

Assessment on Feed Resource, Feed Production Constraints and Opportunities in Salamago Woreda in South Omo Zone, in South Western Ethiopia

¹Denbela Hidosa, ²Yidinachachew Tesfaye and ³Ayele Feleke

¹Departments of Livestock Research Process,
Jinka Agricultural Research Center, Jinka, Ethiopia

²Department of Socio economic Research Process,
Jinka Agricultural Research Center, Jinka, Ethiopia

³Farm Africa, BRACED Project, Jinka, Branch Coordinator, Jinka, Ethiopia

Abstract: The study was carried out in Salamago Woreda aimed to assess feed resource, feed production constraints and opportunities. Six kebeles per Woreda were selected and one focus group discussion which comprised 12 pastoralists per kebele was organized and interviewed. For the key informants' interview, two livestock production experts and six livestock developmental agents were interviewed. The focus group discussion and key informants interview was used to collect primary data on feed resource, feed resource availability, feed conservation practices and feed resources utilization, major feed constraints and opportunities for feed productions. The study results shown that grass from the open grazing land, indigenous browse species and crop residues were major feed resources for the livestock in to study area. The open grazing land had poorly managed and the biomass productivity generated from open grazing land has retreated. The major livestock feeding system was free grazing and pastoral communities had no trends of conserved feed and provided concentrate supplements to the livestock. The 380,540.51 tons of dry matter was produced with deficit of 58, 859.41 tons of dry matter per year. The climate change, bush encroachment, expansion of cropping land, increments in human and livestock populations, lack of inputs and training were identified as livestock feed production constraints in to study area. The migration, supplementations, purchasing available feed and storing the crop residues were used as coping strategies during feed shortage in to study area. Generally, the results from this study revealed that the number of livestock and the available feed resources do not match to support profitable from livestock production, which suggest that the primary focus needs to be improving the existing feed resources through rehabilitation of degraded grazing areas, introduction adaptable fodder production, improving feed utilization practices, introduce feed improvement technologies and promotions the feeding effects of sugar industry by-products such as molasses and sugar cane tops in the form of urea molasses block.

Key words: Feed Resource • Feed Availability • Feed Constraints And Pastoralists

INTRODUCTION

Ethiopia is home, excluding some non-sedentary area of country such as pastoral areas of Afar and Somali regions, to approximately 56.71 million of cattle, 29.33 million of sheep, 29.11 million of goats, 1.16 million of camels, 56.87 million of chickens, and 2.03 million of horses 7.43 million of donkey and 0.40 million of mules [1]. In Ethiopia, livestock sector has contributed 19% to the total Gross Domestic Product and 16-19 % to the foreign

exchange earnings of the country with agricultural share of the GDP ranging 35 - 49% [2]. Moreover, livestock serve as sources of food, traction, manure, raw materials, investment, cash income and social and cultural identity. Despite of these roles, the productivity been generated is in generally low [3] due to socio-economic and technical limitations [4]. Among the technical limitations, feed shortage is the major one that has contributed the productivity performances to be low in Ethiopia [5]. In to the study districts, in general, South Omo, the livestock

production system entirely has been depended on the feed from range forages [6]. However, the productivity generated from these feed resource is under extensive deterioration along with the ever-increasing deforestation for agriculture, fuel wood gathering and recurrent drought [6, 7]. However, currently, the information's are lacking mainly on livestock feed resource availability, feed production, feed utilization and feed production constraints. The understanding the existing situation on feed resources in the study area is one of the appealing strategies in order to call policy makers, pastoralists and other relevant stake holders in order to diagnose the problems and suggests interventional measures to alleviate the problem and improve feed production status and hence, improve livestock production and pastoral livelihoods. Therefore, this study was aimed to assess feed resource, feed resource availability, the major feed production constraints and opportunities for livestock production feed production in to the Salamago Woreda.

MATERIAL AND METHODS

Location and Area Coverage of Studyarea: Salamago Woreda found in the Southern Nations and Nationalities Regional State in South Omo Zone, in South Western Ethiopia. The Salamago Wereda comprised 37% midland altitude and 67% of the area is low land with annual temperature which ranges from 20 to 37.5°C. The average altitude of the Wereda is 971 m and receives bimodal rainfall, in which the long rainy season is in the months of March to June, while the short rainy season occurs in the months of August to October. The vegetation cover of the Woreda is a mixture of different Acacia species, scattered woodland, savanna grass and large grassland plains dominate the vegetation type of the study area [8-10]. The Salamago Woreda has reared different livestock populations which comprises 267,678 cattle, 31, 329 goats and 20, 951 sheep [11, 12].

Study Design and Data Collection Methods: The focus group discussion (FGD), key informants interview and field observations were used to collect primary data on feed resource, feed resource availability, feed production constraints and opportunities. Pastoralists, agro-pastoralists, local leaders, administrators, livestock production experts and livestock extension workers were used as source for primary data collection in this study. Moreover, the researchers also had observed the conditions of communal grazing land in to the study area during their field data collection periods. The secondary

data on livestock population, feed resource and feed resource availability was collected from Woreda Livestock and Fisher Resource Office. Secondary data on annual and perennial crops and the amount of crop residues in the selected area was also collected, from which the amount of crop residues that are used as a source of animal feed were estimated using established conversion factors developed by [13]. The quantity of feed dry matter obtained annually from different land use type was determined by multiplying the hectare under each land use type according to the recommendation of [14] by using the conversion factor of 2.0, 3.0, 1.8 and 0.7 t DM/ha/year were used for communal grazing land, private grazing land, fallow land and indigenous browse respectively. The livestock population per household was converted to tropical livestock unit (TLU) as recommended by [15] for local breed livestock. The DM requirement was calculated based on daily DM requirement of 250 kg (an equivalent of one TLU) for maintenances according to [16] recommendations for tropical cattle.

Focus Group Discussion: Six kebeles from Salamago Woreda such as Omo Hana, Cherimisi, Hayiloha, Woyide, Ginchire and Dakuba were selected in consultation with Woredas' Livestock and Fisher Resource Office and BRACED project, Farm Africa of Jinka Coordination Office. One focus group discussions which consisted of twelve pastoralists (8 Men and 4 Women) was held at each study kebele and totally 72 pastoralists who have better experience in livestock and feed production were selected and interviewed. The livestock feed resource, feed resource availability, feed conservation practice, feed conservation methods, livestock feed resources utilization, major livestock feed constraints and opportunities for livestock feed production existed in to the area and feed shortage mitigation strategies were an important issues discussed during the focus group discussions with pastoralists.

Key Informant Interviews: Pertaining to key informant's interview, 8 key informants (Two livestock production experts from Woreda and six livestock developmental agents from interviewed kebeles were selected and interviewed. The livestock feed resource, livestock feed resource availability, major livestock feed constraints, opportunities for livestock feed production existed in to the area, feed shortage mitigation strategies, new livestock feed technologies, adoption and dissemination rate of new feed technologies by pastoral communities,

alternative livestock feed and extension services on livestock feed production to pastoral communities were also an important issues that had discussed during the discussions with key informants.

Field Observations: The field observation was made by the researchers to enrich the data about livestock feed available and communal grazing land conditions and management of communal grazing land were monitored and observed during field data collection.

Methods of Data Analysis: The qualitative information gathered from focus group discussions on livestock feed were triangulated and analyzed. Furthermore, during focus group discussions, proportional pilling method was used by using piles of local materials such as stones and seeds in order to represents the percentage shares of major livestock feed shortage and Bar graphs used to presented the proportional shares.

RESULT AND DISCUSSIONS

Major Livestock Feed Resources in Salamago Woreda:

The major livestock feed resources in to study area are open grazing land, indigenous browse species and crop residues. During the focus group discussions the pastoralists and agro pastoralists were reported that the major dry matter for livestock feed comes from communal grazing land. The study made in pastoral areas of Bena-Tsemay, Hamer and Dassench indicated that 80-90% major dry matter for livestock feeding was comes from open communal grazing land which is corresponds to results from the present study [5, 7, 17]. However, during the dry seasons, indigenous browse and shrubs used as feed resources in addition to the pasture from the open communal grazing areas. Conversely, [18] had stated that natural pasture is the most common feed resource available to cattle in the wet seasons beside to the tree leaves and shrubs are have used as cattle feed during the dry seasons in Salamago Woreda which is supports the findings from the current study.

Conversely, the agro pastoralist and key informants reported that crop residues used as the second most important cattle feed resource comes from *Teff*, sorghum and pulses crops next to the open grazing land. In support to results from this study [19] report demonstrated that crop residue to be the major feed resources for highlands of Ethiopia next to communal grazing areas. The contribution of the major feed resource in Bodie and Mursi pastoral communities according to the elders

estimations by using the proportional pilling methods revealed that open communal grazing land shares 78% and whereas, indigenous browse and shrubs shared 22%. However, the agro pastoral communities such as Dume and Konso communities reported that 48%, 28%, 20% and 4% of feed resource comes from open communal grazing land, crop residues, indigenous browse and shrubs and Cheka attela respectively.

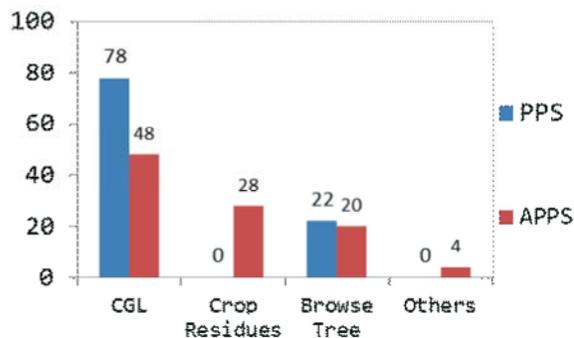


Fig. 1: Major Livestock Feed Resource in Salamago Woreda based on production system according to proportional pilling methods

Availability of Livestock Feed Resource: The Pastoral and Agro Pastoral communities reported that during wet seasons, there is surplus feed production from the open grazing land. However, there are frequent reductions in feed production from the open grazing land during the dry seasons. According to pastoralists, the low availability of pasture to livestock from open grazing land in dry seasons is due to fluctuation in rainfall in aggravated with climate variability. In supports to findings from the current study, the studies made from Ethiopian by [6, 20] indicated that the quality and quantity of the available feed resources had declined drastically during dry seasons. Moreover, also, [21, 22] reports illustrated that the East African pastoralist, the dry matter availability from grazing area had declined during dry seasons due to frequent drought occurrences. During focus group discussion which held at Omo Hana, elders had put some assumption which is astonishing idea, in the past before 30 year back, “Pastoral communities had lived harmony with natural resource and no issue of fluctuation in rainfall amount and distribution and as consequence no thinking for the livestock feed however, know a day human being has stands as enemies of natural resource which made as always worrier of livestock feed”. Generally the estimated data on tons of dry matter produced from study areas shown that, there is imbalance between tons of dry matter produced per year in study Woreda and actual dry matter

requirements of livestock. Results from this study indicated that the feed shortage in to study area is more serious and it is further recalls any interventions in feed improvements.

Management of Open Grazing Land: The pastoral communities of Bodi and Mursi reported that the open communal grazing land managed in traditional regulations which are weak to govern the communal grazing land at the local level. This situation allowed over grazing in open grazing which induced retreating the pasture productivity by advocating bush encroachments with different invasive species such as acacia tree and bushes. Increasing invasive species has been let increasing less palatable and decrease highly palatable forages species. The [6] report demonstrated that pastoral communities of Bana-Tsemay and Hamer have the culture of sharing resources at any circumstances however, it is not well designed which is corresponds to ideas reported by pastoralists from the current study. Meanwhile, [23] report shown that the Borana pastoralist have well deigned traditional rule and regulation which helps to govern over resource available on communally grazing areas which is contradicted to pastoralists found in our areas. Furthermore, [24] reported that unplanned grazing system had induced overgrazing and soil trampling effects contributed to reduce biomass production and lead to degradation of rangeland forages which similar to the idea reported by pastoralist from the current study. Conversely, Agro Pastoral Communities from Dumi tribes indicated that encroachment of open grazing land by cropping land has been increasing at alarm rate and this is leads to shrinkages in open grazing area.

Feed Conservation and Feeding Practices: During the focus group discussions pastoralists replied that there are no feed conservation practices and technologies in study area when surplus feed production during wet seasons. This is aggravated due to lack of knowledge, practices and absence of extension services on feed conservation practices. The [18] reported that feed shortage is aggravated in Salamago Woreda due to absence of feed conservation practices which is in line with findings from the current study. The livestock feeding is free grazing in study area and communities are not in positions to provide commercial supplements. However, some pastoral communities have trends of supplements their calves and sick animals with leaf and pods from browse species during dry seasons. Moreover, [18] report had demonstrated that the Mursi and Bodi pastoral

communities do not supplemented their cattle at any production status and age groups. Conversely, the research facts made by [7, 17] indicated that Hamer and Dassench Pastoralists in do not supply concentrate supplements to livestock which is in line to present findings. However, Dumi and konso tribes' have supplemented livestock with Cheka atella in traditional mode after grazing due to their availability and its low cost. According to [25], non-conventional feeds partially fill the gap in the feed supply, decrease competition for food between humans and animals, reduce feed cost, and contribute to self-sufficiency in nutrients from locally available feed sources. Moreover, Agro Pastoralists from Dumi and konso communities had reported that, communities have practiced the traditional fattening of livestock with locally available feed resources. For example, Dumi tribe supplemented their oxen with browse species locally called "Gerawa" and tree root "Gedi" in addition to free grazing on open pasture land. Likewise, Konso tribe has supplemented their grazing cattle, goats and sheep with browse tree like "Woybeta", different acacia leaf and pods by the tethering around home during dry seasons to crop residues which used as basal diets.

Feed Quality Improvement Practices: Pastoralists reported that there is no any feed quality improvement techniques such as chopping, water soaking and urea treatment. The livestock production has relied on poor quality feed which made fewer benefits from productions. This is due to lack of knowledge, absence of awareness; experience share and lack of inputs are important factors that allowed livestock to rely on poor quality feeds. As results of this study [26- 28] reports had indicated that generally low quality feed improvement practices are not commonly utilized by the small holder farmers in Ethiopia due to lack of awareness, skill gap and lack of inputs.

Improved Forage Production in Salamago Woreda: The pastoralists from Bodi and Mursi communities reported that pastoralist do not have trend of growing improved forage species. According to pastoralists, this is aggravated due to lack of awareness, training and lack of inputs like forage seed. Moreover, pastoralists also had mentioned that less attention was given to improved forage species production is due to its' impracticality with attachment of producing sufficient amount to dry matter to huge livestock numbers. However, the Dumi and Konso communities had received training on improved forage production technologies and have been starting growing improved forage species like elephant grass on

Table 1: Total grazing land (ha) and estimated tons of dry matter production from grazing area in Salamago Woreda in 2016

Grazing Land	Area(ha)	Productivity t/ha	Total DM production (tone)
Private grazing land	9, 509.80	3	28, 529.40
Communal grazing land	76, 078.40	2	152,156.80
Road side grazing	38, 039.20	2	76, 078.40
Fallow land	66, 568.60	1.8	119, 823.48
Total and covered	190, 195.80	-	376, 588.08

Adapted from Livestock and Fisher Office of Salamago Woreda

back yard, around their compound, swampy area and boarder of farming land. [29] reported that there was no improved forages cultivation for cattle at small holder communities' level in Southern Ethiopia due to insufficient land, capacity gap, lack of access for information, poor extension service and lack of inputs such as forage seeds which is in line with results from present study. [30, 31] reports demonstrated that improved forage species are not well developed under the present Ethiopian conditions which are agreed with present study. Moreover, also [1] indicated that currently, the contribution of improved forage crops in Ethiopia less than one percent which calls for further efforts from governments, research institutes and non-governmental organization in promotions of developing improved forage species through filling awareness gap and input provisions.

Dry Mater Production in Salamago Woreda from Open Grazing Land: According to the Livestock and Fisher Resource Office report of the Salamago Woreda around 190, 195.8ha of the area land was by covered by grazing land. From this area of land, the 152,156.80 tons of dry matter produced from communal grazing land and whereas, the 28, 529.40 tons of dry matter also produced from private grazing lands.

Dry Matter Production from Crop Residues: According to the Crop and Natural Resource Office of Salamago Woreda, 2324.64ha of land have covered by the crop land. Similarly to the other area of country, Agro Pastoral Communities in Salamago Woreda currently have produced crop residues from maize, *teff*, haricot bean, finger millet and sorghum. The crop residues are the one of the major feed resource identified into agro pastoral production systems in Salamago Woreda and about 3, 952.43 tons of dry matter of livestock feed is comes from crop residues.

Table 2: Total cropped land and estimated crop residues tons of DM from major crops in Salamago Woreda

Crop Species	Area(ha)	Total DM (Tone)
Maize	1, 041.33	1, 770.80
Sorghum	563.68	958.30
<i>Teff</i>	615.30	1, 045.30
Haricot Bean	58.88	100.08
Finger Millet	13.82	23.48
Banana	31.69	53.86
Total	2, 324.64	3, 952.43

Adapted from Crop and Natural Resource Office of Salamago Woreda 1.1.

Table 3: Total Livestock Feed Supply in Salamago Woreda

Grazing Land	Area (ha)	Productivity (t/ha)	Total DM production (tons)
Private grazing land	9, 509.80	3	28, 529.40
Communal grazing land	76, 078.40	2	152,156.80
Road side grazing	38, 039.20	2	76, 078.40
Fallow land	66, 568.60	1.8	119, 823.48
Crop Residues	2, 324.64	-	3, 952.43
Total land covered	192,520.44	-	380, 540.51

Adapted from Livestock and Fisher Office of Salamago Woreda

Table 4: Annual dry matter requirement (tons) per livestock species in Salamago Woreda

Livestock Species	Population in TLU	DM requirement/ head/year	Total DM (ton/year)
Cattle	187,374.60	2.28	427, 214.08
Sheep	2, 095.10	2.28	4,777.83
Goat	3,132.90	2.28	7,143.01
Total	192,602.60	-	439,134.92

Feed Balance in Salamago Woreda: Feed resources used to calculate dry matter supply for livestock in Salamago Woreda are communal grazing land, private grazing land, indigenous browse and crop residues (Table 3). The total of 380,540.51 tons of dry matter (DM) per year was produced from such feed resource in the Woreda is presented in Table 3.

The 2016, Salamago Woreda livestock and fisher resource office, the livestock population data illustrated that Woreda had on average 192,602.60 Tropical Livestock Unit (TLU) which had comprised (187,374.60 cattle, 2, 095.10 sheep and 3, 132.90 goats) presented in Table 4. Assuming that DM requirement for maintenance of one TLU is 6.25 kg/day (2.28 ton/year/TLU) and the total annual requirement by the livestock species (cattle, sheep and goats) is about 439,134.92 tons of DM per year per Woreda presented in Table 4. As it had calculated that the total DM produced in the Woreda from different feed resource is 380, 540.51 tons (Table3) which had been showing that a deficit of 58, 859.41 tons of dry matter per year.

Livestock Feed Production Constraints: Pastoralist and Agro Pastoralists generalized that constraints to livestock feed production in to study area to be either technical or non-technical.

Climate Variability: According to the pastoralists, agro pastoralists and experts, the climate change is one of the non-technical livestock feed production constraints in to the study area that affects livestock production through induce decline biomass production and prevents the successful establishment of forages. The [32] reported that the biomass production of grazing land is expected to decrease which accompanied due to greater variability in rainfall distributions and frequent droughts due to climate change.

Bush Encroachments: According to pastoralists, grazing area invaded by different invasive aliens such as different acacia and shrubs species which tends to reduce the quantity of forage that available for livestock and leads to shrinkage in grazing areas. The [6] report demonstrated that in Hamer rangeland, the grazing lands are more covered by invasive alien such as different acacia species, bushes and shrubs which was responsible for a decline in rangeland condition due to drought, overgrazing and the absence of burning which corresponds to findings from the current study. Moreover, also studies made by [33] in Southern Ethiopia indicated that bush encroachments has induced reduction in the production of the herbaceous layer, restriction of livestock movement and damage to the body of the animals.

Lack of Training and Awareness: The provision of training and awareness creation are important tools to address agricultural technologies to end users. During the focus group discussion pastoralists reported that communities are not received either theoretical or practical training on livestock feed production. However, agro pastoralists from konso and Dumi communities were reported that communities had received theoretical training on feed technologies like hay making, silage making and quality improvements of low quality feed but did not put it in to practice what communities trained. Conversely, discussions with livestock experts, experts reported that training on forage production provided once per year by Regional Livestock and Fisher Resource Bureau and it is also difficult to deliver what experts trained in to the practice due to insufficient in government services such as inadequate staff transport, fuel, repairs, maintenance, accommodation and lack of inputs.

Coping Mechanism to ward Feed Shortage

Migrations: The Pastoralist in to study area revealed that during critical feed shortage, communities have been employed seasonal movements of herds to areas such as Omo River and Sherma River where grass is thought to be more available during those periods. Conversely, similar trends were practiced in Agro Pastoral area such as Dumi communities which moved cattle to ward Bize valley, Hindo valley, Omo River and Mersiy River to save their cattle during the critical livestock feed shortages and back to home when feed availability was secured. The study made by [6] indicated the Hamer and Bena pastoralist have mobilized their cattle toward the Mago Park during the recurrent drought, deterioration of grazing lands as coping strategies to save their livestock. Conversely, the [7] indicated that pastoralists from Dassench communities mobilized their livestock toward the Island (Desset).

Supplementation with Locally Available Feeds: Agro pastoral communities reported that communities practiced supplementation cattle and goats with locally available feeds during dry seasons. Cattle such as

Oxen, milking cows and calves supplemented with locally available materials such different leaf of indigenous browse, Banana leaf and stem, and tree roots from indigenous by cut and carrying system. However, for the Pastoral communities, the reverse is true and pastoral communities are not in position to provide any supplemental feeds during the critical feed shortage for cattle that are able to graze on natural pasture and however, a few pastoral communities reported that they have provided grass to calves and sick cattle, which are unable to move long distances by the cut and carry system.

Storage of Crop Residues: Agro Pastoral communities of Dumi and Konso have trends of collecting crop residues from maize stover, teff straw, sorghum straw, haricot bean haulms and finger millet stover and stored for the further used to mitigate critical feed shortage.

Opportunities for Livestock Feed Production: Availability of land: Lands are important assets in order to produce feed. Pastoralists, Agro pastoralists and experts were reported that issue of land is not problems due to have excess lands. Which is an opportunity to produce surplus livestock feed their area.

Availability of Sustainable River: On the other hand, elders reported that a yearly available sustainable river

like Omo River is also other important opportunities for produce livestock feed to area.

Omo Kurazi Sugar Factories: On the other hand, pastoralists reported that currently the government of Ethiopia has been planted a large Sugar Factories under the governance of the Ethiopian Sugar Corporation, which will be cultivated 175,000 hectares of sugarcane and supply five sugar factories. The availability of sugarcane factories plantation and irritable condition in to the study area which presents an opportunity to livestock feed productions. Moreover, also pastoralists reported that at the end of sugar productions byproducts of sugar factories such as molasses and bagasse will be used as supplementary livestock feed resource is also present an another opportunities. Government of Ethiopia is currently has organized sedentarization program around the Omo Kurazi sugar factories which assists pastoral communities live in together in order to share experiences which will be made better opportunities for feed production.

Conclusions and Recommendations: The open communal grazing land, indigenous browse species and crop residues are major feed resources with frequent variations in quantity. The biomass productivity generated from this open communal grazing area has been retreated due to over grazing, bush encroachments and climate change. The free grazing on communal grazing area was the major livestock feeding system and pastoral communities are not in positions to conserve feed and provide concentrate supplements. There were lack of low quality feed improvement practice and trends of growing the cultivated forage species. The total dry matter produced from different feed sources was not enough to satisfy the dry matter requirement of livestock during dry seasons. The climate change, bush encroachment, expansion of cropping land, in livestock populations, lack of inputs and training were identified as livestock feed production constraints in to study areas and whereas, migration, supplementations and stored the crop residues were important coping strategies toward feed shortage. Based on the findings from the current study the following recommendations were made:

- The study described that the productivity grazing area is retreating from time to time due to poor management. Therefore, it is imperative to improve the productivity of retreating grazing areas through introducing rehabilitations program by the introduction and promoting area closures, over sown

with locally adaptable legume forages and fertilization with livestock dungs and droppings.

- During wet seasons there is surpluses dry matter production from grazing areas, however, the pastoral communities have no trends to conserve these feed for the further uses. In this regards, it is important to advice pastoral communities to conserve during surpluses productions in the form of silage and hay making.
- Currently the Ethiopia government has planted large sugar factories which will be cultivated 175, 000 hectares of sugarcane and from this it will be expected
 - Molasses and sugar cane tops which will be used as an alternative livestock feed resources in to South Omo Zone. Therefore, it is advisable to promote the feeding effects of these by-products in the form of urea molasses block (UMB), molasses + sugar cane tops and bagasse + urea in wider scale through either cooperative establishments or privatization
 - In this study it was indicated that there is no trends of growing cultivated fodder species in to study areas. Therefore, in to the study areas, adaptable cultivated fodder species is one appealing strategies.
 - To improve livestock feed supply by using different interventions; it is also imperative in upgrading pastoralists' skill through the provisions of training on proper feed resource management, feed conservation techniques and feed quality improvements techniques.

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