
Focus on Seed Programs

The Ethiopian Seed

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Introduction

Ethiopia is located between longitude 33°W and 48°E and between latitude 15.4°N and 3.4°S. The mean annual rainfall varies from 100mm in the northeast to more than 2400mm in the southwest. The lowest maximum temperature recorded in the highlands with the highest maximum temperatures in the northern parts of the Rift Valley and southeastern lowlands of the country. The spatial patterns of relative humidity indicate maximum values in the southwestern, western and northwestern highlands. Low values of relative humidity are observed over the northeastern and southeastern lowlands and the spatial distribution of relative humidity varies from 40% to 85%.

According to 1994 census the total population of Ethiopia is about 57 million approaching 60 million in 2000. About 85% of the population lives in rural areas and earn their livelihood from agriculture.

Ethiopia is a country of immense diversity. According to Vavilov the region is an important primary and secondary center of domestication for some 38 crops. The country has as many as 18 distinct major agro-ecological zones and 49 sub-agro-ecological zones where crops and cropping patterns evolved over a long period of time resulting in an abundance of locally adapted materials.

Agriculture is the mainstay of the national economy contributing over 90% of export, 85% of employment and 55% of GDP. The country has a great potential for agricultural development with total area of 113 million ha, of which 65% is estimated to be arable. Though agriculture plays an important role in the economy of the country, it is characterized by low technology and low productivity. The smallholder farmers cover 96% of cultivated land. Although average land holdings per farmer vary from region to region, the national average holding is about one ha. Large scale farmers, which accounts for only 4% of the cultivated land, have different sizes-from as small as five ha for

horticultural crops to as large as 4000 ha for field crops.

At present approximately 8 million ha is used to produce the main food crops: cereals, legumes and oilseeds (Table 1). Cereals [tef (*Eragrostis tef*), maize, barley, wheat and sorghum] occupy 80 to 85% of the total cultivated area, followed by legumes and oil seeds. The area annually

covered by major cereal crops are 2.1, 1.6, 1.4, 0.9 and 0.8 million ha for tef, maize, sorghum, wheat and barley, respectively. Pulses (faba bean, field peas, haricot bean, chickpea, grass pea, lentil) occupy 1 million ha and oilseed crops [niger seed (*Guzotia abyssinica*), linseed, rapeseed, peanut, sunflower, sesame and castor bean] about 0.4 million ha.

Table 1. Area and production of major crops from 1997/98 to 1998/99

Crops	Area in ha (000)		Production in tonnes (000)		Productivity in tonnes	
	1997/98	1998/99	1997/98	1998/99	1997/98	1998/99
Cereals	5601.88	6744.73	6498.80	7683.00	1.16	1.14
Legumes	837.60	875.38	680.20	931.98	0.81	0.84
Oilseeds	383.50	374.78	164.49	156.75	0.45	0.43
Others	29.71	21.43	16.22	12.13	0.55	0.57
All crops	6852.69	8016.32	9645.23	7359.71	1.07	1.07

Source: Central Statistics Authority (CSA), Bulletin Nos. 171 (1997), 189 (1998) and 200 (1999)

Despite an abundant arable land the country is not self-sufficient in food production, though it was a net exporter of food grains until late 1950s. Agricultural growth averaged 2.2% in 1960s, 0.7 in 1970s and 0.5% in the 1980s. This is attributable to government policy, low level of technology in the predominantly traditional sector of agriculture that comprises about 96% of the main crop area, and lack of modern inputs.

In the 1990s the agricultural sector has responded positively to reforms aimed at enhancing market incentives and private sector initiatives. There has been progress in both the production and productivity of the traditional sector of agriculture through provision of modern inputs such as seeds, fertilizers, pesticides and farm implements.

The Government policy and strategy is aimed at broadening the agricultural production base by improved productivity and support to research, extension, infrastructure, irrigation and the private sector.

National Seed Policy and Laws

In Ethiopia formal seed production can be dated back to the opening of Jimma Agricultural College (JAC, 1942), Alemaya University of Agriculture (AUA, 1954), Ethiopian Agricultural Research Organization (EARO, 1966) and the Chilalo Agricultural Development Unit (CADU, 1967). The Ethiopian seed program, however, was very much ad hoc and seed production was uncoordinated until the late 1970s.

In 1976, the National Seed Council (NSC) was set up to formulate recommendations for organized seed production and supply of released varieties from the national program. This led to the establishment of the Ethiopian Seed Enterprise (ESE) in 1979 and institutionalized seed production, processing, distribution and quality control of cereals, legumes and oilseed crops. The Ethiopian Agricultural Research Organization, agricultural universities and colleges, the Ministry of Agricultural (MoA) and state agricultural development corporations continued seed production to meet the national seed demand. However, seed production and supply is less efficient and the majority of farmers use own saved seed (96%). Most farmers particularly those in the remote areas have no access to modern inputs including seed.

National Seed Policy

Until 1992, there was no coherent national policy for the development of seed industry. In 1993, a national seed industry policy and strategy was formulated to guide seed sector development. The National Seed Industry Council (NSIC) was established under Proclamation No 56/1993 and become responsible for advising the Government on policy and regulatory issues that would help improve and build a sustainable national seed supply system. Proclamation No 122/98 amended the members of the Council.

The main objectives of national seed industry policy are to:

- Streamline evaluation, release, registration and maintenance of varieties developed by national programs.
- Develop an effective seed production and supply system through participation of public and private sectors.

- Encourage the participation of farmers in germplasm conservation and seed production.
- Create functional and efficient institutional linkages among seed industry participants.
- Regulate seed quality, seed import-export trade, quarantine and other seed related issues.

In the national seed industry policy emphasis have been given to agricultural research institutions, the Ethiopian Seed Enterprise (ESE), state farms, private farms and farmers as major producers and suppliers of seed. The private sector is expected to play an important role in seed sector development.

In 1993, the National Seed Industry Agency (NSIA) was established as an executing arm of the Council for guiding and monitoring the seed sector. At present NSIA serves as focal point for policy and regulatory functions of the seed sector. Moreover, the agency plays a pivotal role in developing protocols for variety release and registration mechanisms and seed quality control and certification. It also coordinates and implements the farmer based seed production and marketing project.

Seed Laws and Regulations

A Ministerial Regulation No. 16/1997 which was enacted to cover registration of varieties, seed producers, processors, distributors, quality control, seed trade (import-export), etc. has been replaced by Seed Proclamation No. 206/2000. The latest Proclamation is more comprehensive and creates stronger legal framework for the protection and control of the interests of all players in the seed industry. Moreover, field and seed standards prepared for 74 crops are officially issued for implementation. NSIA

has built the necessary capacity to implement and enforce the standards.

A committee drawn from relevant institutions is conducting a study for plant variety protection law with the intention to have in place an appropriate mechanism that ensures the interests of the Ethiopian breeders and farmers. To date PVP is the only pending regulatory issue on seeds.

Agricultural Research and Crop Improvement

Agricultural research in Ethiopia has a relatively long history and is carried out by a number of institutions. In the past EARO has a national mandate to conduct and coordinate research, but institutions of higher education (universities and colleges) are also engaged in agricultural research. Moreover, specialized units in the MoA and other public sector organizations conduct adaptive and applied research for their own needs.

Agricultural research has been reorganized recently as part of the Government effort to promote the agricultural sector of the economy. From 1998, the Ethiopian Agricultural Research Organization (EARO) became operational and a focal point for implementing national agricultural research in Ethiopia. Some main agricultural research centers have been transferred to the Regional States and are accountable administratively to Regional Agricultural Bureaus but technically to EARO. EARO has 14 main research centers and 29 sub-centers located in various agroecological zones of the country. The organization has a strong collaborative research with international agricultural research centers such as CIAT,

CIMMYT, ICARDA, ICRISAT and IITA.

Genetic Resources Conservation

Ethiopia is the primary center and diversity of most important agricultural crops. The country is endowed with rich genetic resources. The Institute of Biodiversity Conservation and Research (IBCR) was established in 1975. IBCR is responsible for collection, conservation, characterization and utilization of Ethiopia's germplasm. It is a major source for germplasm for crop breeding for NARS in the country.

Variety Development

Variety development for major crops began in 1966 with establishment of EARO (ex Institute of Agricultural Research), a semi-autonomous public organization. It is a principal plant breeding institution, undertaking responsibilities for cereals, legumes, oil seeds, fibers, horticultural and forage crops. Apart from EARO, the Alemaya University (AU), the Awassa College of Agriculture (ACA) and the Mekelle University College (MUC) are also involved in agricultural research and variety development. The Ethiopian Pioneer Hybrid International (EPHI) introduces and tests maize hybrids from parent company for adaptation and release in Ethiopia.

The variety development, evaluation, release and registration procedures pass through several stages as follows (e.g. wheat):

Observation Nursery (ON)

New introductions or advanced lines are grown in 1-2 observation rows and compared with checks and observations recorded for agronomic characters, reactions to diseases and yield.

Preliminary Yield Trial (PYT)

One hundred or more entries are evaluated each year. Each entry is grown in a 4-6 row plot of 2.5 m (in more than one site) using an augmented design along check varieties. Data is recorded and statistically analyzed.

Pre-National Yield Trial (Pre-NYT)

About 25 varieties and two checks are compared. Each variety is grown in a six-row plot of 2.5 m at four or more locations. An RCBD design with three replications and recommended packages are used. Field data recorded and the yield analyzed statistically where 50-70% of the entries advanced to NYT.

National Yield Trial (NYT)

Similar procedures are used as Pre-NYT, but with four replications and more test locations and years. After three years of testing, the promising lines are identified for submission to NVRC.

Farm Verification Trial (FVT)

Promising lines are evaluated on large plots (100m²) on farmers' fields where the new varieties are intended for release. The NVRC visits the trials and make its own assessment.

Variety Release and Registration

The variety release and registration system has evolved over a number of years. Since 1984 variety release and registration has become the responsibility of the NVRC. The Committee is composed of breeders (4), agronomists (1), crop protection specialists (2), research/extension (1) and socio-economists (1) representing different research institution and user organizations. The membership includes the EARO, Institute of Biodiversity Conservation and Research (IBCR), Awassa College of Agriculture, NSIA, Coffee and Tea

Development Authority (CTDA), and the Ministry of Agriculture (MoA). The NVRC proposed a reform of its current structure and functions and elaborated procedures for variety release and registration of horticulture, fruit and tree crops. The Seed Quality Control and Certification Department of NSIA serves as the secretariat of NVRC.

Varieties are in extensive trials before they are proposed for release at regional or national level. Breeders carry out a minimum of two to three year national or regional trials (NYTs) in at least three to five locations or different agro-ecological zones before submitting an application to NVRC. The variety should be tested for yield, tolerance to pests and other important agronomic characters compared with standard varieties or local check. Superiority in yield, grain quality and acceptable level of distinctness, uniformity and stability are required to grant a release.

Breeders and the crop team leaders should consult with appropriate team members, extension and on-farm research personnel before preparing a proposal for variety release. A complete data of the promising variety proposed for release must be submitted to NVRC for review and approval. The varieties submitted to NVRC will further be evaluated for one season in on-farm verification trials under farmers' management practices before a final release.

The NVRC appoints a sub-committee composed of NVRC members and other specialists to report on variety performance after examining the data and field visits. The report covers performance data evaluation, field performance evaluation and recommendations for the NVRC. The Committee may release a variety not only on superior yield, but important characters such

as grain color, early maturity, etc. compared to existing commercial varieties. Upon the release of the new variety breeders will provide small quantity of seed to the chairman of the NVRC who will forward it to the ICBR for the long-term storage.

NSIA serves as Secretariat of the NVRC and maintains the crop variety register. Since 1953, several varieties of cereals, legumes, oilseeds, fiber crops and vegetable crops have been developed and were recommended or released for use by farmers in Ethiopia (Fig 1). The list of varieties currently under production is shown in Table 2.

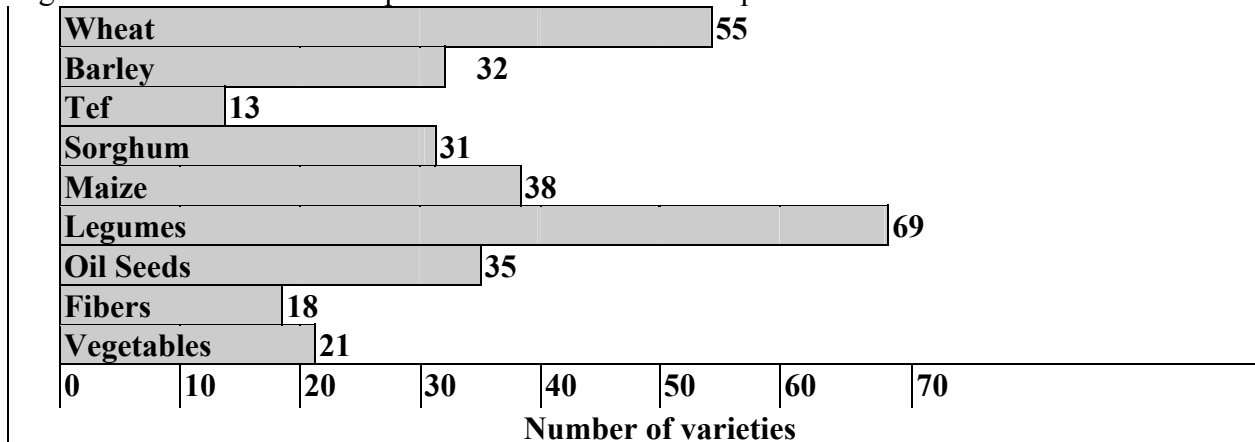
It is believed that an independent variety evaluation agency should be established for conducting DUS and VCU tests. This has been suggested by the NVRC, but did not materialize due to certain limitations. During the past few years NSIA is building its capacity to carry out its duties and responsibilities. Efforts are being made for the establishment of an independent agency responsible for DUS and VCU tests. The existing divisions/teams are upgraded to department level and additional staff recruited. Once established the independent agency conducts DUS and VCU tests and presents its findings to the NVRC for appropriate decisions.

Table 2. List of crop varieties currently produced by the Ethiopian Seed Enterprise

Crop	Varieties
Food barley	Ardu-1260B, HB120, HB42, Shege
Malt barley	Beka, Holker
Durum wheat	Boohai, Foka, Kilinto
Bread wheat	ET13, Dereselegn, HAR1709, HAR710, HAR1685, K6295, HAR604, HAR1899, K6290, Pavon76, HAR1522, HAR1407, HAR1775, HAR1868, HAR1595
Tef	DZ-196, DZ-354, DZ-974, Cross 37
Maize	A511, Katumani, CG 4141, BH 140, BH 660, Kuleni, BH540
Sorghum	Birmash, Dinkmash 80, IS9302, Gambella 1107, Seredo, 76TI#23
Faba bean	Bulga 70, Mesay, CS 20 DK, Tesfa
Field pea	Markos, Hasabe, Mohanderfer, Tegegneh
Chickpea	Akaki, Worku, Mariye
Lentil	NEL-2704, Gudo, Adaa
Haricot bean	Awash, Mexican 142, Red Wolayta, Roba
Soybean	Clark, Coker, Crawford, Williams
Niger seed	Este, Fogera, Kuyu
Linseed	Chilalo, CI 1525, CI 1652, Belay 96
Mustard	Yellow Dodolla

Note: EPHSI produces two maize hybrids, Ajab (30F 19) and Jabi (PHB 3253)

Figure 1 Total number of crop varieties released in Ethiopia



Seed Production

In Ethiopia national seed policy promotes both formal and informal seed production. In the formal sector both public and private companies are encouraged to produce and supply seed. In the latter, farmers are encouraged to participate in local level seed production and marketing within their communities.

Formal Seed Production

Formal seed production is dominated by the public sector. ESE is an autonomous parastatal organization governed by a Board of Directors and is responsible for production, processing, marketing and quality control of seed to meet the national seed demand. The Enterprise was established in 1979, but got legal status in 1982 in Proclamation No. 266/82. ESE was restructured through Proclamation No. 154/1993 to make it more efficient and business oriented entity.

The government, however, encourages the participation of the private sector both in variety development, seed production and supply. The government provides both technical advisory services and training supports for private seed enterprises. Since

1991 the Ethiopian Hi-bred International Inc., a subsidiary of Pioneer International, is the only private entity involved in hybrid maize seed production and supply.

The seed production follows a generation system: breeder, pre-basic, basic and certified seed. Seed production and distribution of major agricultural, horticultural, forage, fiber and stimulant crops are treated below.

Agricultural Crops

Cereals, legumes and oilseed crops are major field crops grown in Ethiopia. Thus, agricultural research for development of improved varieties and seed production and supply is focused on these crops.

Breeder and Pre-basic Seed Production

The maintenance of released varieties and the production of breeder and pre-basic seed will continue to be the duty and responsibility of the agricultural research institutions that have developed the varieties.

The EARO, AU, ACA and MUC are the main institutions involved in plant breeding in the country. They are involved in the development, maintenance, multiplication

and supply of improved varieties. They provide breeder seed and parental material of hybrid maize to ESE (Table 3). EARO and AU, however, have the capacity to produce more seed than requested by ESE and could sell seed directly to users. The research institutions are expected to

strengthen their breeding programs, variety maintenance, breeder and prebasic seed production by acquiring more facilities and manpower. ESE produces a large amount of pre-basic seed of selected crops to produce subsequent generations of seed (Table 4).

Table 3. Amount of breeder seed supplied to Ethiopian Seed Enterprise (kg)

Crop	Years				
	1995	1996	1997	1998	1999
Wheat	1105	1717	50	100	1180
Maize	300	3285	900	350	8400
Tef	18	80	100	100	170
Barley	53	120	100	100	140
Sorghum	-	-	-	200	800
Haricot bean	-	380	100	100	150
Faba bean	-	5	1350	1350	610
Field pea	20	29	600	600	950
Lentil	5	20	-	-	580
Chickpea	-	40	-	-	410
Niger seed	8	6	20	20	90
Mustard	5	-	50	50	120
Linseed	10	-	50	50	240

Table 4. Amount of pre-basic seed produced by Ethiopian Seed Enterprise (q⁺)

Crop	Years					
	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000
Wheat	87	714	941	570	547	669
Barley	55	157	143	85	44	65
Maize	163	214	148	-	-	-
Teff	-	61	74	78	91	48
Haricot bean	21	59	77	8	14	6
Chick pea	10	2	34	11	4	-
Field pea	2	3	4	49	30	23
Faba bean	-	-	-	18	16	47
Lentil	1	7	1	2	-	-
Linseed	3	13	19	15	12	19
Rapeseed	-	-	-	-	6	10
Noug	-	-	1.5	1	1	-
Total	342	1230	1443	837	765	887

Source: ESE; ⁺ One quintal (q) = 100kg

Basic Seed Production

The production of basic seed is the responsibility of ESE. The Enterprise has three basic seed farms: one for highland crops (Gonde-Ethaya) and two for mid- to lowland crops (Shallo and Kunzila), with an area of 2100 ha and potential annual seed production capacity of 4500 tonnes. The quantity of basic seed produced by ESE is

shown in Table 5. In addition, EARO research farms also produce basic seed on contract for ESE (Table 6).

The Enterprise does not produce Pre-basic and Basic Seed of some important crops such as sorghum, groundnut and sesame despite the availability of Breeder Seed and good varieties, because none of the farms are suitable for these crops.

Table 5. Amount of basic seed produced by Ethiopian Seed Enterprise (q)

Crop	Years					
	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
Wheat	7545	10936	7745	8717	11728	10926
Barley	258	922	1198	765	578	677
Maize	1055	1983	170	485	120	-
Sorghum	490	300	-	-	-	-
Teff	1655	3604	2341	1940	658	1106
Haricot bean	1000	667	397	16	297	19
Faba bean	-	-	-	-	-	177
Chickpea	527	65	-	-	80	-
Field pea	-	-	31	346	34	77
Lentil	-	-	14	8	-	-
Rapeseed	-	-	-	-	-	14
Linseed	70	289	240	298	8	43
Niger seed	-	44	43	-	-	-
Total	12600	18810	12179	12575	13503	13039

Source: ESE

Certified Seed Production

In the past, ESE produced certified (commercial) seed under contractual agreements with state farms. It has now begun contracting private farms for certified seed production. A total of 41, 22 and 8 varieties of cereals, food legumes and oil

seed crops are under production by ESE. The quantity of certified seed production by ESE is shown in Table 7.

The EPHI produces hybrid maize seed on farms contracted from state farms and the private sector. Pioneer produced about 4600 tonnes of maize from 1994 to 1999.

Table 6: Amount of basic seed produced by EARO (q)

Crop	Years					
	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000
Wheat	3287	4967	220	7587	7847	4480
Maize	-	-	2238	71	412	6761
Tef	515	582	25	1807	925	638
Barley	469	139	5	805	654	58
Sorghum	-	-	339	495	186	187
Haricot bean	-	-	407	869	537	471
Faba bean	156	155	7	741	903	767
Field pea	31	2	8	384	34	-
Chickpea	123	136	-	86	50	756
Niger seed	-	3	-	52	72	-
Sesame	-	-	7	115	27	-
Groundnut	-	-	6	-	18	-
Rapeseed	38	31	1	806	689	1224
Linseed	17	21	1	304	23	-
Cotton	-	-	-	261	360	20
Oat	91	57	5	-	-	-
Vetch	12	2	-	-	-	-

Source: EARO Research Centers

Table 7. Quantity of certified (commercial) seed produced by ESE (tonnes)

Crop	Seasons					
	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000
Wheat	7426	11743	16830	9320	5806	10500
Barley	142	1083	754	404	-	85
Tef	371	312	4093	149	318	232
Maize	4546	3436	2846	4876	5584	10072
Sorghum	411	621	-	-	26	91
Haricot bean	240	379	12	-	-	26
Soybean	-	-	-	-	-	21
Field pea	447	-	-	-	9	19
Rapeseed	-	139	43	63	34	66
Linseed	-	179	-	-	12	14
Total	13583	17892	24578	14812	11789	21126

Source: ESE

Horticultural Crops

The potential for production of horticultural crops (vegetables, tubers, roots and fruits) is enormous. At present, however, there is very little formal sector seed production and supply of horticultural crops. The EARO, AU and state farms produce very limited quantities of selected vegetable seed such as tomato, pepper, onion and potato mostly for their own use. From 1991 to 1996, totals of 65.1, 6.1, 1.9, 0.4 and 1,922.2 kg of onion, tomato, pepper, papaya and potato, respectively, were produced by EARO. Similarly, during the same period, the Horticultural Development Enterprise (HDE) produced 229,500 and 2,600 kg vegetable and flower seed, respectively. As a result large quantity of vegetable seed is imported annually.

This situation is of great concern to the country in general and to NSIA in particular. NSIA conducted technical and economic feasibility and technical assistance need studies on 11 potential private farms. These farms are located in six agroecological zones with high potential for horticulture production. From 11 farms, five are found suitable for seed production of horticultural crops. With existing potential seed demand these farms are expected to capture the opportunity and engage in horticulture seed production and marketing.

The multiplication and distribution of planting materials (roots, tubers and fruits) is minimal and confined to research stations (Nazreth, EARO) and state farms (Nura Eara and HDE), mainly to satisfy their own seed need, except for some quantities which are made available for farmers upon the request of MoA. These crops include banana, sweet potato, orange, mandarin, lime, lemon, citron, apple, and citrus.

Some private farms (Tepo Valley, Awassa Green Wood, Ethio-Flora, Neget Farm) have started production and marketing of planting materials (onion, sweet potato cuttings, potato tubers) which is encouraging. The NSIA will continue assisting them by providing technical advisory services and trainings. The initiatives taken by some Regional Agricultural Bureaus to establish nurseries for production of planting materials for citrus and fruit crops is expected to facilitate adequate and timely supply of improved materials.

Forage Crops

The Fourth Livestock Development Project (FLDP), Land Use, Soil and Water Conservation Department, EARO and International Livestock Research Institute (ILRI) are involved with local forage seed production. In the past five years contract growers, cooperatives and farmers produced about 590 tonnes of forage seed locally. In practice only FLDP and EARO have produced forage seed and distributed it to farmers around Holeta Research Station since 1991. The Livestock Department of the MoA, through its project with the World Bank, is planning to implement a forage seed production scheme similar to that of the FBSPMS. This scheme is expected to greatly improve forage seed production and supply.

Stimulant Crops

Coffee, Ethiopia's primary export commodity, accounts for 60% of the export earnings of the country. However, being the center of origin and diversity, the Ethiopian Coffee production is obtained from forest or cultivated. The latter consists of small-scale farming and large-scale coffee plantation by state farms. Presently, EARO (Jimma Agricultural Research Center), state farms,

and the RAB produce and distribute coffee seedlings. This will continue until a private sector coffee nursery management and seedling production is developed.

Fiber Crops

Cotton, sisal and enset (*Ensete ventricosum*) are important fiber crops and are mainly produced by large-scale state farms except enset. Cotton, being the source of textile and edible oil, receives greater research attention. Although improved varieties are available there is no formal seed production and distribution system. The Middle Awash Agricultural Development Enterprise and Tendaho Agricultural Development Enterprise currently produce and market cotton seed as a sideline business. Cotton seed production is an attractive venture if taken as the main business by the private sector.

On-farm Seed Production

The Ethiopian farmers have, for centuries, used their own seed of land races saved from previous crops, or seed obtained from neighboring farmers, usually in exchange for grain or some other commodity or even in the form of credit to be paid back in kind or cash after harvest.

The annual total seed requirement in Ethiopia is estimated to be 480,000 tonnes of which 96% of is met from seed saved from previous crops. ESE annually produces and distributes only about 15,000 tonnes of seed. Moreover, the participation of the private sector is very low.

The national seed policy encourages the participation of communities in local seed production and supply. At present the NSIA is coordinating a project whereby farmers are involved in seed production through Farmer-based Seed Production and

Marketing Scheme (FBSPMS) to encourage farmer-to-farmer seed exchange and varietal diffusion in the informal sector. The scheme is now being implemented by the regional states. The states in cooperation with NSIA are providing technical assistance, training and inputs to farmers participating in the scheme. The results obtained so far are encouraging and the scheme is expected to expand in the coming years.

A brief descriptive explanation, regarding FBSPMS, is given as follows:

- Participating farmers are selected based on the criteria set by the scheme. In each location farmers are organized in clusters to facilitate supervision, seed cleaning services, minimize isolation problems and produce similar varieties in adjacent plots.
- Farmers are provided with agricultural inputs (seeds, fertilizers, chemicals, etc.) on credit after 25% down payment. Training in techniques of seed production, storage and handling is provided to farmers and development agents.
- Cereals (wheat, tef and barley) are the major crops multiplied for seed. However, pulses such as chickpea, and faba bean are also multiplied in a limited quantity (Table 8).
- About 44,995 farmers have participated in the program from 1997/98-2000/01 crop seasons. About 24,672.7 tonnes of various crop seed were produced in the last three seasons. About 16,500 tonnes of seed is expected to be produced in 2000/01.
- Marketing is handled either by the Regional Agricultural Bureau (RAB), farmers' cooperatives or by a commercial trading company. The degree of involvement, however, varies from region to region.

- Seed quality control is ensured by regional or zonal agricultural bureau in collaboration with the National Seed Industry Agency. Additional technical assistance in planning and supervision are also provided by RAB and NSIA.
 - At the grass root levels the scheme is implemented by the Woreda Agricultural Officers and participating farmers with direct supervision from the zonal and regional agricultural offices.
 - Participating farmers are closely assisted by the development agents, assigned by each regional agricultural bureau, in all operation of the scheme.
 - Apart from provision of inputs harvesting materials such as bags and sacks are made available to participating farmers by the scheme.
 - Seed processing machineries, vehicles and motorcycles are provided by NSIA to implementing RAB as a capacity building initiatives.
- The program enabled farmers to have:
- better awareness and understanding of seed production and quality control techniques.
 - increased access to agricultural inputs and timely supply of seed at affordable prices.
 - increased income from improved seed sales and improved livelihood of farmers
 - better position to pay credit from increased production and income.

Table 8. List of crops and varieties used for FBSPMS

Crop	Variety
Wheat	ET13, Pavon 76, HAR1407, HAR1522, HAR1595, HAR1685, HAR604, HAR710, K6295, HAR1899, HAR1868
Barley	HB42, HB-120, ARDU-1260B, Beka, Holker
Teff	DZ-354, DZ-196, DZ-974, Cross-37
Maize	Kuleni, A-511, Katumani, Alemaya composite
Sorghum	76T1# 23
Chickpea	Mariye
Field pea	Tegegnech, G/22763/2C
Faba beans	CS 20 DK
Haricot beans	Awash-1, Roba, Mexican 142
Groundnut	Sedi, Shulmith
Linseed	Chilalo, CI-1525
Potato	Tolcha

In a similar effort the Swedish International Development Authority (SIDA) and the Amhara National Regional State initiated a collaborative rural development with an overall objective to improve the living conditions of the rural populations. The project has a holistic approach and includes several components such as seed production, road construction and education. The pilot schemes were started in East Gojam (high potential area) and Southern Wollo (drought prone area) in 1997. The purpose is to involve farmers in local seed production and marketing. To date no detail report has been received on the progress of the initiative.

Emergency Seed Supply

In late 1980s, the Strategic Area Seed Reserve Project, a partnership of the ESE, IBCR (ex PGRC/E) and the MoA, was involved in establishing informal seed security mechanism by identifying, collecting, multiplying, and storing local landraces in selected areas susceptible to recurring droughts. During the pilot scheme local landraces collected from North Shewa and South Wollo Zones were multiplied and stored for distribution to farmers affected by drought. The program eventually evolved into farmer-based germplasm conservation, enhancement, seed production and utilization operated by local NGO. The project played a key role in restoring local germplasm to farmers following drought years.

In the past several NGOs were involved in relief supply including seed during drought years. Until 1990, for example, NGOs account for 26% of the seed supply by ESE. In an effort to shift from emergency to development a number of international and local NGOs become involved in small-scale local seed production and in establishing community seed banks in drought prone areas of the country. For example the Relief

Society of Tigray promotes community seed banks improve local seed supplies in drought-prone areas.

Seed Processing and Storage

Seed processing not only adds value to the seed, but also maintains the quality of seed thereby creating farmers confidence in seed. Moreover, better seed processing and handling reduce cost and promotes efficiency.

Seed Processing

Most of the agricultural research centers and universities, which are responsible for breeder seed, pre-basic, even basic seed production, have seed cleaning facilities. Similarly, ESE, EPHI, FBSPMS, and the SIDA Seed Project in Region 3 have seed processing plants and/or cleaners.

ESE has seed plants and mobile cleaners with a potential capacity of 61,000 tonnes (Table 9). ESE, if additional capacity is required, can use mobile cleaners that were purchased and distributed to regions for the FBSPMS. EPHI has one processing plant with an annual capacity of about 6000 tonnes.

Seed Storage

ESE has seed storage facilities with a total capacity of 37,600 tonnes, located adjacent to its seed processing plants and transit stores in major seed production areas. The processing and storage facilities are in excess of present needs. However, with the current plan of increasing seed production from 23,000 tonnes in 2000/01 to more than 100,000 tonnes in 2005/06, it is anticipated that more storage facilities will be required. ESE has already planned to construct 25

additional stores with a total capacity of 23,500 tonnes in different parts of the country.

Table 7. Seed processing and storage facilities of Ethiopian Seed Enterprise

Location	Cleaning capacity (t/h)	Total capacity (t)	Storage capacity (t)
Asella	4.5	10,010	5,000
Koffelle	4.0	10,010	3,700
Awassa	5.0	6,550	2,900
Nekempte	4.5	10,010	5,000
Mobiles (4)	7.0	13,200	-
Assassa	-	-	4,000
Dodolla	-	-	4,000
Komolcha	-	-	2,000
Robe	-	-	4,000
Bahir Dar	4.5	7,700	4,000
Shallo	-	3,520	1,500
Gonde	-	-	1,500
Total	-	61,000	37,600

Seed Marketing and Distribution

In Ethiopia, only two organizations officially produce and market certified seed for the major food crops: ESE and EPHI. ESE has seed distribution points located at Assella, Koffelle, Awassa, Nekempte and Bahir Dar, near its seed plants.

In the past ESE sell most of its seed directly to state farms, and to farmers through NGOs and Agricultural Inputs Supply Corporation (AISCO) of MoA. AISCO started selling seed in 1984 and stopped in 1991. Up to 1990, the share of annual seed sales to state farms, NGOs, and AISCO was 50%, 26% and 24%, respectively. In 1994, however, the share changed dramatically with state farms receiving only 5%, NGOs 65%,

emergency relief through MoA 29.7% and direct sale to farmers 0.3%.

During the last five years, the Regional Agricultural Bureau (RAB) become involved in distribution of seed to the peasant sector through a new agricultural extension package program. The RABs receive 56%, 47% and 70% of seed sales in 1997, 1998 and 1999, respectively. This trend will continue to prevail during the next five years (2001/02-2005/06) since the extension program is planned to expand covering more than 5 million farmers.

The amount of seed distributed by ESE is shown in Table 10. In addition 660,960 and 1154 tonnes of hybrid maize was distributed in 1995, 1996 and 1997 respectively. Seed sales show fluctuation from year to year and

were 123% in 1994 and 47% in 1996, compared to seed production by ESE.

ESE used to have a problem of carry-over stock, while the majority of farmers are unable to obtain improved seed. This problem was attributed to poor seed marketing (promotion and sales outlets) for reaching the farmer and/or the inability of the enterprise to meet the farmers' need (varietal choice, product quality). An attempt by ESE to use private dealers was not successful either.

ESE is currently developing a sustainable marketing strategy in which farmers will be

the main clients. ESE has recently completed its reorganization with eight production and processing centers (3 new ones) and 21 seed marketing and distribution units located at strategic points. This will become operational from 2001/02 and will enable ESE reach the small farmers.

The Ethiopian Pioneer Hibred Inc. started seed production operation after price deregulation was introduced. It is selling hybrid maize seed direct to state farms and through extension agents and private dealers to farmers. From 1994 to 1999, a total of 5294 tonnes of hybrid maize was sold.

Table 10. Amount of Certified (Commercial) Seed Sales by Ethiopian Seed Enterprise (tonnes)

Season	Wheat	Barley	Maize	Sorghum	Tef	Haricot bean	Others [†]
1995	10,135	153	2,632	588	434	52	138
1996	9,375	273	2,819	163	357	113	3
1997	8,126	371	2,300	7	279	38	30
1998	11,082	203	4,725	12	33	9	17
1999	11,088	191	6,130	23	2,242	11	107

Source: ESE; [†]Faba bean, chickpea, field pea, soybean, rapeseed, sunflower, linseed, niger seed and mustard

Seed Pricing

Both seed and grain prices were fixed until 1990 because of government economic policy. Since 1992, however, seed price is deregulated and depends on market forces. The seed and grain price is given in Table 11. Seed is not officially subsidized. There seems, however, an implicit subsidy arising from the public ownership of the seed enterprise.

Credit Facilities

In general all industries with a viable project have an access to credit and seed industry is no exception. Farmers who can afford to pay 25% down payment in cash for input purchase and who want to be involved in seed production can obtain credit from local banks through Regional Agricultural Bureaus without any collateral.

Table 11. Grain and seed price in Ethiopian Birr

Crop	1995		1996		1997		1998		1999	
	Grain	Seed	Grain	Seed	Grain	Seed	Grain	Seed	Grain	Seed
Wheat	187	216	162	214	169	211	201	245	183	245
Barley	166	209	149	230	141	230	173	246	181	246
Maize										
Composite	104	202	91	202	83	172	107	222	108	222
Hybrid	-	500	-	500	-	497	-	547	-	578
Sorghum	165	219	119	223	119	223	184	196	155	196
Tef	210	352	187	360	167	324	205	324	207	324
Haricot	142	215	141	353	150	322	174	322	194	322
Faba bean	216	-	202	-	191	-	214	-	219	257
Chickpea	232	229	218	-	213	-	230	-	225	230
Field pea	265	-	250	-	223	-	266	-	259	-
Lentil	294	-	300	-	305	-	340	-	371	-
Rapeseed	402	378	378	378	349	349	276	349	271	349
Lin seed	448	308	467	371	438	350	433	350	397	350
Sunflower	387	-	356	-	380	-	332	-	322	-
Niger seed	456	-	456	343	483	343	360	343	328	343

Incentives for Seed Sector

The national seed policy encourages the development and expansion of formal sector (public and private) and organization of the local seed production at community or village level to promote the use of low-cost seed through secondary seed scheme.

Formal Sector

The Government aims to strengthen the technical, managerial and institutional development of the public sector and to allocate resources to build national capacity in seed production in favorable areas through contractual arrangement with government seed farms, seed growers and farmers based on national seed policy. The public seed sector (ESE) will be given the responsibility of seed marketing and distribution at national level and expand its facilities (plants, storage, vehicles, etc.)

For the development of seed industry the Government also supports and promotes domestic and foreign private seed enterprises to produce, market and distribute seed. The National Seed Industry Policy has created a favorable competitive environment through price deregulation, subsidy elimination, equal access to breeder and basic seed, and independent quality control.

The present investment policy and regulation encourages and facilitates coordination and expansion of investment in agricultural development and agro-processing. Under the policy new domestic and foreign investments as well as existing enterprises under going expansions are exempt from payment of duties and taxes levied on imports of capital goods, equipment and spare parts, provided that these are not available in the country in comparable quantity, quality and price. They are also exempt from payment of income tax for the period of 3-8 years from the commencement of production. Moreover, no assets of domestic or foreign investor or enterprise may be nationalized wholly or partly except in accordance with the general policy and law by the state and upon payment of adequate compensation.

Informal Sector

The Seed Systems Development Project coordinated by NSIA and the SIDA seed project are promoting the local seed production and supply at community or village level using local and/or improved varieties in seed multiplication. Under the project NSIA provided several seed cleaning machines with the capacity of 10-20 q/h to RABs to serve the farmers clean their seed with relatively low cost. The scheme is also encouraged through provision of credit facilities for purchase of inputs (seed,

fertilizer, pesticides, machinery and implements).

International Seed Trade

The Ministry of Trade and Industry (MOTI) is responsible for seed import and/or export trade license while the NSIA is in charge of issuing the certificate of competence, a pre-requisite for issuing a trade license.

According to Seed Proclamation No. 206/2000 the requirements for seed import and export include, inter alia, the following.

- Seed importers-exporters must be registered with NSIA to get the certificate of competence and must have a trade license from MOTI.
- Seed importers-exporters are required to apply and get import-export permit from NSIA before importing-exporting any seed.
- Seed importers-exporters must comply with the requirements of the Plant Quarantine Service of MOA.

The organizations involved in seed import and/or export include private traders, private producers, public enterprises (ESE, HDE), NGOs, research institutions, universities and colleges. Crops usually imported or exported are cereals, pulses, oil crops, vegetables, ornamentals, fruits, medicinal plants, trees and shrubs. The quantity of seed/planting materials imported is shown in Table 12.

In 1992, a revised Plant Quarantine Regulation No. 4/1992 was issued based upon the Plant Protection Decree No. 56/1971. All imported plants and materials, which are liable to be infested or infected with plant pests, are subjected to plant

quarantine checks. The regulation restricts the importation of some plants, plant products and other articles without import permit duly issued by the Ministry of Agriculture. It positively contributes to MoA's regulatory function on seed import and/or export in checking the seed health and issuing the phytosanitary certificates.

Seed Quality Control

In general the responsibility for seed quality control should be vested in an independent agency, which has no links to production and is therefore impartial. In the absence of seed regulation and certification agency, ESE conducts its own internal quality control by establishing minimum field and seed standards for production of cereals, legumes and oilseeds. ESE has a central seed testing laboratory at its headquarters and satellite laboratories attached to seed processing centers. It has the necessary facilities and expertise for seed quality control. Similarly, EPHI also has its own internal quality control system.

However, NSIA has established quality control facilities and recruited and trained the required manpower to take over the role of external seed quality control and certification to build farmers' confidence in improved seed. NSIA initially will concentrate on certification of most important crops (maize, wheat, sorghum, tef, faba bean, chickpea, field pea, lentil, haricot bean, cotton). NSIA is expected to enforce the Seed Proclamation No. 206/2000. In the medium term plan seed quality control and certification will remain under NSIA.

Seed Research, Training and Extension

There is no formal seed research though in the past some adaptive research was carried out on seed treatment by EARO and state farms to control seed-borne diseases and soil-borne insects.

Apart from some courses at under graduate level, there is no professional specialization in seed science and technology in institution of higher education. Therefore, the human resource in the seed sector is scarce both at technical and managerial levels. The country mainly depends on overseas training for short-term specialized seed courses through EEC, FAO, UNDP, ICARDA and the World Bank.

The present agricultural extension system is known as Participatory Training Extension System (PADETES) characterized by demonstrating and training farmers in technologies developed by agricultural research. The extension service provides small farmers with ½ ha demonstration plots of improved varieties, complimentary inputs and adequate information. The program emphasizes the use of improved varieties, seeds and complementary inputs. At present the extension package program implemented by the Regional Agricultural Bureaus provide credit for inputs such as seeds, fertilizers, pesticides and farm implements.

International Memberships

The Ethiopian Agricultural Research Organization is a member of the ASARECA, an association of NARS in eastern and central Africa.

Ethiopia is a founding member of the WANA Seed Network and a 'lead country' to develop model variety evaluation, release and registration mechanisms in member countries.

Seed Trade Association (AFSTA) based in Nairobi, Kenya.

The ESE and the Ethiopian Hi-bred Inc. are members of the recently established African

Table 12 Seed import for production or sale in 1999/2000

Organization	Import (kg.)										Export (kg)
	Forestry Seed	Cereals	Vegetables	Flowers	Pulses	Forages	Medicinal Plants	Fiber	Oil Crops	Aromatic Plants	Cereals
Production											
Ethio-Flora				1000A 0.75							
Meskel flower			2705.64 157								
Ethio-Falcon			8915								
Angereb Enterprise			802								
Moda Enterprise						400					
Dinsho P.L.C.			7500								
Abdulhamid				166440							
Agricultural Extension	4										
Amhara Region	38A						125				4.2
Pioneer Hi-bred		5332									
Twenty-Twenty			4	3				80	27	6	
Uni Bef			1195								
Ministry of Agriculture							300				
Lupo	4600		7629								
Etheco			150								
World Vision	15C										
Total	4604	5332	29057	166444		400	425	80	27	6	4.2
Trade											
AISCO			13500								
Ethio-Falcon			8915								
Chametex			400.4								
Markos PLC			44300		1000						
Eth-fruit			7238								
Don Commercial Enterprise			265	2.7							
Aboker Trading			2065								
United Inputs Supply			4300								
Ajamo Trading Enterprise			8596.5	15							
United Trading								115			
Nazareth International Trading			860								
Akmera Mesfin			5720	13335B							
Total			96159.9	17.7	1000			115			

Note: B= Sample, C= Packet (25-100gm); A, B and C are not included in the sample

Major Constraints in the Seed Sector

The Ethiopian Seed Industry is generally characterized by constraints related to variety development (horticultural crops and ornamentals); seed production (mainly horticultural crops,

ornamentals, tree crops, fiber crops, pulse and oil crops), marketing and distribution; seed quality control; and seed extension.

Production

1. Shortage of improved varieties and inadequate supply of good quality breeder

and basic seed, mainly for horticultural crops and ornamentals.

2. Limited technical and managerial expertise and experience for efficient and economic production of quality seed.
3. Absence of specialized seed farms for seed production of pulse, oilseed, horticultural and fiber crops.
4. Inadequate coverage of economically important crops such as pulse, oilseed, horticultural and fiber crops.
5. Low level participation of the private sector in the national seed industry development.

Distribution

1. Inefficient seed distribution system (few sales centers, no retail dealers).
2. Absence of effective sales promotion and marketing
3. Low quality of seed offered for sale, mainly for tef and hybrid maize.
4. Low grain price paid to farmers.

Recommendations for the Seed Sector

The constraints facing the seed sector require policy, regulatory, managerial and technical intervention if progress is to be achieved in seed industry development in Ethiopia.

Production

1. ***Lack of varieties and inadequate breeder and basic seed supply:*** For effective seed production, all activities that involve variety development, maintenance, and seed production should be properly linked as any single weakness would result in poor performance of the seed system. Thus, the agricultural research system should be strengthened for continuous development of

varieties and supply of breeder seed of strategic crops.

2. ***Limited technical and managerial experience and material resource:*** There should be sustained invest in human resource development and essential facilities for enhancing capability in germplasm conservation, utilization and crop improvement as well as seed production, processing, marketing and quality control.

3. ***Absence of specialized seed farms:*** For efficient, economic and sustainable seed supply, seed production should be decentralized into major crop production zones with active participation of both public and private sectors. At the same time, the local seed supply should be organized using both local and improved varieties through secondary seed multiplication scheme.

4. ***Inadequate coverage of economically important crops:*** Despite the availability of breeder seed and reasonably good varieties, pre-basic and basic seed production do not cover economically important crops such as cotton, sorghum, groundnut and sesame. Therefore priority crops should be identified, breeder seed multiplied and distributed to users by the respective institutions.

5. ***Low participation of private sector in seed industry:*** For a sustainable national seed industry development, it is necessary that private seed sector participation flourishes. A public-awareness campaign should be strengthened through workshops, seminars and study tours to attract private investors.

6. ***Lack of independent quality control system:*** The establishment of the National Seed Quality Control and Certification Division under NSIA by itself is not a

solution for the current seed quality problem. The Agency should start certification of seed produced by the public and private sectors and enforce the regulation to build farmers' confidence.

Distribution

1. ***Inefficient seed marketing and distribution system:*** The seed marketing and distribution centers are mainly concentrated in Arssi, Bale, Gojam, Sidamo and Wollega. The number of seed marketing and distribution centers should be increased to cover major production areas and located strategically to minimize price differences arising from transportation costs. Although current efforts of ESE in expanding marketing centers are encouraging, private dealers should be licensed to handle seed marketing and distribution. Moreover, seed distribution by farmers' service cooperatives should be encouraged at grass root levels.

2. ***Absence of sales promotion:*** The awareness of the Ethiopian farmers on the use of improved seed needs to be improved. A sales promotion unit should be strengthened within the marketing system. A

strong agricultural extension program is also required to promote use of improved seed, especially for newly released varieties.

3. ***Low quality seed offered for sale:*** In the past, the quality of seed offered for sale has been inferior and sometimes less than farmers' own seed in terms of physical and physiological quality. Breeder, basic and certified seed should be properly controlled and premium prices paid for contract growers to encourage production of quality seed.

4. ***Low grain price.*** During the last five years, particularly after the implementation of new agricultural extension package, there has been a tendency of increased production of cereal crops. Such increased production tends to depress the grain price compared to high cost of agricultural inputs. This influences farmers' decision to use inputs, particularly seed. A mechanism should be devised to implement the floor grain price as indicated in the national seed policy whereby farmers can sell their products at reasonable prices.



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