo area), Alamata, Sheket (Tigray), Asebot, Afar region, Bale, Fike, lowlands of west Harraghe and Afder | Earliness; drought tolerance | Katumani; Melkassa I |
| SM2 | Tigray, North Shoa, East Shoa, North Wollo, Merabete, Wogeltena, Gursum | Earliness; drought tolerance | A 511 |
| M1 | Pawe, West Afar, South Omo, Segen valley, Teltelie, Negele Borena, Bale, Somali border area, Abay Gorge, Abomsa, Asebe Teferi, Bedesa, Alemaya, Karians, Tirma, Liben, Moyale | High yield | Rare I |
| M2 | Adet, Alemaya, Sirinka, Ambo, Holetta, Sinana, Kulumsa, Yabello, Dabat, Finote Selam, Debre Tabor, Fiche Degem | High yield | BH 660;BH 540 |
| SH1 | Abobo, Asosa, Anfilo, Denbidollo, Waka, Sawla, Gibe Valley, Omo valley, Baro and Akobo areas and Gumer | | |
| SH2 | Bako, Awasa, Areka, Gimsi, nejo, Shambu, areas along Bure to Nekemte, Gilgel Gibe areas, Sekoru, Asendabo, Sodo, Arba Minch, Hosana, Silte, Kondaltiti, Butajira, Buie, Mareko, Dodoalla, Agarfa, Robe, Gelemso, Deder, Mechara, Girawa, Kobo (North Hararghe), Arjo and Endibir | High yield; disease resistance | BH 140; BH 540; BH 660; BH 541 |
| H1 | Tepi, Jinka, Konso, Derashe | Disease resistance | USB |
| H2 | Areas around Gore, Jimma, Bedelle, Mettu, Agaro, Gera, Bore, Bensa, Kibrmengist, Hagereselam, Masha, Aleta Wondo, Ticho (Robe), Adelle, Limu, and Mizan | High yield | BH 660 |
| PH1 | Mizan, Bench Maji zone (Maji partly) | High yield | |
| PH2 | Southwestern parts specifically around Kefacho, Sekacho and Bench Maji zones | High yield | |

**Source**: EARO 2002

## 3.3 The key players

Typically, seed systems are comprised of multiple actors with numerous, often conflicting, interests and objectives. Actors range from non-market actors, such as public regulatory agencies, research institutes, extension services, and non-governmental organizations; to market actors, including domestic and foreign private firms, cooperative unions, and trade associations; and farmers themselves. Each of key stakeholders is introduced and discussed below.

### *3.3.1 The Ethiopian Institute of Agricultural Research*

The Ethiopian Institute of Agricultural Research (EIAR, formerly the Ethiopian Agricultural Research Organization (EARO)) is a public sector entity responsible for the coordination of the national agricultural research system. It undertakes research to generate agricultural technologies relevant for the country as a whole, and coordinates nine major research centers which maintain their own autonomous status. Each of these centers is responsible for maintaining and providing breeder seed to basic seed producers for specific crops and crop varieties.

### *3.3.2 Regional agricultural research institutes*

Currently, there are six regional agricultural research institutes (RARIs) in the country that were established since 1997 under the administration of individual regional states to undertake agricultural research specific to the region's agricultural sector. These are the Tigray Agricultural Research Institute (TARI), Amhara Regional Agricultural Research Institute (ARARI), South Agricultural Research Institute (SARI), Oromiya Agricultural Research Institute (OARI), Somali Pastoral and agro-pastoral Research Institute (SOPARI), and Afar Agricultural Research Institute (AARI).

### *3.3.3 Institute of Biodiversity and Conservation*

As a federal body responsible for the conservation of the country’s biological resources, the Institute of Biodiversity and Conservation (IBC) plays an important role in the conservation of local germplasm and also in the enrichment of the pool of the existing crop germplasm through the introduction of germplasm from international sources using ex-situ and in-situ conservation methods.

### *3.3.4 Agricultural higher learning institutions*

The major agricultural higher learning institutions in the country are Alemaya University, Jimma and Ambo Colleges of Agriculture of Jimma University, Mekelle University and Awassa College of Agriculture of South University. Each institution participates in crop research to varying degrees and for different crops. For instance, Alemaya University conducts research on maize and sorghum improvement, while Jimma College focuses on horticultural crops, and Ambo College on highland maize.

### *3.3.5 International agricultural research institutes*

Most of the crop/commodity-focused international agricultural research institutes (IARIs) are involved in the Ethiopian seed system through their close collaboration with the EIAR and other components of the national research system. The most active IARIs in Ethiopia are CIMMYT (maize and wheat), CIAT (beans), INTSORMIL (sorghum and millets), ICARDA (arid and dryland crops), AVRDC (vegetables), and ILRI (livestock). They play an important role in the system by providing technical backstopping, germplasm exchange, and financial support. For example, INTSORMIL played an important role in introducing 3462 types of sorghum germplasm between 1999 and 2003—an important contribution to improvement of a crop that provides subsistence in many parts of rural Ethiopia (Table 2).

**Table 2. Sorghum germplasm introduced and selected, 1999-2003 (by year and source)**

| Year of introduction | Germplasm type | No of entries introduced | No of entries selected | Source |
|---|---|---|---|---|
| 1999 | Sorghum varieties/lines | - | - | INTSORMIL |
| | Sorghum hybrids | 419 | 126 | INTSORMIL |
| | **Total** | 419 | 126 | |
| 2000 | | | | |
| | Sorghum varieties/lines | 25 | 18 | INTSORMIL |
| | Sorghum hybrids | - | - | - |
| | **Total** | 25 | 18 | |
| 2001 | | | | |
| | Sorghum varieties/lines | 1,417 | 277 | INTSORMIL |
| | Sorghum hybrids | 219 | 14 | INTSORMIL, ICRISAT |
| | **Total** | 1,636 | 291 | |
| 2002 | | | | |
| | Sorghum varieties/lines | 208 | 54 | INTSORMIL |
| | Sorghum hybrids | 266 | 43 | INTSORMIL |
| | **Total** | 474 | 97 | |
| 2003 | | | | |
| | Sorghum varieties/lines | 70 | 40 | INTSORMIL |
| | Sorghum hybrids | 838 | 177 | INTSORMIL |
| | **Total** | 908 | 217 | |
| | **Grand total** | **3,462** | 749 | |

Source: National Sorghum Improvement program, Melkassa Research Center, EIAR

### *3.3.6 Ethiopian Seed Enterprise*

Currently, the Ethiopian Seed Enterprise (ESE), a public enterprise, dominates the formal seed market and manages the production, marketing, and distribution of improved cultivars nationwide. ESE is the only public seed enterprise responsible for production of seed for all crops (cereals, pulses, fruits, vegetables and forage), although its seed production is dominated by cereals, especially maize and wheat.

ESE is internally organized into several different departments, the major ones being Seed Production, Technology Extension, Quality Control and Seed Marketing. ESE is externally accountable to its Board of Directors, which are in turn accountable to Agricultural Inputs and Marketing Department of MoARD.

ESE produces seed on its own farms located throughout the country (including sites in Ardita, Awassa and Arsi), and through contract with public and private farms, cooperative unions, and small-scale farmers. Each of these relationships is detailed below.

Seed production through small-scale farmers was considered taking into consideration the importance of the informal seed sector, which provides over 80 percent of the national requirement with farm-saved seed. The former National Seed Industry Agency (NSIA) through the Seed Systems Project has been implementing Farmer Based Seed Multiplication and Marketing Schemes (FBSMMS) in several regions of the country, which encouraged variety diffusion within communities through farmer-to-farmer seed exchange. The main objectives of the scheme are two-fold. First, the scheme aims to improve farmers' skills in seed production and to create awareness about the importance of seed as a major input into improved production and productivity. Second, the scheme hopes to increase the capacity of ESE seed production in order to meet the overall demand in the country.

The scheme operates based on the following functions:

1. Selection of target *woreda* (district): this is done by ESE production experts taking into consideration the crop type for which seed production is required, the production potential of respective *woredas* and accessibility for quality control and monitoring.
2. Selection of participating farmers: this is done after ESE selection of the target *woreda* and it is done in collaboration with respective officials from the *woreda* bureau of agriculture. Similarly, ESE production experts select participating farmers taking into consideration area available and suitability of the specified seed production, willingness of the farmers and accessibility.
3. The selected farmers then get registered and sign an agreement. Usually, the agreement states that 85 percent of the raw seed produced will be given to ESE and farmers can retain 15 percent; the purchase price is the current price at the time of threshing plus 15 percent of the price.
4. ESE experts provide training on the production techniques of seed production for the specified crops and ESE experts from its own quality control department supervise and provide advice during germination, flowering, seed setting and harvesting time. ESE provides also bags for collecting the produced raw seed.
5. ESE collects the produced raw seed and clean and grade for sale to other farmers and/or stakeholders. In most cases, farmers are not willing to give the produced seed to ESE as they know that they can sell the seed at very high price as compared to the 15 percent price increase.
6. Generally, since the start of the scheme from 3,000 to 5,000 ha of land is used annually for seed production of different pulses, teff, sorghum and millet in Tigray, Amhara, Oromia and SNNP regions of the country. Maize seed has never been produced in farmers' fields.

Outcomes of the scheme have been mixed. Farmers have complained that 15 percent retention of the produced seed is very small and the price offered is also low (market price plus 15 percent of the price). ESE has argued that farmers' have not performed as expected, and are sometimes unwillingness to hand seed over to ESE as agreed for reasons such as consumption due to food shortage and prior sale to address other financial requirements. ESE has also argued that the collaboration with *woreda* Bureaus of Agriculture (BoA) officials is not as expected as the BoA have no incentive to support the scheme.

For seed production in collaboration with private and state farms, ESE usually determines its needs based on the expected demand in crop type and quality, and the major locations/areas where the demand is expected. Accordingly, it approaches private and state farms and signs agreement to produced raw seed. ESE considers suitability (irrigation facility, isolation and production potential), capacity, and accessibility of the farms to select. However, state farms get priority if there is the option to select from private and state farms. ESE does not require that producers have seed production license as it has its own internal quality control. In most cases, maize seeds—both hybrids and composite—are produced in private and state farms.

ESE sells seed at a fixed price, earning a profit margin range of 3 to 5 percent. Its primary customers are regional states: Each year, regions submit their demand to ESE, which attempts to respond accordingly. However, as farmers revise their expectations of rainfall, prices and other factors, their demands often change from the region's initial estimates. This frequently causes significant coordination problems for ESE and the regions, particularly in drought-prone areas such as the Rift Valley.

### *3.3.7 State farms*

State farms are also involved in the production of seeds by taking contracts mainly with ESE. The Upper Awash Agro Industry Enterprise (UAAIE), located in the Rift Valley near the Awash River, has been producing maize seed (in addition to its horticultural crop production) since 1998. UAAIE's maize seed is produced primarily through annual contract agreements with private and public seed processors. Usually, after purchasing the seed from the farms, ESE cleans and grade the purchased seed before making available for distribution.

Ziway Farm and Horticulture Development Enterprise is similarly involved in maize seed production through contractual arrangements with other seed companies, namely ESE and Pioneer Hi-Bred. During the production process supervision is undertaken by the ESE and Pioneer Hi-Bred experts at different stage of the crop. After harvest, the seed is provided at a price set in the agreement. Seed processing is undertaken by the respective seed companies.

### *3.3.8 Private firms*

Currently, 26 private companies are licensed to produce, 3 to process, 19 to import, 33 to retail, and 4 companies to export. Private companies licensed to produce maize seed are Pioneer Hi-Breed Seeds P.L.C., Hawas Ago Business, Awassa Green Wood, Hadiya Trading Enterprise, Ethio Flora, and Ano Agro Industry. All these companies are involved in the production of hybrid maize varieties except few that produce open pollinated maize varieties when ever there is contractual arrangement. The firms hold a competence assurance certificate issued by the

Agricultural Inputs Quality Control Department of MOARD to produce, process, import, retail and/or export seed.

**Table 3. Hybrid maize production by company and variety in 2004**

| Company | Variety | Amount produced (quintals) | % of total supply | % of total hybrid maize seed |
|---|---|---|---|---|
| ESE | BH -660 | 23293 | 70.83 | 69.97 |
| | BH – 670 | 405 | 100.00 | |
| | BH -140 | 13750 | 100.00 | |
| | BH - 540 | 13261 | 94.55 | |
| | BH – 541 | 251 | 100.00 | |
| | BHQP - 542 | 1145 | 100.00 | |
| Pioneer Hi-Bred | Phb - 3253 | 7000 | 100.0 | 16.12 |
| | Phb -30H – 83 | 5000 | 100.0 | |
| Hawas Agro Business | BH -660 | 180 | 0.55 | 0.24 |
| Awassa Farm Development Enterprise | BH -660 | 962 | 2.93 | 1.29 |
| Awassa Green Wood | BH -660 | 3500 | 10.64 | 4.70 |
| Hadiya Trading Enterprise | BH -660 | 1100 | 3.34 | 1.48 |
| Bako Agricultural Research Center | BH -660 | 2397 | 7.29 | |
| | BH - 540 | 765 | 5.45 | 4.25 |
| Ano Agro Industry | BH -660 | 612 | 1.86 | 0.82 |
| Anger Farm, PLC | BH -660 | 842 | 2.56 | 1.13 |
| **Total** | BH -660 | 32886 | | |
| | BH - 670 | 405 | | |
| | BH -140 | 13750 | | |
| | BH - 540 | 14026 | | |
| | BH - 541 | 251 | | |
| | BHQP - 542 | 1145 | | |
| | Phb - 3253 | 7000 | | |
| | Phb -30H – 83 | 5000 | | |

Source: Agricultural Inputs Marketing Department, MoARD (2005)

Pioneer Hi-Bred is a market leader next to ESE in the production and distribution of hybrid maize in Ethiopia. The firm imports its branded hybrids from abroad and puts them through the national variety release procedure before entering the market.

Farmers' cooperatives and unions also produce and distribute seed, often with the support of government-guaranteed loan. Cooperative members purchase seed from their cooperative, while non-members can also purchase seed for an additional fee.

Following economic liberalization efforts in early 1990s, the participation of the private sector at least in the production of seed has increased considerably. Tables 3 and 4 summarize the participation of different producers in the production of maize seed. Although the supply of both openly-pollinated maize varieties and hybrid maize is dominated by ESE (82 and 70 percent, respectively), the private sector does contributes significantly (18 and 20 percent, respectively).

**Table 4. OPV maize seed production by company and variety in 2004**

| Company | Variety | Amount produced (quintals) | % of total supply | % of total OPV maize seed |
|---|---|---|---|---|
| ESE | A - 511 | 2145 | 100 | 82 |
| | Katumani | 2772 | 66 | |
| | Gibe - 1 | 1150 | 100 | |
| | Kuleni | 503 | 100 | |
| Awassa Green Wood | Katumani | 1000 | 24 | 13 |
| Ethio-Flora | Katumani | 425 | 10 | 5 |

Source: Agricultural Inputs Marketing Department, MoARD (2005)

Note, however, the absence of private firms engaged in independent, commercial seed marketing and distribution in Ethiopia. Most of the private producers mentioned earlier are merely contracted by ESE or Pioneer Hi-Bred to produce seed, but they do not engage in marketing or distribution direct to farmers.

### *3.3.9 Civil society*

There are many different community-based organizations (CBOs), non-governmental organizations (NGOs), and faith-based organizations operating in Ethiopia, many with an interest in agriculture and rural development. World Vision, Sasakawa Global 2000, FARM Africa, CARE, CRS, Alem Tena and Meki Catholic are among the larger, more important organizations active in the seed sector.

Many of these NGOs are involved in the promotion of community-based seed systems for various crops that are important to food security. For example, the Catholic Church, in collaboration with *woreda* BoAs, is promoting community-based maize seed multiplication of the Melkassa 1 variety in the Meki and Ziway area. The Catholic Church in Alem Tena and Meki are also involved in promoting the bargaining power of the farmers through establishment of local cereal banks. The cereal bank is owned by group of farmers involved in seed multiplication and its main role is to improve farmers' access to market through purchase of produce usually at time of harvest with premium price (current price plus 15 percent of current price). The role of such bank for promoting the availability different types of seed especially for those suitable for moisture stress area is tremendous.

### *3.3.10 Farmers' cooperatives and unions*

In recent years, farmers' cooperative and unions are playing important role in the seed system as producers and also distributors. Most of the cooperative unions are involved in input distribution to their members and also to non-members. In previous years, it was the woreda bureau of agriculture responsible for distribution of seed to the farmers.

#### *3.3.10.1 Small-scale farmers*

Finally, consider the small-scale farmers—the most critical stakeholder in Ethiopia's seed system, both as a consumer and producer of seed. For the most part, small-scale farmers depend on locally selected and saved seed alongside farmer-to-farmers seed exchanges. But their cultivation strategies and seed choices are by no means simple: many factors play a role in determining farmers' selection and planting behavior. First-hand experience with the performance of particular varieties, reputation of a variety or the source of its seed, accessibility of markets for both inputs and outputs, and many other factors go into the small-scale farmer's decision-making process.

# 4 THE REGULATORY FRAMEWORK

Given the various market and institutional failures mentioned earlier, regulation is vitally important to the development and growth of an effective seed system. An effective regulatory regime would thus be highlighted by the following (Gisselquist and Van Der Meer, 2001; Tripp and Louwaars, 1997):

- varietal registration to ensure use of branded names as indications of quality
- performance testing and phytosanitary certification to assure product safety for cultivation, consumption and the environment
- certification and truth-in-labeling, to further assure quality for cultivation
- plant variety protections and other forms of IPR to stimulate private investment in breeding
- technical support to government agencies to improve the execution of the regulatory standards.

The question is whether Ethiopia's regulatory regime includes provisions to address these issues, and whether these provisions are having a desired effect on the seed system.

## 4.1 Regulatory organs

The regulatory organs in the Ethiopian seed system are the different departments of the Ministry of Agriculture and Rural Development, which are discussed below.

**Agricultural Input Quality Control Department:**
The Agricultural Inputs Quality Control Department is one of six departments under the Agricultural Marketing and Inputs section of MoARD (Figure 1). Its main role in the seed sector is to provide licenses to seed producers and certification of seed for domestic, imported, and exported seed.

Until late 2004, the department operated eight seed laboratories in four regional states. However, due to the continuing process of decentralization, these laboratories are now administered by respective regional BoAs. There are two labs in Tigray, one in Axum and another in Mekelle. In Amhara, one lab is in Gonder and the other in Dur Bete. There are two additional seed labs built in Debre Markos and Dessie of Amhara. In Oromiya, one lab is in Ambo and one in Assela; and in SNNP, one lab is in Wolkite and one in Durame. The eight seed labs are responsible for quality control of seed produced for use in their respective regions. In cases where seed produced or imported is for use in more than one region, the Federal Agricultural Inputs Quality Control Department takes responsibility for quality control. The current official relationship between the department and the regional labs has a form of cooperation in the area of provision of training and experience sharing.

License and certification of seed is basically required for those who produce seed for commercial purpose or those who import or export. Commercial activities in the area of seed production with local farmers promoted by different agricultural processing companies like Assela Malt producing company and food processing companies, is not licensed or certified by the department as the production intention is to get enough production locally.

**Agricultural Inputs Marketing Department:**
The major role of the Agricultural Inputs Marketing Department is to assess national seed demand and supply, and develop strategies to address any surpluses or shortfalls. Typically, the problem is one of shortage, mainly for varieties demanded by farmers as they revise their expectations of rainfall, prices, and so on, as noted earlier.

In recent years, the Department has pursued strategies to overcome seed shortages in close collaboration with regional BoAs, ESE, and other public and private providers of seed. For instance, in the 2003/04 production season, the strategy employed was to purchase seed from farmers that had not been under the supervision of the Agricultural Inputs Quality Control and then clean, grade, assess the germination and if reasonably good to distribute to the farmers as certified seed.

## 4.2 Varietal release procedures

Two steps are involved in the release of a new variety (or a hybrid) in Ethiopia: (1) testing of the new improved variety and, (b) registration of and the variety. The National Variety Release Committee (NVRC) is responsible for managing both of these steps. The NVRC—formerly under the National Seed Industry Agency (NSIA)—is administered by the Crop Development Department of the Ministry of Agriculture and Rural Development (MoARD), and is comprised of representatives from MoARD, the Ethiopian Institute of Agricultural Research (EIAR), agricultural higher learning institutions and other relevant organizations/institutions. Its members are senior professionals from the following disciplines, with their number of representatives denoted in parentheses: plant breeding (2), agronomy/physiology (1), entomology (1), pathology (1), economics (1), food science (1), research-extension specialization (1), and others as required.

The specific guidelines for a varietal release mandate that the following conditions be fulfilled before the variety is released:

- The new variety must show excellent performance in sufficient number of tests in comparison with the standard cultivars grown in the ecological zone(s) where it is to be used.
- The variety should be tested for yield, disease reaction and other important characteristics for a minimum of two to three years in Regional or National Variety Trial (RVT or NVT) at least in 3 to 5 locations.
- The variety to be released should be uniform, stable and distinctly superior to the existing commercial cultivar grown in the area in one or more characteristics important for the crop and is satisfactory in other requirements. However, when there is no adequate number of released cultivars of a particular crop, the NVRC may consider releasing a variety even if it is not superior to the existing cultivar, without compromising the requirements of the grower.
- The new variety should be planted along with the established local or improved cultivar as the case may be in relatively large plots (at least 100 $m^2$ at 2 to 3 sites). One of the sites should be on station and the other two on farm verification trials during the anticipated year of release for assessment by NVRC.
- Prior to preparing proposal for release of a variety, the researcher should consult with commodity program leader and other concerned researchers. The consensus reached on the merits of the variety should be communicated to the NVRC.
- Appropriate data to support recommendations like yield, agronomic data, disease reaction and other support data for individual locations and years should be presented in addition to complete morphological description and distinguishing characteristics of the candidate variety.

The evaluation procedure itself is conducted by a technical committee appointed by the NVRC and comprised of NVRC members and other relevant specialists. Following the recent structural reorganizations in the government ministries, the Crop Development Department of the MOARD has assumed responsibility for organizing this committee and for providing information on the release status of varieties, and the agronomic and morphological descriptions.

The committee's task is to report on the varietal performance after examining the submitted data and evaluating the verification trial plots. The evaluation report from the technical committee is expected to cover performance data evaluation, field performance evaluation, general comments, and recommendation.

A variety release proposal should be submitted to the committee chairperson by May 30 each year. Action to place a variety on the release list is taken at the November/December meeting of the NVRC. The breeder submitting a variety for release is called to appear in person before the NVRC to answer questions about the proposal. Decision reached by the NVRC are published or reported at the National Agricultural Research and Development Forum annually.

A new variety should be assigned a permanent designation by the breeder/team (preferably a short local name) at the time of approval for release. This is a pre-condition for release and

registration. The breeder should plant provisionally the released variety in the following year on one-hectare plot at the research center for final inspection by the NVRC.

The breeder or institution responsible for developing the variety that has been approved for release would be expected to maintain an appropriate quantity of the breeder and basic seed for use in replenishing and restoring commercial seed of the variety to the desired genetic purity.

## 4.3 Plant breeders and farmers rights

The Government of Ethiopia enacted the Plant Breeders Act in January 2006 to stimulate the growth of a private sector seed industry, and to ensure that firms investing in plant breeding would be able to recoup their research and development expenses through the commercial sale of improved plant varieties. Breeders rights will be administered by the MoARD and enforced by the judicial system.

The legislation brings Ethiopia closer to compliance with the conditions for accession to the World Trade Organization, although there remain issues related to the extent to which Ethiopia's judicial system has the capacity to effectively enforce breeders rights. It is also worth noting that the legislation, in combination with pending legislation on the protection of traditional knowledge, affords farmers with the continued right to save, select, and exchange seed.

## 4.4 Agricultural biotechnology

Varietal improvements using advanced methods of genetic modification and other biotechnologies are not yet in place in Ethiopia, although the potential of agricultural biotechnologies such as Bt maize and Bt cotton are high on the discussion agenda in the COMESA and ASARECA countries. At present, the intellectual property rights (IPR) and biosafety policies needed to support their introduction are still under discussion in Ethiopia (Gezahegn and Dawit, 2005). Moreover, the technical and scientific capacity to conduct such advanced research is still in question (Terefa, 2006).

## 4.5 Breeder and basic seed supply

The supply of breeder and basic seed is the responsibility of those research centers—primarily EIAR and the RARIs—that develop the variety and are registered as its maintainer. For example, the OPV maize varieties Mekassa 1 and Katumani, both developed primarily for lowland areas of the country, are maintained and supplied by EIAR's Melkassa Research Center (Table 5).

**Table 5. The trend in the supply of Melkassa 1 and Katumani maize varieties by Melkassa Research Center**

| Production season | Melkassa 1 | | Katumani | |
|---|---|---|---|---|
| | Area (ha) | Production (quintals) | Area (ha) | Production (quintals) |
| 2005/06* | 43.69 | 1092.25 | - | - |
| 2004/05** | 21.51 | 691.48 | 25.35 | 317.38 |
| 2003/04 | 23.00 | 259.20 | 40.80 | 935.50 |
| 2002/03*** | 20.00 | 105.97 | 42.56 | 107.08 |
| 2001/02 | 61.35 | 1151.05 | 1.00 | 40.04 |
| 1999/2001 | 1.00 | 28.50 | 52.69 | 1259.66 |

**Source**: Farm Management Division, Melkassa Research Center. **Notes**: * allocated land and expected production; ** Planted on good soil and good weather; *** drought year

The area allocation is usually determined by the demand from certified seed producers. However, once certified seed producers receive the basic seed they usually produce their own basic seed. Thus, they do not demand basic seed each year. Even for single cross hybrid maize varieties like BH 140 and BH 540, once they get the parental lines, they maintain these lines for future use. This is stated to be one of the weaknesses of the current seed policy as the capacity of certified seed producers in maintaining basic seeds may not be as the technology generator, the Research Center.

## 4.6 Seed certification

The general procedure for seed certification begins with verification of the source of the basic seed to be used for production of certified seed, followed by verification of germination rates, grading, and other functions to assure quality. However, there are cases--particularly in times of seed shortages—where produced seeds were certified without following stated procedures such as verification of source and type of the basic seed.

Basic seeds imported for production of certified seed by different companies are subject to the formal variety release procedure except for vegetable and fruit seeds that are usually certified by ISTA (International Seed Testing Association) and OECD, which is acceptable by the Department. However, quarantine and germination tests are mandatory. There are cases, where importation of seeds for cotton, lentil, chickpea and soya bean was made by the government without following the formal importation procedure.

## 4.7 Qualifying for a license

The maize seed sub-sector poses an interesting case for further consideration because hybrid maize represents a potentially major area of investment. Hybrid maize can express greater vigor than openly-pollinated varieties in characteristics such as yield, resistance to biotic or abiotic stresses, or uniformity. But when hybrids are not bred under strict conditions to prevent cross-pollination (e.g., in a farmer's field), they lose much of this vigor and fail to breed true, a fact

that translates into yield losses from the cultivation of saved seed that range from 10 to 40 percent.

The cost and complexity of preserving hybrid vigor from one generation to the next can encourage farmers to purchase hybrid seed from breeders or their agents each season. This ensures continued access to the desirable qualities embodied in the hybrids and continued remuneration to the plant breeder, and prevents propagation with saved seed or dissemination through farmer-to-farmer exchange. The cost, time and complexity of breeding hybrids—possibly requiring between 10 and 20 years of varietal crossing and other R&D functions—also ensures innovators with perpetually appropriable rents, provided the lineage of their hybrid remains a secret and other hybrids available to farmers do not perform better.

Ethiopia's regulatory framework sets forth several rules and technical requirements to qualify for a license to produce, prepare, import or export maize seed, as follows.

**License to produce maize seed**

(a) At least be a diploma holder with at least 5-year experience in the agricultural sector or more;
(b) Have an investment license; and
(c) Have suitable land for the production of maize seed.
For each crop variety a land of not less than 5 ha and for hybrid maize there is a need to have at least 30 ha for each variety of hybrid. In addition, the total land size in a given location should not be less than 100 ha.

**License to prepare maize seed produced by others**

(a) At least be a diploma holder with at least 5-year experience in the agricultural sector or more;
(b) Have investment license or seed preparation trade license;
(c) Have a seed cleaning house with required facilities; and
(d) Have seed cleaning machines with treater, weighing unit and bagging unit.

**License to import /export maize seed**

(a) Visible ability to import, export, distribute or retail seed;
(b) Have a trading license to import, export, distribute or retail seed; and
(c) Owned or hired storage facility with the required standards.

# 5 SEED PRODUCTION AND MARKETING TRENDS

## 5.1 National demand and supply of seed

The supply of seed in aggregate was only 27% of the total seed demanded for the 2005 production season (Table 6). However, there is considerable variability in the level of supply among the different crops, where more than 50% of the demanded volume of seed was supplied for maize and chickpea.

**Table 6 The quantity of seed demand and actually supplied in the 2005 production season (quintals)**

| Crop | Demand | Supply | % of demand covered |
|---|---|---|---|
| Maize | 155215 | 82458 | 53 |
| Barley | 70839 | 11628 | 16 |
| Wheat | 518487 | 106279 | 20 |
| Teff | 78389 | 4197 | 5 |
| Faba Bean | 77728 | 4761 | 6 |
| Chickpea | 48187 | 26405 | 55 |
| Haricot bean | 33742 | 7027 | 21 |
| Sesame | 21769 | 6046 | 28 |
| Grand Total (including other crops) | 1117597 | 304042 | 27 |

Source: Agricultural Inputs marketing Department, MoARD (2006)

## 5.2 Costs, prices and marketing margins

Even though, the cost of production varies across locations and organizations, the sale prices for the different seeds are set by ESE and are fairly constant, with regional variation based primarily on transportation costs.

The cost of maize seed production for both hybrids and OPVs is presented in table 7, and is based on estimates from one ESE farm for the 2004-05 production season. The per quintile production cost of maize seed was was 392.30 birr for hybrid and 407.46 birr for OPV. The higher production cost observed for OPVs is explained by the low yield (14 quintals per hectare) relative to hybrids (21 quintals).

**Table 7. Maize seed production cost breakdown (2004/05 production season)**

| Description | Cost component | Cost of hybrid maize seed production | | Cost of OPV maize seed production | |
|---|---|---|---|---|---|
| | | Birr per quintal | % of the total cost | Birr per quintal | % of total cost |
| Direct Labor cost | | 32.74 | 8.35 | 28.31 | 6.95 |
| Direct Material cost | | 50.48 | 12.87 | 60.82 | 14.93 |
| | Seed | 8.14 | 2.07 | 1.50 | 0.37 |
| | Chemicals | 15.34 | 3.91 | 23.21 | 5.70 |
| | Fertilizer | 17.18 | 4.38 | 26.00 | 6.38 |
| | Harvesting & packing materials | 9.81 | 2.50 | 10.11 | 2.48 |
| Center overhead | | 255.34 | 65.09 | 262.98 | 64.54 |
| Enterprise contribution | | 53.74 | 13.70 | 55.34 | 13.58 |
| Total Production Cost (birr/quintal) | | 392.30 | | 407.46 | |

Source: Ethiopian Seed Enterprise, 2005

Among the cost components for ESE maize seed production, overheads account for about 65 percent of the total cost. This suggests the considerable inefficiency in the production and distribution of seed under the current system, especially considering the fact that and the price

margin between ESE and farmers' is about 35 percent for OPVs and hybrid maize (again, with regional variations due to transportation costs).

Maize seed prices have shown a gradually increasing trend since 1995 (Table 8). For OPV maize seed, the price increased from 214.91 birr/qt in 1995/96 to 222 birr/qt in 2004/05 production season. Similarly, for hybrid maize seed the price increased from 500 birr/qt in 1995/96 to 578 birr/qt in 2004/05.

**Table 8. Maize seed price trend (1995 – 2005)**

| Year | OPV (birr/qt) | Hybrid (birr/qt) |
|---|---|---|
| 1995/96 | 214.91 | 500.00 |
| 1996/97 | 201.38 | 496.96 |
| 1997/98 | 216.48 | 547.00 |
| 1998/99 | 240.00 | 577.49 |
| 1999/00 | 240.45 | 578.00 |
| 2000/01 | 228.08 | 578.00 |
| 2001/02 | 187.87 | 560.00 |
| 2002/03 | 222.00 | 578.00 |
| 2003/04 | 222.00 | 578.00 |
| 2004/05 | 222.00 | 578.00 |

**Source**: ESE, 2005

The major purchasers of seed produced by ESE are regional governments for their extension program, FAO and other donors for relief program, farmers' cooperatives, state farms and others. The amount of purchased from ESE by the different stakeholders for maize seed is summarized in table 9. The total quantity over years tends to increase even though there are variations since 1996.

**Table 9. Trend in quantity of Maize seed used by intermediary (qts)**

| Year | State Farms | | MOARD | | FAO &Donors | | Extension Program | | Cooperatives | | Others | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Qt) | % | (Qt) | % | (Qt) | % | (Qt) | % | (Qt) | % | (Qt) | % | |
| 1996 | 3757 | 20 | 596 | 3 | 3480 | 18 | 9333 | 49 | 1726 | 9 | | | 18892 |
| 1997 | 1895 | 11 | 228 | 1 | 155 | 1 | 12888 | 77 | 856 | 5 | 658 | 4 | 16680 |
| 1998 | 2354 | 6 | | | 783 | 2 | 38252 | 90 | 800 | 2 | 337 | 1 | 42526 |
| 1999 | 1165 | 3 | | | 69 | 0 | 43494 | 96 | 595 | 1 | 174 | 0 | 45497 |
| 2000 | | | | | | | | | | | | | 71198 |
| 2001 | | | | | 1658 | 3 | 47612 | 87 | 5061 | 9 | 407 | 1 | 54767 |
| 2002 | 532 | 2 | 1 | | 772 | 3 | 16438 | 64 | 7878 | 31 | 104 | 0 | 25725 |
| 2003 | 830 | 1 | 1259 | 2 | 5385 | 9 | 34761 | 59 | 15265 | 26 | 1624 | 3 | 59124 |
| 2004 | 457 | 2 | 152 | 1 | 1877 | 9 | 13886 | 70 | 2955 | 15 | 568 | 3 | 19893 |

**Source**: Agricultural inputs marketing department, MoARD (2005). Empty cells show that information was not available

## 5.3 Marketing margins

The rate of return to seed production taking into consideration the current cost and price relationship prevailed during the 2005 production season for hybrid maize for ESE was about 147%. If the overhead costs are reduced by 50% the rate of return will be 308%, which is about 52% increase in profitability. This shows the prevailing good opportunity and profitability in seed production.

# 6 CONCLUSIONS

This paper documents the structure and evolution of Ethiopian seed system, including its key players, the regulatory framework, and recent market trends.

In general, only 27% of the total amount of seed demanded was supplied in 2005 production season without considering the quality of the supplied seed in terms of variety and other quality attributes. Moreover, the crop types for which seed is produced is limited to major cereals showing huge potential for the seed industry to grow through expansion to other potential crops.

Even though, the participation of the private sector is increasing in seed production, their role in the marketing and distribution directly to end-users in limited, which is believed to be the reason for the one time supply of seed and unavailability of seed shops in the country.

Following the early 90's market reform, the participation of private sector has increased in both seed production and distribution even though still the role of the public sector is playing a dominant role. Further analysis is required in several areas. First, closer examination is needed with respect to the system's efficiency and effectiveness in serving small-scale farmers. Second, additional study is needed on the roles and responsibilities of the various public sector entities in researching, developing, regulating, producing, and distributing improved seed. Third, further analysis is needed to determine if existing the regulatory framework and market conditions could encourage greater private investment in plant breeding and seed multiplication. Finally, additional emphasis should be placed on the analysis of trends in seed prices and their impact on the small-scale farmer.

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# Annexes

## List of contacted stakeholders

| Name of contacted person | Position /responsibility | Organization |
|---|---|---|
| Mandefro Negussie, Dr | Lowland maize breeder | Melkassa Research Center, EARO |
| Enyew Arega | Head, Agricultural inputs quality control department | MoARD |
| Ali Ahmed | Head, Seed production technology extension department | Ethiopian Seed Enterprise |
| W/o Abeba | Planning department | Ethiopian Seed Enterprise |
| Girma Legesse | Expert, Planning department | Ethiopian Seed Enterprise |
| Gesese Teklu | Head, Agricultural inputs marketing department | MoARD |
| Aba Seyum | Program coordinator | Meki Catholic Church |
| Ato Leulseged | Farm manager | Elfora |

**List of organizations licensed to produce, process, import, retail and export seed**

| Ser. No. | Name of Organization | Type of Certificate | | | | |
|---|---|---|---|---|---|---|
| | | Producing | Processing | Importing | Retail | Export |
| 1 | Anger Private Limited Company | ✓ | - | - | - | - |
| 2 | Hadiya Trading Enterprise | - | - | ✓ | ✓ | - |
| 3 | Biyo Agricultural Development Private Limited Company | ✓ | - | - | ✓ | - |
| 4 | Gadissa Gobena Private Farm | ✓ | - | - | ✓ | - |
| 5 | Ata Private Limited Company | ✓ | - | - | ✓ | - |
| 6 | Ano Agro Industry | ✓ | - | - | ✓ | - |
| 7 | Teppo Agricultural and Trade Private Limited Company | - | - | ✓ | ✓ | |
| 8 | Awassa Green Wood | ✓ | - | ✓ | ✓ | ✓ |
| 9 | Ethio Flora | ✓ | - | - | ✓ | |
| 10 | Ethiopian Seed Enterprise | ✓ | ✓ | - | ✓ | |
| 11 | Pioneer Hi- breed seeds Ethiopia | ✓ | ✓ | ✓ | ✓ | |
| 12 | Blue Nile Flora Private Limited Company | ✓ | - | - | - | - |
| 13 | Oda Share Company | - | - | - | ✓ | - |
| 14 | Markos Private Limited Company | - | - | ✓ | ✓ | - |
| 15 | Nazareth International Trading PLC | - | - | ✓ | - | - |
| 16 | Chemtex P.LC. | - | - | ✓ | ✓ | - |
| 17 | Harvest General Trading | - | - | ✓ | ✓ | - |
| 18 | Alihulugeta Agricultural Development P.L.C. | ✓ | - | - | - | - |
| 19 | Neget Farm P.L.C. | ✓ | - | ✓ | ✓ | - |
| 20 | Ethiopian Fruit and Vegetable Marketing Share Company | | - | ✓ | ✓ | - |
| 21 | HAWAS Agri- Buesness PLC | ✓ | - | - | ✓ | - |
| 22 | Ajmu Import & Export Trading Enterprise | - | - | ✓ | ✓ | - |
| 23 | Multi Agricultural Service Center | ✓ | - | - | - | - |
| 24 | Multi Farmers Shop and Advisory Service | - | - | - | ✓ | - |
| 25 | Valley Development and Trade | ✓ | - | - | ✓ | - |
| 26 | Akrem Metena | - | ✓ | ✓ | ✓ | ✓ |
| 27 | Coffee Plantation Development | ✓ | - | - | ✓ | - |

| Ser. No. | Name of Organization | Type of Certificate | | | | |
|---|---|---|---|---|---|---|
| | | Producing | Processing | Importing | Retail | Export |
| 28 | Kaleabe Farm Development | ✓ | - | - | ✓ | - |
| 29 | Bale Farm Development Enterprise | ✓ | - | - | ✓ | - |
| 30 | Awassa Farm Development Enterprise | ✓ | - | - | ✓ | - |
| 31 | General Chemicals and Trading PLC | - | - | ✓ | ✓ | - |
| 32 | Mohamed Bahmud Seed Enterprise | ✓ | - | ✓ | ✓ | ✓ |
| 33 | HEBIST P.L.C. | - | - | ✓ | ✓ | - |
| 34 | Segel General Trading P.L.C | | | ✓ | ✓ | - |
| 35 | Gadisa Gobena Farm Produce PLC | ✓ | - | - | - | - |
| 36 | AGMF Private Limited Company | ✓ | - | - | - | - |
| 37 | DAWN Commercial Enterprise | | - | ✓ | ✓ | - |
| 38 | Samson Development Service PLC | - | - | ✓ | ✓ | - |
| 39 | Teppo Agricultural and trade PLC | ✓ | - | - | - | - |
| 40 | NONO Agricultural Development P.L.C. | ✓ | - | ✓ | ✓ | ✓ |
| 41 | Horticulture Development Enterprise (Zway Farm Development) | ✓ | - | - | ✓ | - |
| 42 | S.O.S Meki Irrigation Project | ✓ | - | - | - | - |
| | Grand Total | 26 | 3 | 19 | 33 | 4 |

## Maize seed production cost breakdown (2004/05 production season)

| Description | Cost component | Cost of hybrid maize seed production | | Cost of OPV maize seed production | |
|---|---|---|---|---|---|
| | | **Birr per quintal** | **% of the total cost** | Birr per quintal | % of total cost |
| Direct Labor cost | | 32.74 | 8.35 | 28.31 | 6.95 |
| | Residual disposal | 1.61 | 0.41 | 1.70 | 0.42 |
| | Planting | 0.98 | 0.25 | 1.04 | 0.25 |
| | Fertilizing | 1.03 | 0.26 | 0.25 | 0.06 |
| | Weeding & Hoeing | 3.29 | 0.84 | 4.98 | 1.22 |
| | Detasseling | 4.40 | 1.12 | - | - |
| | Marking | 0.15 | 0.04 | - | - |
| | Male removing | 1.59 | 0.40 | - | - |
| | Thinning | 0.71 | 0.18 | - | - |
| | Pesticide | 0.14 | 0.03 | - | - |
| | Herbicide | 0.20 | 0.05 | - | - |
| | Crop guarding | 2.35 | 0.60 | 3.62 | 0.89 |
| | Harvesting | 5.52 | 1.41 | 5.69 | 1.40 |
| | Threshing/shelling | 1.18 | 0.30 | 1.21 | 0.30 |
| | Loading unloading | 6.31 | 1.61 | 6.50 | 1.60 |
| | Cob sorting | 1.39 | 0.35 | 1.43 | 0.35 |
| | Others | 1.89 | 0.48 | 1.95 | 0.48 |
| Direct Material cost | | 50.48 | 12.87 | 60.82 | 14.93 |
| | Seed and seedlings | 8.14 | 2.07 | 1.50 | 0.37 |
| | Chemicals | 15.34 | 3.91 | 23.21 | 5.70 |
| | Fertilizer | 17.18 | 4.38 | 26.00 | 6.38 |
| | Harvesting & packing materials | 9.81 | 2.50 | 10.11 | 2.48 |
| Center overhead | | 255.34 | 65.09 | 262.98 | 64.54 |
| Enterprise contribution | | 53.74 | 13.70 | 55.34 | 13.58 |
| Total Production Cost (birr/quintal) | | 392.30 | | 407.46 | |