Review of Strategies for Forage Conservation and Utilization to Improve Animal Productivity in Tanzania

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Abstract

Ruminants are the major animals in Tanzania contributing significantly to both gross and agricultural domestic products of the country. However, it has been shown that the contribution of livestock sector has not reached the expected potential due to various factors. Nutrition is among the major challenges causing low production from ruminants in Tanzania. This is because over 90% of animals depend on communal pastures which are characterized with low nutrients. The common practices of the livestock keepers in the main production systems include feeding the animals in situ and watering them in common water points thus defecation, urination and trampling of fodder further degrade the quality and reduced quantity of forage. In addition, the pastures are not well managed. Furthermore, the situation is

exacerbated by effects of climate variability which cause a reduction in forage quantity and quality significantly. This review paper was based on systematic search of literature (SSL) from various sources to understand the common feed utilisation and conservation methods used by livestock keepers in Tanzania. The review established that, grazing is the only form of forage utilization employed by over 90% of all livestock keepers. Other forms of ruminants feeding including the cut and carry of home grown and seasonal natural pastures in the smallholder dairy farming systems (SDFS) mainly found in the highland areas of Tanzania. Hay is the commonest method for feed (forage) conservation in Tanzania. However, it has been discovered that the combinedmethods of feed conservation and utilization have not improved ruminants nutrition over the years. It is therefore necessary to encourage the farmers (livestock keepers) to opt for integrated methods which can increase the quantity and quality of feeds thereby enhancing animal productivity.

Keywords: *Fodder, Enclosures, Grazing, Hay, Silage, Productivity*

Introduction

Tanzania is a rich with huge livestock resource base including 28.4 million cattle, 16 million goats and 6 million sheep (MALF, 2017). Ruminants are the major animals in the country contributing significantly to both

gross and agricultural domestic products (GDPs). It has been estimated that meat and milk contribute over 60% of the agricultural GDP and there has been increase in production of both meat and milk from ruminants (MALF, 2017). In 2016, a total of 558,164 tons of meat and 2.09 billion litres of milk were produced in the country. About 86 percent of meat was obtained from ruminants (MALF, 2017). However, it has been shown that the increase in production is largely due to increase in number of animals rather than increase in production per animal (MLFD, 2015). Nutrition and feeding are among the major challenges causing low production from ruminants in Tanzania and other countries in the tropics. In Tanzania, majority of ruminants (over 90% of animals) areraisedin the traditional systems where the animals depend on communal pastures as the main source of nutrients. However, in these systems ruminant feeds (fodder) are neither well managed nor utilized efficiently (properly). The common practices of the livestock keepers in these systems include feeding the animals in situ and watering them in common water points whereas theirdefecation, urination and trampling of fodder further degrade the

quality and reduced quantity of forage.In addition, the natural pastures in Tanzania are of poor nutritional quality and become seasonal at various times of the year (Selemani *et al.,* 2013).In smallholder dairy production, mainly in highland areas fodder is grown in small plots (Maleko *et al*., 2018). Occasionally the use of crop remains (various straws) is practiced in both smallhoder and traditional systems especially during critical situation of forage scarcity. Furthermore, the challenge of poor livestock nutrition isexacerbated by effects of climate variability. Together, these factors cause poor nutrition and underfeeding of animals (Maleko *et al*., 2018) and consequently leading to poor performance (low birth weight, low weaning weight, slow growth), negative energy and protein balance, and reduction in productivity of meat and milk as well as related production coefficients which have been reported to be low than expected (reference).For example,mature weight of Tanzania short horn zebu (TSZ) was estimate on average to range from 200 to 350kg in recent years (MLFD, 2015) compared to 425kg in 1970s (Getz, 1974). The reproduction coefficients are also lower in ruminants as the example of calving rate

of 40 to 50% in indigenous cattle (MLFD, 2015). Mortality rates caused by diseases and poor nutrition has been rated high such as pre-weaning mortality of 30 to 40% and adult mortality of 8 to 10% in cattle and lambs or kids mortality rate between 20 and 40%. In indigenous cattle milk yield of 400 liter per lactation and carcass weight between 100 and 175 kg only have been reported(MLFD, 2015). Moreover, offtake rates of between 8 and 10% per annumin indigenous cattle are considered low (MLFD, 2015).

There is a great need of addressing the deficiencies in pasture and range resources and find out ways of improving efficiencies with an overall goal for improving animal productivity. For sustainable forage production in developing countries such as Tanzania, it is important to consider various factors such as soils, climatic effects, production capability of various species and the carrying capacity of given area. In addition, strategies supporting sustainability of rangelands including fodder utilization need to be reviewed and re-formulated. Moreover, fodder production is usually plenty in the wet season and lacking

during the dry periods, as such methods for conserving feeds should be encouraged to ensure that there will be feeds year-round. The aim of this review work was to identify methods for utilization and conservation of forages which have been inverted with the goal of enhancing animal productivity. Specifically, it was intended on highlighting methods which can be recommended for adoption by the Tanzania livestock keepers.

Review methods

This review paper was based on systematic search of literature (SSL) from various sources including published work in local librariesas well as online publications using internet search engines such as google, yahoo search, web of science and African journal online (AJOL). Resources included were such as books, scientific papers, research notes or reports, project reports and policy briefs available in hard copies or online. The SSL has increasingly become a preferred methodology for reporting review work in various fields of study in Tanzania and elsewhere (Msalya, 2017; Maleko et al., 2018; O'Connor et al., 2014; Phiri et al., 2012). During the search only resources or papers

reporting on the subjects of utilization and conservation of forage were considered. Specifically for online search five key words such as fodder utilization in Tanzania, pasture conservation in Tanzania, fodder publication, Tanzania rangelands utilization, and pasture utilization were used. Only papers from peer reviewed sources (journal, conference proceedings, theses, or book chapters) were reviewed. From the papers, information was extracted, compiled and interpreted. The results (mainly) previous reports of scientists involved in the field are summarized in this paper.

Forms of forage utilization in Tanzania

Efficient forage utilization involves fodder usage which increase or improve average daily gain (ADG) of animals. In African countries, continuous grazing has been reported as the main form of forage (pasture) utilization (Kidunda*et al.*,1990). In Tanzania, over 90% of ruminant livestock are grazers and browsers in the communal rangelands which are characteristically composed of nearly 100% natural pastures and local shrubs with less or no improvement on pastures/plants or rangelands. This form

of forage utilization leads to disappearance of the most valuable forage species and increase of poor quality and the less desirable/less productivegrasses. Furthermore, there has been less control of the movement of animals in the communal lands causing increase in weeds infestation (Hill *et al*., 2006; Snyman and Du-Preez, 2005). Poor management of rangelands encourages growth of bushes and reduces the available grazing land and this situation affects the carrying capacity and stocking rates (Broatch, 1970). In most cases overstocking has caused overgrazing of thepastures leading to reduced pasture vigour, soil erosion and reduced soil fertility. Consequently, animal performance is generally impaired as evidenced by weight losses and poor reproduction coefficients.

Other forms of ruminants feeding in Tanzania including the cut and carry of home grown and seasonal natural pastures in the smallholder dairy farming systems (SDFS) mainly found in the highland areas of Tanzania (Maleko *et al*., 2018). Like in the traditional systems, there are seasonal variations in quantity and quality of fodder in the SDFS (Maleko et al., 2018). A little supplementation and

usage of farm remains in form of stover is occasionally practiced. Therefore, it is obvious that animal farming in various production systems in Tanzania has not been strategically planned to improve productivity of the animals. Therefore, alternative strategies for enhancing production need be considered.

Methods for Forage Conservation in Tanzania

Although, seldom reported, there is indication that hay is the commonest method for feed (forage) conservation in Tanzania. However available studies have shown that it is mainly practiced by research and large scale farming organizations (both public and private) including Sokoine University of Agriculture (SUA), Tanzania Livestock Research Institute (TALIRI), The National Ranching Company (NARCO) Limited and a few prominent farmers.In these organizations and some of the practicing farmers, natural pastures are the main resources of the dry feed for hay making. In some pastoralists communities forage conservation of dry feeds has many forms including cut or standing hay. One of the successful examples of fodder conservation is the deferred pasture plots and crop

remains or the temporary enclosures in some pastoral and agro-pastoral communities of Tanzania. This practice has mainly involved the keeping of pasture and cereal crop remains as standing hay in the farms or pasture plots and are used for feeding during the dry season (Selemani, 2015). In the Lake zone of Tanzania particulary in Shinyanga regions the practice is known as "ngitiri" and is used by the agro-pastoralists farmers to feed the animals during the dry season (Rubanza *et al.,* 2005; Selemani, 2015). In Dodoma (central Tanzania) and Arusha (northern Tanzania) such practices are known in the local languages as "milanga" and "alalili" respectively (Mwilawa *et al.*, 2006). These feeds have been shown to contain recommendable levels of macro and micro minerals (Rubanza et al., 2005) as well as considerable good basal vegetation cover than the continuously grazed areas (Selemani, 2015). However, the feeds were shown to have low amount of total nitrogen (TN) and crude protein (CP) as well as limited dry matter yield (Rubanza et al., 2005; Mwilawa et al., 2006; Selemani, 2015). Production of animas based on these systems is not efficient and therefore recommendations for improvement in

management and increasing yield by various workers (Mwilawa *et al.,* 2006) have been requested.

In the SDFS, farmers are increasingly growing feeds for their animals and these are in a very few places processed into silage or some have kept in the farms as green reserves. For example, preservation of pasture in plastic bags (plastic silos) with additives were shown to have a reasonably good level of nutrients and has been well accepted by the farmers in Turiani and Njombe districts (Mtengeti *et al.,* 2013; Lyimo et al., 2016). In other SDFS areas such as the Lushoto districts farmers grow and keep established fodder species including napier and guetamala which are used in dry season feeding along with crop residues (Maleko et al., 2018). Even though, it has been shown that, these animal feeds are low in nutritional quality and do not fully support enhanced animal productivity (Lyimo *et al.*, 2016). It therefore absolutely necessary to find out methods for feed utilization and preservation which can be adopted by the farmers to enhance animal productivity.

Recommended Strategies for Fodder Utilization and Conservation

Increasing the feed resource base is an important step needed if ruminants' productivity has to be enhanced. Short term measures for sustainable utilization may include systems such as short duration grazing or split season grazing management system as well as rotational and deferred grazing with local strategies for management of fodder. Rotational grazing accompanied with reasonable stocking rates allows for re-growth of pasture. In rotational grazing it is possible to divide the communal plots into fenced or unfenced paddocks and animals are allowed in such paddocks for a specified period of time while considering the maximum allowable stocking rates. Remaining grasses at the end of the grazing season in a paddock can beharvested and processed for feeding during seasons of scarcity. In literature, combination of rotational and deferred grazing has shown better results than continuous grazing or when rotation and deferred grazing are used alone (Walker and Scot, 1968).

In Tanzania, experiments on grass cutting at recommended intervals and culling of browse and tree species have been recommended as feed conservation methods in the smallholding systems (Iddy, 2013; Kasobanike, 2012). In Tanzania ensiling crop leaves such as cassava was recommended by Kavana et al., 2005).Furthermore, unnecessary loss of feeds through trampling can be avoided by practicing cut and carry and or paddocking of the grazing areas. Rehabilitation through planting of grasses and multi-purpose trees in degraded lands can increase availability of feeds. Utilization of existing feed resources may increase if the animals are strategically supplemented with the available resources to improve nutrients availability. In India, drought resistant crops such as sorghum are now recommended for feeding in dairy farming systems and have shown greater impact (Santos *et al.,* 2011). Therefore, non-conventional animal feeding methods can be recommended for intensification of livestock. In recent years the crop residues, discarded fruits and vegetables, and other indigenous feed resources are processed into silage along with produced densified total mixed ration blocks or pellets (Makkar, 2014). In various

places of the world, insects are becoming popular feed resources for animals and have been shown to be highly converted into useful products while they require low amount of water and little space (Bukkens, 1997). This can be achieved through use of recommended biotechnological tools for improving nutritional quality of available feed resources (Flachowsky et al., 2005) and can be implemented in Tanzania (Msalya *et al.,* 2017).

Conclusions

Feeding of ruminants in Tanzania is a major challenge particularly in the era of climatic change. It is now obvious that there are more ruminants in the country than what the available resources e.g. land and pasture can accommodate. Various methods for feed utilization have caused greater damage of resources leading to feed shortage. Methods for feed improvement have not brought significant impact on animal feeds. In the present paper methods which can improve animal feeds were recommended. It is important that investment is done to improve animal feeds availability for the ruminants to contribute positively to the economy.

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