

Challenges and Opportunities in Securing Forage Seed Systems in Ethiopia: A Review

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ABSTRACT

The objective of this paper is to review the existing forage seed production systems, challenges and opportunities in Ethiopia. To achieve this, the authors used published facts including journal articles, edited books, proceedings and reports. Ethiopia is known for its huge livestock population and low productivity due to critical feed scarcity both in quantity and quality. This in turn is the result of low forage development practices which is suffered from insufficient supply of forage seeds at reasonable price in the country. To solve the forage seed supply problem, the public sector, research and development institutions, have been engaged in multiplying improved forage seeds using contractual, opportunist and specialized approach. But their impact is still low compared to the current demand for improved forage seeds as farmers prefer to allot their lands to food crop production than to forage seeds. As a result, the availability of quality forage seeds at reasonable price is currently below the demand which limits improved livestock feed availability in the country. Moreover, the forage seed business do not attract commercial seed companies due to their natural low seed producing capacities, land scarcity, lack of adequate technologies, inefficient seed marketing and distribution networks. Although there are challenges for improved forage seed production and supply, Ethiopia is endowed with favorable environmental conditions to produce different forage species and varieties to enhance livestock feed availability. Therefore, Agricultural research institutions, Universities, NGOs and other stakeholders should exert integrated efforts to promote and develop sustainable forage seed production.

Key words: *Forage seeds, seed systems, forage value chain, challenges and opportunities*

1. INTRODUCTION

Ethiopia has a huge livestock population in different agro-ecological zones. The Ethiopian livestock sector constitutes a considerable economic and social importance at household and national levels. The sector contributes 35-49% of the country's Agricultural Gross Domestic Product (AGDP), 15-17% of the total national Gross Domestic Product (GDP) (Gebremariam et al., 2010; Behnke and Metaferia, 2011; MoA and ILRI, 2013), 16% of export earnings (Yaynshet, 2010) and 30% agricultural employment

(Behnke, 2010). Besides, livestock play a significant role in generating income for 80 % of rural smallholder households, and in meeting domestic meat and milk consumption requirements (Shapiro *et al.*, 2015). In addition to direct income benefits livestock provides indirect benefits, such as fuel and fertilizer from animal manure and draught power for farm production. Moreover, according to the Central Statistical Agency's (CSA) (CSA, 2014) report, about 11.4 million households are involved in livestock production in Ethiopia. Based on analysis done by Ministry of Agriculture (MoA) and International Livestock Research Institute (ILRI) about 49% of these livestock holders live below the Government of Ethiopia (GoE) established poverty line and undernourished. Furthermore, projections show that without significant immediate investments in improving livestock productivity, the national-level production–consumption gaps for meat, milk and eggs in 2028 will be about 47%, 27% and 55%, respectively (MoA and ILRI, 2014). In spite of the potential for significant social and economic benefits, the country's livestock sector is lower in productivity among which due to inadequate feed supply both in quantity and quality is very critical. For most livestock keepers, the inability to feed their animals adequately throughout the year is the most critical and widespread technical constraint to increase livestock productivity. This turn is a key to achieve better livelihoods, food security and nutrition, as well as more sustainable use of natural resources (Tekalign, 2014). According to CSA (2017), the dominant animal feeds in Ethiopia have been grazing (54.59 %), crop residues (31.6%), hays (6.85%), others (5.11%), byproducts (1.53%), and improved feed (0.31%). Similarly, Alemayehu *et al.* (2016) indicated that natural pasture is the major livestock feed resource in the country. However, the available feed from natural grazing lands and crop residues are characterized by poor nutritional content and digestibility that results to lower livestock productivity.

In order to improve the shortage of livestock feed in crop livestock production system, it is important for farmers to integrate forage production in the farming system. Establishing reliable forage production depends on the availability of reliable supplies of quality forage seeds (Alemayehu, 1997; FRG, 2008; CSA, 2014). Moreover, improved feed supply and feeding practices could increase livestock productivity and production. In addition to their feeding value, improved forage species also play an important role in minimizing greenhouse gas (GHG) emissions from livestock, improve soil fertility, reduce soil erosion and ensure better mixed crop-livestock integration (Muluneh *et al.*, 2012). For instance, intercropping species like maize and lablab or coffee and Desmodium is more advantageous than growing one crop alone (Tekalign, 2014). Therefore, to increase livestock productivity, more and better forage seeds need to be produced on-farm or grown commercially and sold through well-functioning markets. This will be achieved through employing appropriate marketing channels as the availability and marketing of good quality forage seeds is a major unaddressed gap in Ethiopia. The general objective of this paper is to review the existing forage seed production systems, challenges and opportunities in Ethiopia. The purpose of the review is to pinpoint the activities done on forage seeds production, marketing systems, challenges and opportunities for further enhancement of the forage seed sector in the country. To prepare this review

the authors have used published facts from different sources including journal articles, edited books, proceedings and reports.

2. EVOLUTION OF FORAGE SEED PRODUCTION IN ETHIOPIA

Historically, efforts have been made by the public sector, research and development institutions in developing forage seeds. Although still small in scale, private seed producers are laying the groundwork to fill the gap between the growing demand and low supply. As indicated by Alemayehu and Robertson (2013) forage seed production was started by the Arsi Rural Development Unit (ARDU) in the 1970s. During that period major grass forage seed species multiplied include *Oats*, *Rhodes grass*, *Phalaris*, *Cockfoot*, *Panicum*, *Setaria*, *Forage sorghum*, *Buffel*, and *Elephant grass*. Besides, legumes like *Vetch*, *Lablab*, *Alfalfa*, *Desmodium*, *Trifolium* species and root crops such as *Fodder beet* and *Turnips* were multiplied for their seeds (Alemayehu *et al.*, 2016). Hence, the pioneer work of ARDU paved the pathway for the subsequent establishment of various development activities under the framework of “systems approach” involving crop-livestock-forage and seed production and extension activities. Moreover, ARDU’s forage seed production efforts were sustained and were well received among farmers where they multiplied starter seeds of *oats*, *vetch* and *fodder beet* offered by the unit (Alemayehu and Robertson, 2013; Alemayehu *et al.*, 2016). As a follow up activity the Fourth Livestock Development Project (FLDP) of the MoA introduced the seed contract system where farmers were contracted to produce forage seeds between 1987 and 1988 (Lemi, 2015). As indicated by Tekalign (2014), the approaches introduced by FLDP include contractual system of forage seed production, opportunist seed production and specialized seed production enterprise. The main emphasis of the FLDP project were on herbaceous and tree legumes seed collection from forage development sites and model farmers. This collection was aimed to produce high quality and quantity seeds at lower price locally under organized and controlled system. This system helped in the production of large amount of seeds at lower costs of production as compared to large farms using daily labor (Alemayehu and Getnet, 2012). However, this system worked well during the life span of the project but failed to operate successfully after the project phased out. According to Tekalign (2014) the efforts to promote and disseminate forage seeds did not continue due to different reasons such as lack of sufficient grants to purchase and supply seeds by the agricultural office. Moreover, farmers had not the capacity to produce and supply seeds due to labor, land and capital scarcity. Despite farmers prefer to use their lands to produce other type of crop seeds than forage seeds that had more impact on their livelihoods. *Fodder beet*, *Alfalfa*, *Tree lucerne*, *Sesbania*, *Oats*, *Vetch*, *Buffalo* and *Elephant grasses* were widely used by projects such as Crop Diversification and Marketing Development (CDMD), with the assistance of the FAO and Land O’Lakes International Development to produce forage seeds and seedlings (Tekalign, 2014).

The focus of the Herbage Seed Unit of ILRI was also on supplying selected tropical forage seeds and planting material, which are “best bet” species for experimental and training purposes. This helped to provide training on forage seed production and management to farmers, extension workers and commercial producers and carry out experiments. In addition, initiatives were taken to minimize livestock

feed problems encountered in the country by projects working in Agricultural Cooperatives and Pastoralist Livelihoods Initiative-Livestock Marketing in collaboration with FEED I (Feed Enhancement for Ethiopian Development I) funded by ACDI/VOCA’s under USAID.

Holetta, Kulumsa and Melkassa Agricultural Research Centers were also involved in producing breeder and basic seeds and propagating forage materials for research and dissemination purposes. Adami Tulu Agricultural Research Centre in collaboration with Japan International Cooperation Agency (JICA) also undertook a participatory community based forage seed production study using a farmer research group approach in Adami Tulu and Arsi- Negelle districts. The focus of these centers was to produce and distribute improved forage seeds mainly to research students. But due to poor market linkages majorities of the varieties have reached only few farmers. Besides, the amount of seed produced by the centers was insufficient compared to huge demand of stakeholders (Muluneh *et al.*, 2012; Tekalign, 2014). However, the engagement of the private sectors in forage seed production started recently. Although participation of the private sector has increased in forage seed production, its capacity is still limited and not equipped to meet the forage seed demand of the country. Currently, in Ethiopia private sectors like Eden Field Agri-Seed Enterprise, Sidama Seed Enterprise and Seid Improved Forage Seed Producers have been involved in the production and dissemination of certified seeds to different users (Azage *et al.*, 2010; Tekalign, 2014). In addition to seed production on their own farms, these enterprises also produce seeds on farmer’s field based on contractual agreements to buy forage seeds. However, the involvement of the private sectors in forage seed production has been limited as the market at farmer’s level for these resources has not been developed (Azage *et al.*, 2010).

3. FORAGE SEED PRODUCTION SYSTEMS

In sub-Saharan Africa (SSA) in general, no single systems of seed production is suited to the varying social or environmental situations. Current seed production and supply systems, involving both the public and private sector are focusing only on commercial large-scale food crops seed production and marketing. This has resulted in critical shortage of improved forage crop seeds and production is limited to few public institutions and private sectors. In the areas of seed development, challenges that exist cannot be dealt only with formal systems, and requires an effort from various stakeholders including non-governmental organizations, private sectors and farming communities Herbage Seed Unit (HSU, 1994). Research has identified a range of adaptable and productive forage species that can be integrated into the local production systems for improving livestock productivity. According to Mesfin *et al.* (2012),

however, the adoption of these forage species by livestock farmers is low. One of the most pressing concerns is related to seed supply of improved forage varieties and how to establish sustainable seed supply systems for commodities that cannot be economically supplied through a centralized and formal seed industry (CIAT, 2003). Moreover, the availability of quality seeds based on the demand at reasonable prices is crucial to feed development and livestock productivity to meet the expanding meat and milk demand.

In Ethiopia, seed productivity of most perennial forage grasses and legumes range between 100-400 kg/hectare (EIAR, 2012). However, with the careful selection of well-adapted forage crop species, Ethiopia could potentially establish forage seed production sites to supply quality seeds to domestic and international markets. According to Abebe (2010), seed system in Ethiopia represents the entire complex organizational, institutional and individual operations associated with the development, multiplication, processing, storage, distribution and marketing of seeds in the country. Ethiopia's seed sector is composed of formal and informal components. However, the informal sector dominates as farmers exchange the majority of seeds amongst themselves. The concept of direct seed marketing is currently unfamiliar and not exercised. The main limitations of the forage seed industry also include a shortage of public and private sector expertise. Poor coordination among forage seed producers, extension service providers, development practitioners' and other market actors limits the viability of the value chain. Besides, very few actors play a role in developing the forage seed value chain in Ethiopia (Tekalign, 2014). Forage seeds are often produced through a contract farming model. Contract farming refers to a system in which a firm purchases the harvest of individual farmers, and the terms of the purchase are arranged through contracts. The term out-grower is also used in the same arrangement except that production and marketing services take place on the farmer's own land (Lemi, 2015). This type of arrangement is attractive to farmers because they get reasonable and predetermined fixed prices for their produce. The other alternative for producing forage seed is using Farmer Training Centres (FTCs) which can serve as an entry point for scaling up and/or out forage development. Significant amount of forage seeds are harvested from these centers and then distributed to interested farmers.

4. EXISTING FORAGE SEED SYSTEMS

Rules and regulations such as variety release procedures, intellectual property rights, certification programs, seed standards, and contract laws influence the structure, coordination and performance of the seed system (Abebe *et al.*, 2007). A well-functioning seed system is defined as one that uses the appropriate combination of formal, informal, market and non-market channels to efficiently meet farmers' demand for quality seeds. Both the formal and informal seed systems operate simultaneously in the country and it is difficult to distinguish between the two systems. According to USAID (2012), seed systems passes through four phases as it evolves from a traditional to an advanced system. In phase one, the informal seed system predominates; most farmers save their own seed or obtain seed from nearby farmers, and the rate of new variety development and adoption of new seeds is low. In phase two, seeds of improved varieties developed by the public sector begin to replace local varieties; the use of Ethiopian

complementary inputs, such as fertilizers is limited but increasing, and an emerging private sector is involved in multiplication and distribution of released varieties. During phase three, the private sector begins to play an active role in research and development, particularly in developing hybrids. Seed

systems become more organizationally varied, but the seed supply from the informal sector still ranges from fair to poor. In the last phase, the seed system as a whole is well developed; commercial seed production and marketing are common, effective seed laws and regulations are in place, linkages with actors outside the seed sector are well established, and the use of improved seed is high. However, the current forage-seed system in Ethiopia is underdeveloped. Variety release, quality control and seed certification and standards are not clear and scattered, with limited to no traceability (Mesfin *et al.*, 2012). Lack of a market-driven forage-seed industry is a key limiting factor to more and better-quality seed being produced. However, there is potential to involve different stakeholders in the production and marketing of improved forage seeds. One of the critical constraints to develop a sustainable seed system is dependency created by projects and government agencies which subsidize for forage seeds. Willingness to pay and demand for seed is provided by the experiences of many innovative farmers who produce and sell better forage seeds (USAID EDDP, 2011).

Moreover, structural weaknesses in the seed system such as limited capacity actors, poor infrastructure, limited interaction between actors, poor coordination of system functions and missing key actors during implementation have hindered its development. This in turn has led to a general dysfunction of the forage-seed system and limited understanding of policy tools and instruments to deal with problems.

5. FORAGE SEEDS VALUE CHAIN

A well-defined forage seed value chain does not operate effectively in Ethiopia. To ensure continuity of forage seed production and dissemination; institutional linkages need to be established and strengthened to have commitment along the chain from initial forage seed production to marketing systems. In the informal sector, farmers are the main forage seed producers and multipliers where they grow seed in their farm plots. However, the existing challenges include shortage of certified and quality seed, lack of appropriate technology and limited financial capacity. Currently, produced forage seed is either exchanged among farmers or sold to commercial enterprises. It has not been well developed throughout the country since the existing marketing systems are weak and poorly functional. There is a lack of emphasis and enabling environment to establish and strengthen the forage seed business from the policy makers. In addition, the current supply of certified seeds is very limited and access to proper markets is difficult due to the weak producer-consumer linkages. Therefore, there is a need to create market forums involving producers, dealers and consumers to strengthen forage seeds marketing systems. In Ethiopia, commercial forage seed producers in the formal sector currently include the Ethiopian Seed Enterprise (ESE) and regional seed enterprises such as Somali Seed and Forage Enterprise and Eden Field Agri-Seed

Enterprise. The formal sector also consists of farmers that are involved in growing forage seeds in a contractual scheme. However, this type of forage seed production systems is not well developed since farmers and agro-industrial enterprises prioritize food crop production.

The existing forage seed value chain is facing different types of challenges. For instance, Forage seed producers lack sufficient seeds in both quality and quantity, and lack of information on forage seed demand, and limitations in working capital. Moreover, absence of effective certification mechanisms inhibits private forage seed producers from engaging in forage seed production. Besides, the financial institutions are not facilitating access to loans potential and existing forage seed producers. Land inaccessibility is also another main restriction to private sector involvement in the forage seed sector. These challenges call for multi-directional government approaches including promotion and adoption of new technologies, access to market information, establishment of regulatory and certification mechanisms and access to finance and lands. Additionally, government needs to ensure the forage seed sector is attractive to investment.

6. CHALLENGES OF FORAGES SEED SYSTEMS IN ETHIOPIA

At the current state, the forage seed business may not attract commercial seed enterprises due to their low seed producing potential. As a result, crops with lower seed production potential are not preferred by commercial seed enterprises because of their high seed requirements for multiplication and lower yield per unit area. Another problem in this sector is related to lack of experiences and knowledge in the area of seed technology. For instance, many forage legume seeds need special treatment like scarification for their successful growth. Some forage legume seeds need specific inoculums, which again are not readily available and difficult to handle (Mohamed, 2007). Some of forage species are either biennials or perennials that cannot compete with annual food crop seed production for farmers' profitability. Hence, it is difficult to multiply seeds of many forage crops under contractual seed systems with farmers (Yonas, 2012). Furthermore, farmers may demand a higher price for the seed produced under contractual systems. This in turn increases the production cost, which would be reflected on the final commercial forage seed prices. Besides, low inflorescence density, delayed flowering and seed shattering, low seed settings, susceptibility to disease and pest attack, lodging and indeterminate growth habits are some limiting factors for forage seed production in Ethiopia. Therefore, the involvement of specialized forage seed producing enterprises has been hindered by low seed yield, lack of adequate technology needed for growing and processing forage seed crops, non-existent or inefficient seed marketing and distribution networks in Ethiopia.

Moreover, nationally or regionally mandated public seed enterprises have had limited involvement in forage seed production in the country. The existing forage seed enterprises typically produce a small amount of improved seeds for use mainly by dairy farms. However, the main challenges to most seed enterprises in producing adequate forage seeds are land scarcity and lack of awareness on the benefits of forage uses (Mohamed, 2007). As a result, the public sectors produce limited varieties and amounts of

forage seeds that does not meet the growing demand of the country. Hence, the current forage seed demand surpasses the supply and creating high prices for end users. Moreover, seed cleaning and processing centers across the country are very weak due to lack of expertise, low quality equipment and facilities as well as a lack of access to finance. To date, controlling and assuring seed quality has been given little attention. In most cases, it is very difficult to trace the breeder or maintainer of the initial seed source, as there is no record moving along with the seeds. Hence, as the seeds are exchanged between various actors within the value chain, the traceability of the seeds to their sources disappears. As the seeds move within the value chain, the quality deteriorates due to the limited efforts of quality checks by the public forage seed enterprise.

The major actors within the existing forage seed systems in Ethiopia are producers, wholesalers, retailers and buyers. However, there are no widely known private enterprises engaged in commercial forage seed processing (cleaning and packaging). Individual traders move along the value chain and collect seeds of all varieties and bulk them up for resale without proper cleaning and processing. The bulk of the seeds are sold to NGOs and government offices for further distribution to livestock holders and forage seed multipliers. Moreover, there is no regulatory tracking of the quality of the seeds circulating in the country. Evaluation mechanisms are minimal and when implemented they consist of simple control mechanisms for physiological purity, germination and moisture content. In general, there is lack of information about the seed source and quality as it transits along the value chain to end users.

7. OPPORTUNITIES FOR FORAGE SEED PRODUCTION IN ETHIOPIA

According to Alemayehu (2006), Ethiopia has an immense ecological diversity and a huge wealth of biological resources. The complex topography coupled with environmental heterogeneity of the country offers suitable environments for a wide range of forage life forms. Moreover, Ethiopia is known to be the center of origin and diversity for a number of domesticated crops (Getnet *et al.*, 2012). Large numbers of indigenous grass species and great diversity within the species make the country a potential source of new and better tropical pasture grasses. Ethiopia is also a centre of diversity for many herbaceous legumes such as the genera *Trifolium*, *Vigna*, *Lablab*, *Neonotonia*, and others (Alemayehu, 2006). Besides, Ethiopia's diverse climate favors the existence of a number of valuable wild grasses and legumes and browse plants.

Plant germplasm conservation efforts in the country is also another opportunity for forage seed production which can contribute significantly to the livestock productivity through improving the livestock feed availability both in quality and quantity. The diverse agro-ecology, water and land availability provide a

good opportunity for forage seed production in Ethiopia. This is in line with Alemayehu (2002) who indicated that most improved tropical species could grow in the lowlands while temperate species grow from mid-land to highland areas of the country. Additionally, the yield of improved forage species is higher compared to the naturally occurring forage species and has higher nutritional value. Moreover, the length of the productive season is longer for improved species than the native once, which in turn provides an opportunity for dairy and fattening programs to develop and use pasture and forage on a large scale.

Forage development can also contribute in improving soil fertility, reducing soil erosion, relieving the effect of climate change, desertification and providing firewood. These legumes are well adapted to the current soil and grazing systems. Therefore, they can be integrated into the existing farming systems while they retain their feeding values (Alemayehu, 2001). Even though the irrigation potential of the country is high, forage seed production under irrigated areas is untapped and still there is a great opportunity for producing seasonal and long-term irrigated pasture and forage species. On the other hand, the forage seed demand is expected to continue as the demand for feed increases to support the growing market demand for livestock and livestock products. Moreover, according to Muluneh *et al.* (2012), the existing high demand for seed by smallholder farmers, commercial livestock farms and emerging dairy cooperatives are other opportunities that can solve market issues of forage seed producers. In addition, in view of the high demand for livestock development in Ethiopia for both self-sufficiency and export market and striving agricultural growth and transformation plans create a good opportunity to improve livestock productivity. This in turn demands for high quality feed availability based on the availability of reliable quality forage seeds of the desired species.

8. CONCLUSION AND RECOMMENDATIONS

The high cost and low availability of good quality livestock feed from forage is major constraints to increase livestock productivity in Ethiopia. Moreover, the widespread issues in past forage development programs include: limited capacity of stakeholders, inadequate infrastructures, poor seed processing technologies, and limited coordination among stakeholders has affected the forage seed systems. Besides, the involvement of private sectors in the forage seed value chain is limited. Therefore, it is recommended that, new and existing private and public enterprises need to be strengthened to participate in the production and supply quality forage seeds value chain. Market linkages along the value chain needs to be developed. There is a need to develop extension services and training facilities focusing on forage seed production and management at all levels. Moreover, the introduction of new forage species and varieties needs to be emphasized. Agricultural research institutes, Universities, NGOs, and other stakeholders should collaborate to develop appropriate forage seed production technologies. Finally, the government should strengthen the forage seed system by supporting and promoting contractual systems.

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