Opportunities for promoting the adoption of forages in Kenya

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Abstract: Livestock production plays an important socio-economic role in many areas across Kenya. They are kept in all the major livestock production systems including smallholder mixed crop-livestock system, crop-livestock-tree production system, and pastoral/extensive livestock production system, which occupy about 70% of land in Kenya. Livestock production is mainly constrained by inadequate feed quantity and quality. Forage forms the major source of feed for ruminant livestock as they provide high-quality forage to alleviate feed shortages. The demand for pasture and fodder production and conservation to meet livestock feed requirements, particularly during the dry seasons, has created the need to re-position the forage value chain in Kenya, with a view to addressing fodder availability, quality and affordability challenges and hence enhanced efficiency. Kenya has a long history of forage breeding, evaluation and dissemination that has identified forage species suitable for different regions. This paper presents opportunities for improving the forage value chain, which include strengthening forage research to develop appropriate technologies, information and management practices (TIMPS), developing seed systems to improve seed availability, identifying potential options for dissemination of forage technologies for increased adoption, promoting forage cultivars for crop-livestock integration, breeding productive and highly nutritive forages, and developing better agronomic and management practices to enhance forage persistence, productivity and commercialization.

Introduction

The Kenyan livestock sub-sector accounts for about 12% of the entire Gross Domestic Product (GDP) and 45% of the agricultural GDP. The sub-sector employs 50% of the agricultural labour force and supports livestock related industries such as feed manufacturing, veterinary inputs, livestock equipment and agro-processing industries. The livestock are mostly comprised of dairy, beef, small ruminants and non-ruminants. These livestock are fed mainly on natural and planted forages but the availability of the feed is affected by changes in weather patterns, poor management and overgrazing. This is particularly more critical during the dry season, when livestock rely on low quality feed resources, which are nutritionally deficient in energy, nitrogen, minerals and vitamins, with little or no supplementation. To improve forage availability, Kenya has over the years undertaken forage research, which focused largely on pasture grasses, fodder grasses, herbaceous legumes, fodder trees, and forages for rangeland development (Boonman JG. 1993 and Orodho B.W. 2006). Subsequent efforts were undertaken to promote production of those forages in different agro-ecological zones in Kenya and the commonly utilized forages are presented in Table 1.

However, despite these efforts contribution of introduced forages to livestock production has been low and natural pasture grasses and broad leaved weeds are the main feeds for the dairy cows. Forage utilization is faced by many challenges, key among them being low priority given to forage research and development, poor seed availability, limited knowledge on benefits of forages, high labor requirement for establishing and maintaining forages, poor persistence of legumes in grass/legume mixture, declining per capital land availability, weak extension services and emergence of new diseases (Creemers J. and Aranguiz A.A. 2019). As a result, adoption of planted forages in Kenya is low contributing less than 40% livestock feeding (Mwendia S.W. 2021). These paper highlights opportunities that are available to develop and promote adoption of planted forages in Kenya.

Table 1: Recommended ley grasses and fodder crops for different livestock producing areas in Kenya.

Region	Altitude (m) and Annual Rainfall (mm)	Ley Grasses and Fodder
Semi-arid areas	1000-1800 and < 650	*Cenchrus ciliaris; Eragrostis superba* *Andropogon gayanus; Panicum maximum* *Chloris roxburghiana;*
Warm and wet medium altitude areas	1200-1850 and 1000-2500	Napier grass (*Pennisetum purpureum*); Giant setaria (*Setaria sphacelata*); Giant Panicum (Pannicum maximum) Guatemala Grass (*Trifolium laxum*); Sudan grass (*Sorghum sudanense*); Columbus grass (*Sorghum almum*); Boma and Elmba Rhodes (*Chloris gayana*); Setaria (*Setaria sphacelata*); Coloured guinea (*Panicum coloratum*); Star grass (*Cynodon dactylon*); Guinea grass (*Panicum maximum*)
Cool and wet medium altitude areas.	1850-2400 and 1000-2500	Napier grass (Pennisetum purpureum); Giant Panicum (Pannicum maximum); Giant setaria (Setaria sphacelata) Guatemala grass (Trifolium laxum); Sudan grass (Sorghum sudanense); Columbus grass (Sorghum almum); Oats (*Avena sativa)*; Rhodes grass Chloris gayana; Setaria grass *(Seteria sphacelata);* Coloured guinea (*Panicum coloratum*); Star grass (*Cynodon dactylon*); Kikuyu grass (*Pennisetum clandstinum*); Congo signal (*Brachiaria ruziziensis*)
Cold and wet high altitude	2400-3000 and 1000-2500	Oats (*Avena sativa*); Kikuyu grass (*Pennisetum clandstinum*); Perennial ryegrass (*Lolium perenne*); Tall fescue *Festuca arundniaceae*

Opportunities to improve forage utilization

a) Strengthening forage research

To improve and sustain livestock production a strong back-up of forage research and development is required. Many institutions have been involved in forage research, the main ones being Kenya Agricultural and Livestock Research Organization, Kenya Seed Company, International Livestock Research Institute and International Centre for Tropical Agriculture. These institutions, especially the national ones, are facing funding challenges leading to major gaps in research support. Increased funding is therefore critical to help realize the potential of forages in providing high quality, persistent and productive feed resources to alleviate feed shortages for enhanced productivity. Research should focus on agronomic and productivity studies to identify appropriate forage varieties for the various agro-ecological zones, develop alternative methods of fodder conservation and water conservation techniques for fodder production in the drylands.

b) Seed system to improve seed availability

Despite the importance of forages in livestock farming forage seed systems are poorly developed and yet, demand of forage seed is on the increase due to the growing livestock numbers and increasing demand of livestock products (Mwendia *et al*. 2016). Demand of forage seed to rehabilitate degraded rangelands is also on the increase. In addition, there is high demand of seed to support commercialization of forage production especially for grass and legume hay, and silage to meet feed requirement for intensive livestock systems and to sustain animals in dry periods. Unfortunately, the formal seed systems that produce and market certified seeds is limited to a few species mainly suited to high potential areas and irrigated system. The species include, Rhodes grass (*Chloris gayana*), Setaria (*Setaria sphacelata*), Silverleaf Desmodium (*Desmodium uncinatum*), Greenleaf Desmodium (*Desmodium intortum*) and Lucerne (*Medicago sativa*). Furthermore, there is an increase in importation of certified forage seeds especially for the Brachiaria hybrid varieties (e.g. Mulato II), fodder sorghum and Lucerne. To enhance availability of forage seeds several initiatives are recommended, which include, enacting friendly regulations to test and release certified seeds to even attract international seed producers to market seed in Kenya, introducing forage seed subsidy to reduce the cost of the seed, continuing with the efforts of testing and releasing of forages suited to marginal areas/rangelands. Special attention should be given to producing seed of some grass varieties such Brachiaria varieties, Kikuyu grass (*Pennisetum clandestinum*) and Guinea grass (*Panicum maximum*) that has been very difficult to achieve.

c) Enhance dissemination of forage technologies for increased adoption

Since the colonial era, extension services to support growth of agricultural and livestock sectors has been offered by the government. Through this government extension support, most of the current popular forages grown in Kenya (Table 1) were promoted. Agricultural extension in Kenya is now a devolved function, being undertaken by the county governments and it is mainly affected by shortage of funds (Milu M. and Jayne T. S. 2016). A survey conducted to describe the Kenya forage sector (Creemers J. and Aranguiz A.A. 2019) identified 'lack of awareness, knowledge and skills on how best to grow and make use of forages as a key constraint affecting forage production and preservation. For effective dissemination the county extension system need to be strengthened with skilled personnel equipped with resources to enable them perform their functions efficiently. Several methods are available to disseminate forage technologies, which include; a) holding field days to demonstrate technologies, b) packaging information in manuals and leaflets, c) developing mobile applications, d) undertaking farmer advisory visits, e) use of mass media especially vernacular televisions stations and radios, and f) developing forage technology farmer training modules. Each of these methods can be deployed singularly or in combination to effectively extend forage knowledge to farmers. Government and private sector institutions should enhance their capacities in terms of skilled personnel numbers and physical facilities to reach farmers more easily. Special attention should be given to training and extending forage knowledge to farmer's/livestock keepers in the rangelands, who are hitherto not well supported by existing extension services.

d) Promotion of forage cultivars for crop-livestock integration

In high to medium potential areas land available for keeping livestock and growing food crops is declining due to land fragmentation caused by increase in human population, land inheritance, infrastructure development and urbanization. Introduction of forage cultivars that can be grown together with food crops can improve crop and livestock productivity and contribute to food and nutritional security by providing food for human and feed for livestock (Kebede, G. *et al*. 2016). The other benefits associated with integrating forages in crop production include, improving soil fertility, controlling soil erosion, suppressing weeds and controlling crop pest. Forages that are recommended for integration into cropping systems are leguminous forages that can provide both food and feed for livestock. Examples of these are *Lablab purpureus* (Dolichos), *Glycine max* (Soya bean), *Phaseolus vulgaris* (Common bean), *Pisum sativum* (garden pea), *Vigna unguiculata* (Cowpea) and *Crotolaria ochroleuca* (Sunn hemp). These legumes provide food as grain and leaves for vegetables. Their stover are rich in protein and are nutritious feed for livestock. Other forages that can be incorporated in cropping systems are the short duration fodder grasses such as *Avena sativa* (oats) and fodder barley (*Hordeum vulgare*). These forages crops can be grown together with maize, sorghum and millets cereal crops, which are the main staple food crops in Kenya. Methods of integrating forage legumes into these cereals cropping systems would include intercropping, relay planting, rotational short-term fallow, planting as cover crops in plantation crops and as a nurse crop for establishing plantation crops. It is therefore apparent that intensifying integration forages into mixed livestock-crop systems can enhance livestock productivity and better utilize available farmland and protect it from degradation.

e) Breeding productive and highly nutritive forages,

Forage breeding to identify varieties suited to different agro-ecological zones and production systems is critical to enhanced forage adoption. In breeding, forage traits to look for are dry matter production, nutritive value (e.g. high protein content and dry matter digestibility), tolerance to diseases, water use efficiency, and seed production among other important traits. This has resulted to lack of seed for promising forages. In addition, most research institutions involved in forage breeding lack well trained scientists on pasture germplasm improvement and seed production. A great opportunity therefore exists to develop suitable cultivars by increasing investment in forage breeding research to enhance forage seed production to promote commercialization of fodder production and utilization.

f) Better agronomic and management practices to enhance persistence, productivity and commercialization of forages.

To realize the genetic potential of the promising forage cultivars, farmers have to use good agronomic practices. Unfortunately, they have limited knowledge on the appropriate agronomic and management practices to produce forages (Creemers J., and Aranguiz A.A., 2019). Such practices include, land preparation and time of planting, spacing and planting density, fertilization and manuring, water management, weed and pest control, time of harvesting and method of harvesting. An opportunity therefore exists to develop and package for dissemination information on appropriate agronomic and management practices of production and utilization of forages to enhance adoption.

Conclusion

Forages remains an important livestock feed resource but their contribution to livestock productivity is low. This is mainly attributed to challenges farmers face in accessing up-to-date information/knowledge on improved forage varieties, forage management and utilization practices. Opportunities therefore exists in increasing investments in research to develop and adapt better forage cultivars to different agro-ecological zones, develop better agronomic practices and efficiently disseminate knowledge on forage technologies, information and management practices. Besides, well developed seed systems will ensure farmers establish suitable forage cultivars to produce adequate quality forage for their livestock. To utilize small farm sizes more efficiently farmers can introduce forages that can integrate well with food crops such as maize, which is a major staple crop as it is apparent that intensifying integration forages into mixed livestock-crop systems can enhance livestock productivity and better utilize available farmland and protect it from degradation. It is recommended that research on the role of forages in climate smart agriculture to enhance and maintain soil fertility and reduce degradation of the rangeland be undertaken because of the emerging challenges of climate change.

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