

Forage seed systems in eastern Africa: Challenges and opportunities

*S.W. Mwendia*¹, U. Ohmstedt¹, S.K. Ng'ang'a¹, A. Notenbaert¹, M. Peters¹, C. Jones²*

¹International Center for Tropical Agriculture, Regional Office for Africa, P.O. Box, 823-00621, Nairobi Kenya

²International Livestock Research Institute, P.O. Box 30709-00100, Nairobi Kenya

Abstract

Despite the profound livestock importance in eastern Africa, livestock productivity remains low attributable to a number of challenges. One of the major drawbacks is the lack of quality feeds and forages. This results in poor animal performance and suboptimal use of resources. Intertwined with this lack of quality forages is the dearth of forage planting materials - including seed and vegetative material – to offer producers improved forages adapted to different ecologies and agricultural contexts. To alter the landscape, developed forage technologies coupled with awareness creation is needed along the forage value chain to support commercially functioning forage seed systems. With the projected doubling of demand for animal products (meat and milk) in sub-Saharan Africa, the pressure will be exerted on livestock feed resources. This is likely to result in a knock-on demand for forage cultivation hence forage seed demand. To be successful, the forage seed systems need to be supported by enabling policies across the region, which include: functional procedures for certification and quality control; public-private partnerships for the production and dissemination of planting materials, and; technical advice on the production and management of forages. The work reported in this paper highlights, the challenges, and opportunities which, if implemented, are likely to bolster forage seed system development in eastern Africa.

Introduction

While in developed economies, where livestock constitute a major agricultural component, functioning forage seed systems operate, this situation has not been realized in eastern Africa, despite livestock production being a vital agricultural component. Efficient livestock production relies heavily on the quantity and quality of feed and forage resources. Feed is the single largest variable cost of livestock production (Chamberlain and Wilkinson, 1996) which means that it inevitably takes the bulk of requirements in livestock production (Odero-Waitituh, 2017). Further to this, with more land being dedicated to crop production and the increasing requirement for livestock products to meet human demand, the competition for scarce natural resources, particularly in developing countries, is intensifying. The source of feeds is also changing and, as new market opportunities for meat and milk lead to increased prices of concentrates and agro-industrial by-products, this increase in demand is increasingly being met by crop residues and planted forages. This situation is being accentuated by the fact that the availability of grazing land is decreasing and, in the face of a changing climate, it is predicted that the demand for more resource efficient and drought tolerant, productive species and varieties will grow. The genesis of a strong and stable animal feed resource base, usually the roughages, depends on the use of proven forage technologies. However, such forage technologies require the availability of seeds and planting materials (Mengistu et al. 2016) that are easily and economically accessible by the livestock keepers.

Eastern Africa (Ethiopia, Uganda, Rwanda, Kenya Tanzania), is a home to an estimated 109.2 Million cattle (Leta and Mesele, 2014; Ministry of Livestock and Fisheries Development (MOLFD), 2015; Ministry of Agriculture Animal Industry and Fisheries (MAAIF), 2008). These resources, whose role is to meet the predicted increase in demand for milk and meat by 2050 (Delgado et al. 2001), will have to respond with an increased production and production efficiency, if the demand is to be met.

Subsequently, accessibility to seeds and planting materials of improved forages is paramount. While annual forage seeds demand is about 90,000 tons (Andrade, 2001) in a country like Brazil with a developed forage seed system (Jank et al. 2011), it is scarcely documented for eastern Africa. However, in Ethiopia 200,000 tons have been reported to be produced between 1988 to 2002 (Alemayehu et al., 2017) and projections are that, as one of the countries with the highest cattle population in Africa, production will be about 17 tons a year by 2020 (Shapiro et al. 2015). In this country, farmers largely rely on crops residues, naturally occurring pastures and, to a limited extent, cultivated forages. To support this demand vegetative propagation is often used, but this is not without limitations. While naturally occurring pastures are likely to be of poor quality, vegetative propagation can carry the risk of the spread of diseases and pests. In addition, vegetative materials are laborious to work with due to bulkiness. For example, if a substantial land area is to be established, accessing enough quantities can be a challenge. The work reported here assessed the status of forage seed production in Ethiopia and Kenya to give an indication of forage seed status in the region.

Approach

The two countries, Kenya and Ethiopia, were selected for the review based on their livestock, and especially cattle, populations and their contributions to livelihoods. Both countries have sizable cattle populations of approximately 17.4 and 54 million, respectively found under rain-fed conditions (Steinfeld et al. 2006). A review of the past and current initiatives on forage seed systems in the two countries were synthesized against the status of current and projected contributions of livestock to human nutrition. Scopus and Google Scholar search engines were used to filter out the information using relevant keywords, including forage seed, commercial, eastern Africa and prospect/potential.

Results and discussion

A search of the relevant journal papers, reports, working papers and books returned a minimal amount of published work that has been performed on forage seed demand or its potential in eastern Africa. Of the 658 peer-reviewed articles referencing forages, only 2 were touching on forage seed production and not on the commercial aspect. The few articles on forage seeds, including other accessible reports, were synthesized and reported.

Ethiopia

According to Ethiopian livestock masterplan done in 2014, the estimated forage seed quantity within the country was 2.2 thousand tons and is projected to increase by about 300% by the year 2020. The projections are influenced by the increase in carcass weight per animal from 107 kg to 138 kg, and annual milk production per cow from 189 liters to 313 liters in 2020. Similarly, production in commercial dairy farms would grow from the 4,608 liters to 5,080 liters in 2020. Over the same period, crossbred dairy cows Population would increase from 450,000 to 4.5 million. It has been shown that the opportunity exists to double production in response to improved nutrition with these effects amplified when considering profitability (Mayberry et al., 2017). These scenarios precipitate a likely increase in demand for forage seeds to support the improvements. Evidence shows that farmers understand the use of improved fodder, which results in increased productivity (Tekalign, 2014), but access to such material at affordable prices is key. Despite this understanding, and livestock contributing up to 35% of agricultural gross domestic product in Ethiopia, only 1% of feed resources are currently derived from planted forages with the major feed resources derived from crop residues (50%) and grazing unimproved natural pasture (35%) (Tolera et al., 2012; Shapiro et al., 2015).

The forage seed value chain is weak and barely functional with inadequate forage seed research and a general lack of reliable forage seed production, processing and distribution schemes, poorly developed

seed marketing systems and limited involvement of private seed companies (Fikre, 2018). Ethiopia currently relies mainly on opportunistic seed production, or, contract seed production by farmers and/or farmer's cooperatives and the establishment of specialized plots by governmental and non-governmental organizations (Mengistu et al., 2017). This lack of functionality is attributable to a number of challenges including the lack of promotion of forages determined to be useful in different systems and agro-ecologies, and, weak or non-existent institutional linkages. Although both formal and informal sectors are at play, with the informal involving farmers who grow forage seeds, there is a general lack of certified seeds and technology. Producer–consumer linkages that would otherwise contribute to commodity flow connecting to the market for sustainability are lacking. The formal sector, that includes the Ethiopian Seed Enterprise which involves farmers with contractual arrangements, is not well elaborated as the emphasis is usually on food crops. Work undertaken previously has shown, there is the potential to produce seeds locally. For example, the Smallholder Dairy Development Program (SDDP) from 1987-1991 and the Fourth Livestock Development Project (FLDP) that lasted between 1988 to 1994. During the implementation of the FLDP, national forage seed production reached 150 tons per year but this was not sustained after the completion of the project (Mengistu et al. 2016). This was due to low seed prices against the high cost of seed production. As such, exploring on forage seed business models that could be suitable, whether locally produced or through importation, is worth pursuing. More recently, the 'FeedSeed' pilot project, aimed at developing climate-adaptive forage seed systems in Ethiopia, which ran from October 2013 to January 2016, successfully identified and trained thirty seed entrepreneurs with twelve of these enterprises dedicating a total of 210ha of land to forage seed and planting material production and selling US\$616,000 of improved forage seeds during 2015/16 (ILRI. 2016) will hopefully produce more sustainable outcomes.

Kenya

Kenya is estimated to have a cattle population reaching 17.4 million with an estimated 5.8 million livestock keepers involved under rain-fed conditions in arid, semi-arid, humid, sub-humid and tropical areas (Steinfled et al. 2006). Unlike Ethiopia, Kenya lacks any information on estimated forage seed demand. While Kenya has developed seed systems especially for the main staple food crops e.g., maize, it is under-developed for the forage seeds. Although there are several registered seed companies – representing “the formal forage seed segment” – only the Kenya Seed Company deals with a significant amount of forage seeds (Mwendia et al. 2016), but for limited forage species. Nevertheless, “the informal forage seed segment” which includes the use of planting materials especially from research centers and exchange of planting materials among farmers, also exists. Anecdotal evidence, however, shows that farmers are embracing forages that are productive and proven to work. For example, recently there had been a promotion of *Brachiaria* (Syn. *Urochloa*) species through projects and development partners in Kenya (Njarui et al. 2016; International Center of Insect Physiology and Ecology (ICIPE), 2011) and Rwanda (Mupenzi and Everson, 2012). So far, three *Brachiaria* forage hybrids (Cayman, Cobra, and Mulato II) were formally licensed in Kenya on 8th July 2016 (Kenya Gazette - Vol. CXVIII—No. 74, 2016) and information from the company licensed to sell the seeds (Advantage Crops Limited) shows a soaring demand (C. Wasonga Pers. Comm.). The company had already sold about 5 tons of the seeds by early 2018, and have received demand across different countries in the region (Fig. 1). However, since the hybrids were licensed in Kenya, their movement to other countries has been on research permit, most likely limiting the uptake (C. Wasonga Pers. Comm.).

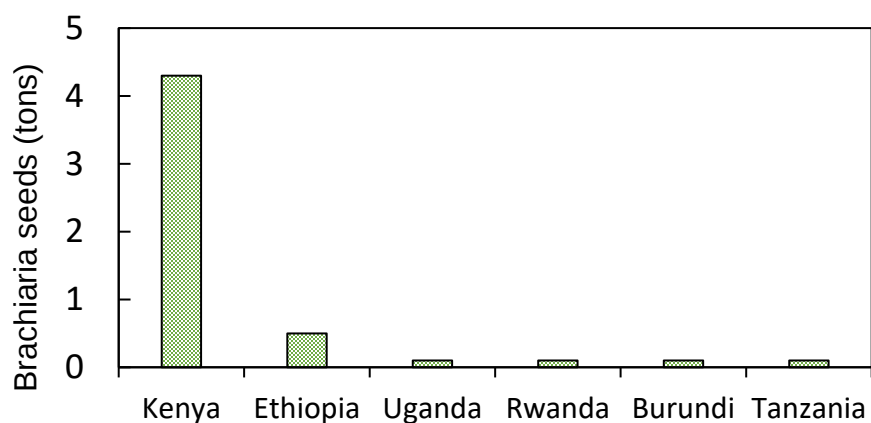


Fig. 1. *Brachiaria* seed (tons) sold across eastern African countries (2017-April 2018) from Advantage Crops Limited. (Data obtained from Advantage Crops Limited).

Worldwide, the global forage seed market has been growing. In 2014, the seed market was estimated at USD 10,789 million expected to reach about USD 17,508 million by 2020 (Transparency, 2015). This reflects the importance they serve in the production of milk and meat for the global human population projected to reach about 9 billion by 2050 (World Bank, 2014). It is likely, that the forage seed demand in eastern Africa will grow over time driven by the livestock revolution - increase in demand for animal source foods. The demand for milk and meat in sub-Saharan Africa (SSA), has already surpassed developed economies (Steinfeld et al. 2006; FAO, 2006). The human population in SSA has been increasing steadily at $\approx 3\%$ (World Bank, 2014) and by 2016 had reached a billion. In addition, cattle numbers have also been increasing implying more forage requirements. This could be linked to the high number of livestock keepers, at about 5.7, 5.9, 2.1, 8.3, and 15 million for Uganda, Kenya, Rwanda, Tanzania, and Ethiopia respectively, (Steinfeld et al. 2006). As such, this may impact on forage seed requirements to meet the feed resource base.

A recent study on economic foresight on the use of *Brachiaria* species in eastern Africa showed there is a potential to increase milk production by up to 40% (Gonzales et al. 2016). If indeed farmers experience this and achieve convincing results, the demand for such species is likely to grow. Awareness creation for such forages grasses aimed at reaching the livestock keepers would thus be key. To be able to empower the livestock keepers with the information that is required, awareness creation could happen through multiple avenues such as demonstration plots, media, and field-days. Usually, farmers lack information and technical knowledge on how to access and grow (Franzel, 2014), and how to feed the animals appropriately. It is likely that these shortcomings have contributed to the low *Brachiaria* sales observed in these countries (Fig. 1), except Kenya where the seeds are licensed. Addressing such weaknesses will be necessary for the uptake of technologies to take effect. Policy environment should be supportive for seed access by livestock keepers across countries. The Common Market for East and Southern Africa (COMESA) initiative on harmonizing seed trade across the region, to increase efficiency and supply market needs (Mukuka, 2014) is a step likely to boost forage seed adoption.

Seed development and distribution infrastructure are essential for the success in the use of quality productive forages (Makkar, 2016). Currently, in eastern Africa this requires attention. Ideally, this could benefit from the infrastructure developed for other seeds (food crops), by having the same dealers incorporate forage seeds in their portfolio. However, this has to make economic sense. Using

a model that is most feasible, i.e., importation or local seed production, could also be variable depending on the type of seeds in question.

Conclusions

The rise in demand for animal products in SSA will most likely lead to increased forage cultivation coupled with rising demand for forage seeds in eastern Africa. It is likely that both formal and informal approaches would work and has the advantage of synergizing as some seeds have been found not to be profitable to companies. The private sector is mostly interested if there are financial returns from forage seeds. However, not all seeds are likely to have the same business potential. Grasses that form the basal diet are likely to trade in large volumes compared to legumes that are for supplementation. Opportunities that exist include the development of productive forage technologies coupled with awareness creation. Evidence of improved animal performance would contribute to forage uptake and increased forage seed uptake. Facilitative policy on seed movement across countries in the eastern Africa will support forage adoption.

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