Global Journal of Research in
Multidisciplinary Studies
Journal homepage: https://gsjournals.com/gjrms/
ISSN: 2980-4191 (Online)

(RESEARCH ARTICLE)

Participatory evaluation and demonstration of livestock feed conservation technologies for small scale dairy farmers in Melokoza and Basketo special districts, Southern Ethiopia

Derrebe Kassa Hibebbo [1,*] and Milkias Fanta Heliso [2]

South Ethiopia Agricultural Research Institute (SEARI), P.O. Box 2228, Arba Minch, Ethiopia.

Global Journal of Research in Multidisciplinary Studies, 2022, 01(01), 014–021

Publication history: Received on 23 August 2022; revised on 28 September 2022; accepted on 01 October 2022

Article DOI: https://doi.org/10.58175/gjrms.2022.1.1.0024

Abstract

The current study was conducted to assess feed conservation and utilization practices and evaluate nutritional characteristics of silages conserved under farmer's condition in Melokoza and Basketo special districts. A total of 60 small scale dairy farmers were interviewed to assess feed conservation and utilization practices of the districts before actual experiment at backyards of 12 voluntary farmers that were latter divided in to three silage making groups with [desho (G1), elephant (G2) and native grasses (G3)]. Similar proportion of molasses (5%) and *D.intortium* (25%) were added to adjust the soluble carbohydrate and crude protein (CP) content of silages to the minimum expected level and facilitate fermentation. Each group has four farmers supplied with basic materials including plastic sheet for lining of silo and shading. Data of each silo within each group was averaged and used as a treatment unit in the design of the trial (RCBD). Physical quality characteristics of silages were assessed through sensory evaluation whereas nutritional analysis was made in Hawassa University, Animal nutrition laboratory. As the result from quick survey, 95% of the respondents do not experience feed conservation and technical skill limitation was reported as the major reason for low adoption. 70% of the respondents use crop-residue for copping feed scarcity. However, the experimental work on silage showed that all ensiled materials were excellent in physical qualities. The DM contents of G1, G2 and G3 were 45.03, 29.45 and 50.36 whereas IVDMD were 77.6, 64.9 and 59.0% respectively. CP values ranges from 8.18 to 9.22%. The pH values obtained ranges between (4.02-4.18) which was the desired level for quality silages. Hence, it could be concluded that silage making is one of the best feed conservation option to enhance nutritional sufficiency of small scale dairy farmers with the superiority of G1 which was excellent in most tested parameters. Nevertheless, animal experiments are necessary to determine the effects of these variations in silage composition on animal performance.

Keywords: Feed conservation; Silage; Nutritive quality; Participatory evaluation; Small scale farmers

1 Introduction

Livestock production contributes 40% to global agricultural Gross Domestic Product (GDP) and to an estimated 30% of agricultural GDP within the developing world (Abbasi and Nawab, 2021). Dairy production, a sub-sector of livestock production, is important for the livelihood of many smallholder farmers in the developing world (Janssen and Swinnen, 2019; Abbasi and Nawab, 2021). However, smallholder dairy production systems in Sub-Saharan African (SSA) countries are characterized by low productivity and a slow rate of technology adoption (Mekonnen et al., 2010). This is equally the case in Ethiopia where adoption of dairy technologies and practices has been slow. The productivity of ruminant animals in general and dairy cattle in particular in the region is largely limited by feed-related challenges (feed and forage inadequacy, inaccessibility, unaffordability and low quality) Seyoum et al. (2018).

* Corresponding author: Milkias Fanta Heliso

During the rainy season, pasture plants grow rapidly and, although their nutritive value is quite high at the beginning of rainy season but, they mature rapidly during the dry season with resultant decline in their nutritive value. Consequently, the farmers are forced to feed their animals with crop residues or standing hay that are low in nutritive value, leading to reduced feed intake, poor growth, delayed sexual maturity, and low milk yields (Gebregiorgis et al 2012). The total amount of feed produced in most smallholder farms is far less than the needs of animals kept, and these cascades to the national level. That is why dairy sector in Ethiopia is yet to realize its potential to produce enough milk to meet current and predicted future domestic demands (CSA, 2021).

In order to meet the current level of dairy production and its annual population growth, the deficit in all components of fodder, dry crop residues and feed has to be met either by increasing productivity, utilizing untapped feed resources, and conserving during available seasons. Fodders and grasses can be preserved either as hay (dried fodder) or as silage (wet fodder), depending upon weather conditions and available resources for its feeding to livestock during lean periods when availability of fresh forage is meager or negligible (mid November -April). Large quantities of surplus forages produce in most areas of the country during wet seasons which are frequently excess of the needs.

This huge resource dries-up and exposed to wastage within a short period of time as soon as the season shifts to dry. It is essential to preserve them in available seasons at proper stage of maturity to provide nutrients with minimum or insignificant loss. Despite recommendations of forage conservation (in a form of hay and/or silage) as a solution to the widespread problem of variability in feed quality and quantity, adoption of feed conservation technologies among smallholder farmers in Ethiopia is very low which is aggregately the case in Melokoza and Basketo special districts. Therefore, this study was designed to assess feed conservation and utilization practices of the districts and evaluate nutritional quality characteristics of silage conserved under farmers' condition.

Objectives

- To assess feed conservation and utilization practices of Melokoza and Basketo special districts.
- To evaluate nutritional quality characteristics of silage conserved under farmers management condition

2 Materials and Method

Description of the Study Areas: The study was conducted in selected peri-urban areas of Melokoza and Basketo special districts, southern Ethiopia. The districts are located 661 and 626km south of Addis Ababa and 405 and 367km southwest of the regional capital (Hawassa) respectively. They lies astronomically between $6^0$30'0'' N and $36^0$40'0'' E and $6^0$15'N and $36^0$35'E latitudinal and longitudinal lines with an elevation of 1725 and 1490 m.a.s.l respectively. The total land area of the districts were 1681.81 and 1057.51 square kilo meter with annual rainfall of 1125 and 1200 mm and mean daily temperature ranging between 15.1-27.5 ºC and 10.0-23.3 ºC (MDANRO, 2017 and CSA, 2012) respectively. The rainfall of the area is bi-modal with the winter rain (short rains) occurring in March to May and the summer (main season) rains lasting from June to October. According to the districts report, dairy production is one of the major livestock sector widely practiced and natural pasture is the major feed source in the area. Farmers use cut and carry system of livestock feeding mainly because of shortage of farming and grazing land.

Farmer selection: The target population for this study was the households keeping and having good experience on dairy cattle production at the time of this study. A total of 60 small-scale dairy farmers 30 from district were selected and interviewed to gather information on feed conservation and utilization practices of the area immediately before actual experiment conducted at the backyards of 12 voluntarily selected farmers (Arsham 2005). The farmers selected for actual experimental work got trained for concepts, strategies and application of feed conservation technologies. They were then divided in to three different silage making groups as G1: Silage with desho grass, G2: Silage with elephant grass and G3: Silage with native grasses. Each group was made to prepare mini sized (1mx1.5mx1m) silo with shade for preventing from direct sunshine and rain. The type of shade and silo to be prepared was first designed by animal nutrition researcher from Arbaminch agricultural research center but constructed by participant farmers themselves with simple orientation and minimal support for basic equipment's including plastic sheet for lining and shade covering.

Treatment and experimental design: The materials used for silage were desho, elephant and native grasses (most accessible species in the area) and desmodium intortium collected from fields of participant farmers and FTCs around study location. The sugarcane Molasses were purchased from Muza animal feed processing enterprise found in Arbaminch town and diluted, preferably with a small volume of warm water to minimize viscousity and seepage losses. The collected materials were cut to 3-5 cm size, wilted separately and sprinkled with 25% desmodium and 5% molasses by the total weight of the silage and thoroughly mixed to ensure even distribution. The silo was compressed until all the air was removed to create anaerobic conditions and tightly bound and placed in a shade not to be exposed to sun and

rain (Kung and Shaver, 2002). The observation of the silage and sampling was performed after fermentation for 60 days. The experiment used a randomized complete block design (RCBD) with three treatments and four replications as follows; G1: Silage with desho grass, G2: Silage with elephant grasses and G3: Silage with native grasses as the fiber source and desmodium and molasses as an additives.

Laboratory analysis: The forage species used in current experiment were analyzed for its nutrient contents after preservation to estimate the quality of silages. The silage material was judged for its fermentation qualities based on its physical properties like color, smell, taste/flavor, texture and fungal contamination according to DLG silage evaluation key as described by Ososanya and Olorunnisomo (2015). The level of silage flavor was measured by the method of Sofyan et al. (2017): as off-flavor (score 0), less fragrant (score 1), medium fragrant (score 2), and heavy fragrant (score 3). Observations level of fungal contamination in silage was conducted by observing at the presence of mold. The percentage of fungal contamination on the surface area by categories: no contamination (0%), mild (<5%), medium (5-15%), and severe (> 15%). The samples were taken immediately after the opening of silo and later sent to Hawassa University, Animal nutrition laboratory.

The chemical characteristics of the conserved feed material include dry matter, organic matter, Ash, CP, CF, NDF, ADF and lignin were computed according to the procedure of AOAC (2005). The nutritional parameters which includes Total carbohydrates (TC), none fiber carbohydrate (NFC), total digestible nitrogen (TDN), dry matter intake (DMI), organic matter digestibility (OMD), and relative feeding (RFV) values of the conserved feeds were estimated from NDF and ADF following the procedure Jeranyama (2004) expressed as TC = 100-(CP+EE+ASH) (NRC, 2001), NFC = 100-(NDF+CP+EE+ASH) (NRC, 2001), TDN (%DM) =87.84-(0.70*ADF) (Schmid et al., 1976), DMD (% DM) = 88.9-(ADF*0.779) (NRC, 2001) and DMI (% of BW) =120/NDF (NRC, 2001).

3 Results and Discussion

3.1 Feed conservation and utilization practices in Melokoza and Basketo special districts

A quick survey was made to gather information about farmers experience on feed conservation and utilization practices before actual experiment (Table 1). The result shows that there is no tradition of feed conservation and utilization practices even though, the availability of natural pasture is good at rainy season of the year in the area. Only 5% of the respondents experience feed conservation mainly in the form of crop-residue and stand hay. Higher amount of dairy farmers (10%) from Basketo special district practices hay making but not regularly. In a survey of 60 farmers in both districts, no one experiences silage making which is the most recommended form of preserving feeds for later use with stable nutrient composition. The same is true in the case of proper management of crop residue which is not under practice for its abundant availability during the crop harvesting season. This is in agreement with Yisehak et al. (2013) who indicated that feed conservation practice is uncommon in Jimma zone. Other similar finding on feed conservation and utilization practices was also reported by Tolera (2007) for Oromia and Tesfaye et al., (2016) for Tigray regions.

Different reasons were suggested by the respondents for not practicing feed conservation in Melokoza and Basketo among which novelty of conservation practices, high labor requirement and associated costs were reported respectively. As the questionnaire and interview conducted indicated that the majority of farmers in study area states that they have great willing to participate and also has positive perception on feed conservation technologies if supported technically and institutionally but they does not get enough support. Farmers of the study area understand the benefits the technologies for their environment and mainly to cope dry season feed shortage and quality reduction.

Table 1 Feed conservation and utilization practices in Melokoza and Basketo special districts

Feed conservation practice and Utilization	**Locations**				**P value**
	Basketo (N= 30)	**Melokoza (N= 30)**	**Total**		
			Frequency	Percentage	
Do you have tradition of feed conservation?					0.000
Yes	2	1	3	5	
No	28	29	57	95	
Form of feed conservation					0.000

Hay	7	5	12	30	
Crop-residue	13	15	28	70	
Silage	0	0	0	0	
The reason to low practice of feed conservation					0.000
Skill limitation (Technical)	14	11	25	41.7	
High conservation cost	5	6	11	18.3	
Low forage accesses	2	3	5	8.3	
High labor requirement	9	10	19	31.7	

3.2 Physical characteristics of silages

The basic principle of silage making is to convert the sugars in the ensiled fodder into lactic acid which reduces the pH of the silage to about 4.0 or lower. In this way, the biological activities responsible for spoilage are inhibited. To attain this, the early establishment and maintenance of oxygen free, i.e. anaerobic, micro-environment is essential. Physical quality characteristics of silage materials were summarized in table 2. There was no significant differences (P>0.05) among the treatments in terms of the observed pH and mold cover in treatment silages. However, desho and elephant grasses ensiled with desmodium and molasses showed yellowish green color (P<0.05) compared to native grass silage for the same period, which could be related to better fermentative quality of desho and elephant grasses compared to native grass.

Table 2 The physical characteristics of silage from various sources of fiber and legume additive

	Treatments			**SEM**	**P-value**
Variables	**T1**	**T2**	**T3**		
pH	4.02^{a}	4.04^{a}	4.18^{a}	0.082	0.377
Color	2.96^{a}	2.80^{a}	2.47^{b}	0.078	0.012
Mold cover	2.13^{a}	2.47^{a}	2.64^{a}	0.147	0.122
Texture	2.90^{a}	2.63^{ab}	2.40^{b}	0.090	0.022
Odor	2.92^{a}	2.60^{b}	2.40^{b}	0.082	0.012

Values with the same superscript on the same line showed non-significant differences, SEM: Standard error of the treatment means, T1-T3: Treatment silages

Native grass silage with desmodium and molasses additives showed less significant values (P<0.05) in terms of smell and texture compared to desho and elephant grass silages treated with desmodium and molasses. This agrees with the observation of Getahun et al. (2018) and Mulugeta (2015) who reported that addition of molasses and EM to sugar cane top and crop residues, respectively resulted in pronounced alcoholic odor/sweet and strong smell, which is an indicator of better quality silage. Texture of desho and elephant grass silages with desmodium and molasses was significantly (P<0.05) better than native grass silage with same additives and fermentation time. The Mold coverage of the control (native grass silage) ensiled with desmodium and molasses was higher than that of desho and elephant grass with same additives, which could be attributed to low concentration of lactic acid that would arrest proliferation of micro-organisms in it.

3.3 Chemical quality characteristics of conserved feeds

The significant variations (p<0.05) in chemical composition except CP were observed in silages conserved under farmers backyard (Table 3). The higher (p<0.05) DM but lower (p<0.05) ash contents were observed in native grass silage compared with desho and elephant grass silages. The values for DM content except elephant grass silage was within normal range (40-45%) recommended for quality silage (Driehuis et al., 2000). The crude protein content of the silage materials ranged from 7.99 to 9.22% which is also with in normal level recommended for the minimum growth of ruminants (ARC, 1984). The CP content of treatment silages in current experiment increased up to 4.7% due to the use of additives and fermentation compared to the fresh grasses (Bimrew, 2016). This agrees with the findings of Bilal

(2009) and Yonatan et al. (2014) who reported that molasses and corn addition on grass silage and EM inoculation on coffee husks resulted in higher CP content than that of the control. Zhang (2003) also reported that ensiling green maize stover with additives improved CP contents by (25.51%).

The values for EE content were significantly different ($p<0.05$) among treatment silages, which were ordered as native grass silages (T3), Desho grass silages (T1) and Elephant grass silages (T2). All the cell wall components of silage materials treated with molasses and desmodium were clearly ($P<0.05$) affected by the process of fermentation. The reduction of NDF content observed in all the experimental silages may be explained by the hydrolysis of NDF-bound N (Jaakkola et al., 2006; Huisden et al., 2009) during fermentation. The lowest ($p<0.05$) NDF value was observed in desho grasss silage, followed by elephant grass silages with desmodium and molasses. The ADL content did not show significant ($P>0.05$) difference among treatments.

Table 3 Chemical compositions of conserved feed materials (silages)

	Treatment silages			**SEM**	**P-value**
Compositions (% DM)	**T1**	**T2**	**T3**		
DM	45.03[a]	29.45[b]	50.36[a]	1.781	0.000
Ash	13.33[a]	13.71[a]	6.72[b]	0.351	0.000
CP	9.15[a]	9.22[a]	8.18[a]	0.0.929	0.696
CF	26.72[a]	29.28[a]	18.97[b]	0.979	0.001
EE	1.33[b]	0.93[c]	2.25[a]	0.115	0.001
NDF	48.60[b]	56.73[a]	63.20[a]	2.054	0.007
ADF	32.95[b]	39.30[a]	42.15[a]	1.326	0.007
ADL	8.93[a]	13.75[a]	10.56[a]	1.540	0.159

Means ± standard deviation within rows with different superscript letters differ ($p < 0.05$).

DM: Dry matter content, CP: Crude protein, CF: Crude Fiber, EE: Ether extract, ADF: Acid detergent fiber, NDF: Neutral detergent fiber, ADL: Acid detergent lignin and %: Percent

3.4 Nutritive value, intake and digestibility of conserved feeds

Nutritive values, intake and digestibility status of silage materials are summarized in table 4. The result shows that desho grass silages treated with molasses and legume additives (desmodium intortium) had significantly higher ($p<0.05$) nutritional quality in all measured parameters except TC which was higher in native grass silages treated with same additives and fermentation period. For the estimation of DMI, the significant variations ($p<0.05$) were observed among the experimental silages, where desho grass silage was highest followed by elephant grass silages. The values for DDM, IVDMD and RFV was higher ($p<0.05$) in desho grass silage treated with molasses and legume additive (desmodium intortium) compared to elephant and native grass silages treated with same additives. The greater NFC and DMI in desho silage are the result of the lower NDF content of it, and the higher TDN and DDM in treatment silages are also the consequence of lower ADF content of those silage. These findings were consistent with the reports of (Bureenok et al., 2012); feed intake and digestibility of Napier grass were improved with the addition of molasses. Moreover, addition of FJLB also improved the silage quality of Napier grass (Bureenok et al., 2006), and the LAB counts and nutritive values of cassava leaves silage (Kyawt et al., 2014), thereby increasing digestibility and feed intake.

Table 4 Mean DMD%, Feed intake and estimated RFV of conserved feed materials

	Treatment silages			**SEM**	**P-value**
Nutritive values	**T1**	**T2**	**T3**		
TC (% DM)	76.19[b]	76.14[b]	82.17[a]	0.446	0.000
NFC (% DM)	27.59[a]	19.42[b]	18.97[b]	1.855	0.028
TDN (% DM)	64.77[a]	60.33[b]	58.34[b]	0.928	0.007

DMI (%BW)	2.47[a]	2.13[ab]	1.90[b]	0.081	0.007
DDM (% DM)	63.23[a]	58.28[b]	56.07[b]	1.033	0.007
IVDMD	77.57[a]	64.87[b]	58.98[c]	0.856	0.000
RFV	130.32[a]	104.48[b]	90.17[b]	5.240	0.005

Means ± standard deviation within rows with different superscript letters differ ($p < 0.05$).

DMI: Dry matter intake, %: Percent, Bwt: Body weight, DDM: Digestible dry matter, IVTDMD: In vitro true dry matter digestibility, TC: Total carbohydrate, NFC: None fiber carbohydrate, TDN: Total digestible nitrogen and RFV: Relative feeding value

3.5 Farmer perception on silage preservation technologies and utilization

Feeling is the actual psychological influences which hinder the working brain to abstain its duty functionally. In this regard, participant farmers of the study area were categorized under three groups as highly satisfied, satisfied and dissatisfied. The assessment result showed that most of participant farmers were satisfied to the work of feed conservation which accounts about 61.1% and surprisingly 33.3% of respondents responded highly satisfied to the technologies and seen as their major work in addition to their formal work while only one farmer stated his views for the conservation as no advantages because of high labor requirement and cost.

Table 5 Farmers feeling on quality and concept of silage conservation technologies and utilization

Farmers feeling	**Locations**				**P value**
	Basketo (N= 9)	**Melokoza (N= 9)**	**Total**		
			Frequency	**Percent**	
Farmers feeling					0.000
Highly satisfied	3	3	6	33.3	
Satisfied	5	6	11	61.1	
Dissatisfied	1	0	1	5.6	

4 Conclusions

Forage conservation either as silage or hay is perhaps the greatest opportunity to bridge the feed gap due to the seasonal variability in feed quality and availability in Ethiopia. The adoption of silage making by smallholder farmers who produce most of the livestock on the country remains very important due to resource, knowledge, and skill limitations as well as systemic issues and lack of sufficient land. It has been observed that desho grass silages treated with molasses and legume additives (desmodium intortium) had better fermentative quality with higher DMI, IVDMD and RFV than other silage materials in current experiment. However, trials with animals are required to see how these differences in conserved feed material affect animal performance.

Compliance with ethical standards

Acknowledgments

The author would like to thank Agricultural Growth Program (AGP-II) on research grants through Southern Agricultural Research Institute (SARI), Head of livestock research directorate for facilitation and technical assistants of AMARC livestock research work process for their cooperation, so this research could be completed.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Abbasi, S., and Nawab, K. (2021). Determinants of the dairy technology adoption by the rural Milk producers in district Muzaffarabad, Azad Jammu and Kashmir. Sarhad J Agric 37, 921–929.doi:10.17582/journal.sja/2021/37.3.921.929

[2] Agricultural Research Council. (1 9 8 4) . T h e N u t r i e n t Requirements of Ruminant Livestock. Supplement No. 1. Commonwealth Agricultural Bureaux, Farnham Royal, UK, pp. 38-39.

[3] Alemayehu M. Rangeland: Biodiversity Concepts, Approaches and the way forward. Addis Ababa University, Faculty of Science, Addis Ababa, Ethiopia. 2002: 80.

[4] AOAC. 2005. Official Method of Analysis. In: Association of Official Analytical Chemists (AOAC). Helrich, K. (ed.) 15th edn. Arlington, V.A.

[5] Arsham H (2005) Questionnaire design and survey sampling. http://home.ubalt.edu/ntsbarsh/stat-data/surveys.htm

[6] Bilal MQ (2009). Effect of molasses and corn as silage additives on the characteristics of mott dwarf elephant grass silage at different fermentation periods. Pak. Vet. J. 29(1):19-23.

[7] Bimrew A. (2016). Evaluation of the Agronomic, Utilization, Nutritive and Feeding Value of Desho Grass (Pennisetum Pedicellatum). PhD. Dissertation, Jimma University, Ethiopia.

[8] Bureenok S, Namihira T, Mizumachi S, Kawamoto Y, Nakada T (2006). The effect of epiphytic lactic acid bacteria with or without different byproduct from defatted rice bran and green tea waste on napiergrass (Pennisetum purpureum Schumach) silage. J. Sci. Food Agric. 86:1073-1077. https://doi.org/10.1002/jsfa.2458

[9] Bureenok S, Yuangklang C, Vasupen K (2012). The effects of additives in napier grass silages on chemical composition, feed intake, nutrient digestibility and rumen fermentation, Asian- Aust. J. Anim. Sci. 25(9):1248-1254.

[10] Central Statistical Agency (CSA). (2021). Agricultural sample survey 2020/21 (2013 E.C.) Volume I. Report on area and production of major crops (Private Peasant Holdings, Meher season, Statistical Bulletin 590). Central Statistical Agency.

[11] CSA, (2007).Central Statistical Agency of Ethiopia.Accessed 12 May 2010http://www.citypopulation.de/Ethiopia.html.

[12] Driehuis, F. Oude Elferink, S. J. W. H. (2000). The impact of the quality of silage on animal

[13] Health and food safety: A review. The Veterinary

[14] Gebreiorgis F, Negesse T and Nurf eta A 2012 Feed intake and utilization in sheep fed graded levels of dried Moringa (Moringa stenopetala) leaf as a supplement to Rhodes grass hay. Tropical Animal Health and Production, 44 : 511 – 517.

[15] Getahun K, M Ashenafi, A Getnet, and A Getachew. 2018. Nutritional and fermentative quality of sugarcane (Saccharum officinarum) top ensiled with or without urea and molasses. African Journal of Agricultural Research. 13(20), pp. 1010-1017.

[16] Huisden, C. M., A. T. Adesogan, S. C. Kim and T. Ososanya. 2009. Effect of applying molasses or inoculants containing homofermentative or heterofermentative bacteria at two rates on the fermentation and aerobic stability of corn silage. J. Dairy Sci. 92:690-697.

[17] Jaakkola, S., V. Kaunisto and P. Huhtanen. 2006. Volatile fatty acid proportions and microbial protein synthesis in the rumen of cattle receiving grass silage ensiled with different rates of formic acid. Grass and Forage Sci. 61:282-292.

[18] Janssen, E., and Swinnen, J. (2019). Technology adoption and value chains in developing countries: evidence from dairy in India. Food Policy 83, 327–336. doi:

[19] 10.1016/j.foodpol.2017.08.005

[20] Jeranyama, Peter and Garcia, Alvaro D., "Understanding Relative Feed Value (RFV) and Relative Forage Quality (RFQ)" (2004). Extension Extra. Paper 352.

[21] Kung, L. and Shaver, R. (2002). Interpretation and use of silage fermentation analyses reports. Dept. of Animal and Food Science, University of Delaware, Newark, DE 19717.

[22] Kyawt YY, Imai Y, Yara T, Kawamoto Y (2014). Effect of ensiling process and additive effects of fermented juice of epiphytic lactic acid bacteria on the cyanide content of two varieties of cassava. Anim. Nutri. Feed Technol. 14:447-460 https://doi.org/10.5958/0974-181X.2014.01347.X.

[23] MDANRO (Melokoza District Agricultural and Natural Resource Office). 2017. Second agricultural growth program five year plan of melokoza district. Melo Leha.

[24] Mekonnen, H., Dehninet, G., and Kelay, B. (2010). Dairy technology adoption in smallholder farms in "Dejen" district, Ethiopia. Tropl. Anim. Health Prod. 42, 209–216. doi: 10.1007/s11250-009-9408-6

[25] Mulugeta A. 2015. Evaluation of Effective Microbes (EM) Treatment on Chemical Composition of Crop Residues and Performance of Crossbred Dairy Cows. Msc. Thesis Submitted to

[26] Haramaya University, Haramaya, Ethiopia.

[27] NRC (2001). National Research Council. Nutrient requirement of dairy cattle. 7th Rev. Edn. Natl. Acad. Sci., Washington, DC. United State of America.

[28] Schmid AR, Goodrich RD, Jordan RM, Marten GC, Meiske JC (1976). Relationships among agronomic characteristics of corn and sorghum cultivars and silage quality. Agron. J. 68:403-406. https://doi.org/10.2134/agronj1976.00021962006800020051x

[29] Seyoum B., Gemechu N., Harinder M. (2018). Ethiopian Feed industry: current status, challenges and opportunities (Addis Ababa, Ethiopia: Feedpedia).

[30] Sofyan A, Widyastuti Y, Utomo R, Yusiati LM. 2017. Improving physicochemical characteristic and palatability of king grass (Pennisetum hybrid) silage by inoculation of Lactobacillus plantarum - Saccharomyces cerevisiae consortia and addition of rice bran. Buletin Peternakan 41(1): 61-71.

[31] Tesfay, Y., Gebrelibanos, A., Woldemariam, D., & Tilahun, H. (2016). Feed resources availability, utilization and marketing in central and eastern Tigray, northern Ethiopia. International Livestock Research Institute.

[32] Tolera A. (2007): Feed resources for producing export quality meat and livestock in Ethiopia: Examples from selected weredas in Oromia and SNNP regional states. SPS-LMM (Ethiopia Sanitary and Phytosanitary Standards and Livestock and Meat Marketing program) and Texas Agricultural Experiment Station (TAES)/Texas A & M University System, Addis Ababa, Ethiopia. pp77.

[33] Yisehak K, Taye T and Aynalem H(2013). Characteristics and determinants of livestock production in Jimma Zone/Southwestern Ethiopia, Afr. J. of Basic & Applied Sciences. 5 (2): 69-81.

[34] Yonatan K, D Solomon, T Taye, and G Yehenew. 2014. Effect of Effective Microorganism (EM) On the Nutritive Quality of Coffee Husk Silage. International Journal of Scientific & Technology Research Volume 3, Issue 7, July 2014

[35] Zhang W. 2003. Studies on the nutritive value and effective degradability of ensiled corn stover. China Herbivores. cnki:ISSN:1000 6443.0.2003-01-002