Effect of sole maize and maize –lablab silage on the ruminal volatile fatty acids (VFAS) grazing calves in the dry season

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Abstract

Silages of sole maize and mixtures of maize-lablab were made at harvest in plastic bags. The experimental Unit consists of twelve cross-bred yearling bulls (White Fulani x N'dama) calves weighing 71-72kg and were randomly allotted to three dietary treatments: Grazing + sole maize silage, Grazing + mixtures of maize-lablab silage and Unsupplemented grazing as control. The experimental design was a completely randomized design and lasted 84 days. Silage diets were given between 07:30 and 11:00 hours daily before grazing. Rumen fluid was collected at the end of the study to evaluate the co-efficient of ruminal fluid. The crude protein content in sole maize silage was half of that in mixture of maize-lablab silage. Inclusion of lablab in maize stover silage increased the mineral content as well as the lignin fraction. The mean pH value of sole maize silage (3.80) was less ($P < 0.05$) than 4.25 obtained with addition of lablab. The buffering capacity (5.37%) of sole maize silage significantly ($P < 0.05$) increased to 5.71% in mixture of maize-lablab silage. Lactic acid contents differed was influenced significantly ($P < 0.05$) with a mean value of 8.4% and 8.5% respectively in the sole maize silage and with lablab inclusion. Total volatile fatty acid (VFA) ranged from 56.7 μ moles/ml in calves without supplementation to 95.2 μ moles/ml in the calves fed mixture of maize-lablab silage. Mixture of Maize-lablab silage had the highest values for all the minerals determined in the feed materials while sole maize had the least. It was concluded from this trial, that forage legumes are relatively good sources of degradable nitrogen and fermentable energy, so their inclusion in the diet is likely to increase the rumen population of cellulolytic microbes and also proves that, mixture of maize-lablab silage could be used as supplement to enhance the growth and survival of calves during the dry season, when animal feeds are relatively scarce.

Keywords: Grazing calves; maize stover; natural pasture; volatile fatty acids

Introduction

In tropical countries, livestock production systems are associated with mixed crop-livestock farming systems. Inadequate quantity and poor quality of feeds are a major constraint to livestock production in

such systems (Brumby and Gryseels, 1985). Natural pastures and crop residues provide the major dietary energy for dairy cattle but are generally unable to meet the nutrient requirement for milk and meat production. It has been reported that the most economical way to improve energy intake and performance of animals feeding on cereal crop residues is to supplement

them with good quality forage legumes (Topps 1992). However, the possibility of improving the productivity of calves through strategic supplementation of feeds generated from cereal - forage legume intercropping systems using on-farm generated protein sources (forage legume), is not well established. Attempts are being made to integrate forage legumes such as lablab (*Lablab purpureus*) in maize crops. Lablab has a longer growing period than cowpea (*Vigna unguiculata*), and does not interfere with the harvesting of other crops such as cereal crops and cotton. After cob harvest, maize stover is an abundant waste on farmlands and its proper storage and utilization is lacking in humid zone of Nigeria. Crop residues have been estimated to account for about 25 percent of the total feed energy suitable for ruminant livestock in both developed and developing countries in which maize was considered the leading crop in providing crop residues that could be utilized as a livestock feed (Kossila 1985). This necessitated the attempt to conserve maize stover as a silage feed resource which can be fed to ruminant animals during the dry season, when the quality of pasture is low and scarce. Since successful ruminant livestock farming require the provision of good quality and high quantity of forage needed to meet the animal's nutritional requirement. Moreover, the end products of such feed is recognized as the short chains fatty acids such as acetic, propionic, butyric and others being produced in the rumen supplied appreciable required amount of energy to the animal. Therefore this study also seeks to evaluate the effect of sole maize silage and maize - lablab silage on ruminal volatile fatty acid production in calves.

Materials and Methods

Plot establishment

The research was carried out at the Teaching and Research Farm, University of Agriculture, Abeokuta (UNAAB), located on latitude 7°13' 49.46"N, longitude 3°26' 11.98"E of Ogun State, Nigeria (Google Earth, 2006).

The research site was located in the derived savanna zone of Southwest Nigeria with monthly rainfall which ranged from 120mm in May to 195mm in September and mean monthly temperature from 22.5° to 33.7° C. The relative humidity in the rainy (late March-October) and dry (November-early March) season ranged between 63-96% and 55-84% respectively. An area measuring approximately 2-ha was cleared and ploughed twice and harrowed in preparation for planting. The area was divided into 8 plots of 60m x 50 m consisting of four (4) plots as replicates of sole maize while the rest were replicates of maize-lablab. All plots were sown with SWAN1 a hybrid maize variety obtained from Ogun State Agricultural Development Programme (OGADEP), Abeokuta, Ogun State with 2 seeds per hole at 1m x 1m. the seeds of *Lablab purpureus* cv Highworth black obtained from National Animal Production Research Institute (NAPRI), Zaria were later undersown at the rate of 15 kg/ha in between the maize plots at a spacing of 1 m apart and 0.5 m along the rows with 2 seed per hole two (2) weeks after planting (WAP) while the other plots were sole maize. Nitrogen fertilizer was applied to the maize crop at the rate of 26 kg N/ha through the compound fertilizer (NPK 20:10:10) two and six weeks after planting

Silage preparation

At 10 WAP, maize stover without (cobs) and lablab were cut, chopped and wilted for 24hours separately. Total herbage

comprising maize leaves and stems (55% proportion) and lablab leaves and vines (45% proportion) were prepared into silage. Polyethylene bags of 15kg capacity were used as silo. Both the chopped sole maize and the mixture of maize and lablab were carefully packed into the double layer polyethylene bags without puncturing it. The bags were gently but firmly compressed by hand to expel air. The silage bag was later inserted into used fertilizer bag to prevent puncturing. The bags were carefully stacked in a room protected against rats, mice and other pests. A total 260 bags, each weighing 9-10 kg was made for both the mixed maize-lablab and the sole silage materials. After four months of storage, the silage samples from each treatment were selected at random thoroughly mixed and a sub-sample of 1 kg taken for chemical analyses. The sub-samples were well labelled and kept in a deep freezer at (-4°C) for subsequent chemical analysis. A preliminary reconnaissance survey of the natural pasture was made. Thereafter, samples were taken throughout the period of the study from five areas where the animals were grazing in the dry season. Quadrat of 1 m x 1 m were used to mark out the sample areas. The five areas were dominated by forage grasses such as *Pennisetum polystachion*, *Pennisetum purpureum*, *Andropogon gayanus*, *Panicum maximum* and legumes (*Stylosanthes hamata*, *Calopogonium mucunoides* species, at varying proportions. The sub-samples were later bulked and mixed thoroughly. Thereafter, three representative samples were taken for laboratory analysis.

Chemical analysis

Both samples of fresh silage and natural pasture were dried, *hammer-milled through a 1 mm sieve and used for chemical analyses*. Dry matter (DM) content was

determined by drying at 80°C for 48 h (AOAC, 1995) while ash content was determined with a muffle furnace at 510°C for 18 h. Crude protein (N% x 6.25) content in the samples was determined by LECO FP-200 Analyser (St Joseph MI USA) and oil (as ether extract) was extracted with petroleum spirit (b.p. 40 to 60°C) by the Soxhlet method (AOAC 1995).

The fermentation characteristics were determined using the procedure of Wiseman and Irvin (1997) for VFAs. The buffering capacity was determined by titration of a 10 ml of water extract with 0.1M HCl and 0.1M NaOH (Payne and McDonald, 1966). The pH was determined using a combination electrode of a pH meter (Pye UNICAM, PHILIPS). The method of Van Soest and Robertson (1985) was used to determine the neutral detergent fibre (NDF), the acid detergent fibre (ADF) and acid detergent lignin (ADL).

Mineral composition

Silage samples were thoroughly washed in water to remove extraneous matter and then dried at 60°C for 2-3 days in an oven before milling. The samples were digested by nitric and perchloric acids mixture (ratio = 4:1, v/v) and the concentrations of the minerals Calcium (Ca), Potassium (K), Phosphorus (P) and Magnesium (Mg) in the samples were determined by an Atomic Absorption Spectrophotometer (Buck scientific model 200a; Buck Scientific, East Norwalk CT 06855 USA).

Feeding trial

This experiment on the effect of sole maize silage and maize –lablab silage on the ruminal volatile fatty acids of calves, during the dry season was carried out at the Cattle Management Technical Committee (CAMTEC) Unit of the Teaching and Research Farm, University of Agriculture, Abeokuta, Nigeria.

A total of twelve (12) cross bred yearling

bull (White Fulani X N'dama) of ages ranging from 9-12 months old and of approximate weight range of 69 kg – 72 kg. These were randomly assigned to three dietary treatments (maize-lablab silage, sole maize silage and no silage as control) to supplement their dry season grazing. The cattle pens were thoroughly washed and disinfected. At the end of the adaptation period, the animals were balanced for body weight and allocated randomly to the three treatments with four (4) replicates in a completely randomized design. The experimental treatments were: grazing calves supplemented with sole maize silage at 5% BW/day, grazing calves supplemented with maize-lablab silage at 5% BW/day, and grazing calves without supplementation (sole grazing). These experimental diets were offered from 07:30a.m to 11:00am every day with clean water *ad libitum*. The animals were later released for grazing in the natural pasture from 11:00am to 4:00pm daily. This feeding trial lasted for 84days.

Sample collection

Approximately 30 ml of rumen fluid were obtained from 3 animals, 2 hours after morning feeding in the last 3 three days of the feeding trial. These were collected by means of a stomach tube thrust directly into the rumen compartment via the esophagus to monitor the rumen environment. Immediately after collection, the rumen

fluid was separated from coarse particles by filtration through cheese cloth. Rumenal pH was measured immediately after collection using a portable pH meter. About 5 ml sample of the filtrate was acidified with 1 ml of a 5% concentrated orthophosphoric acid solution and kept in an air tight containers in a freezer at -20°C for subsequent determination of volatile fatty acid (VFA) concentrations.

Total volatile fatty acids concentration was determined by steam distillation process using Markham micro-distillation apparatus (Markham, 1942). Individual VFAs (propionic, acetic and butyric acids) were determined using Gas chromatography as described by Mebrahtu and Tenaye (1997). The molar percentage of the individual VFAs (propionic, acetic and butyric acids) was calculated. Ammonia concentration, rumen pH and microbial content were also determined as described by Lanyansunya et al (2007).

Statistical analysis

Data obtained were subjected to Analysis of Variance (ANOVA) of the General Linear Model (GLM) Procedure of SAS (2002).

The experimental model was:

$$Y_{ijk} = \mu + T_i + \epsilon_{ijk}$$

where:

Y_{ijk} = Dependable variables, μ = Overall mean of the population, T_i = the effect of the supplementation, ϵ_{ijk} = Random Residual

Table 1: Chemical composition (g/Kg DM) of sole maize silage, maize-lablab silage and forage samples from natural

Treatments	DM	C P	EE	Ash	NDF	ADF	Lignin
Sole maize silage	871 ^a	119 ^c	80.5 ^b	20.45	527 ^b	470	26.8 ^b
Maize / Lablab silage	766 ^b	235 ^a	116 ^a	27.3	661 ^a	566	39.1 ^a
Natural pasture	871 ^a	92.7 ^b	110 ^a	23.3	671 ^a	433	35.5 ^{ab}
±SEM	2.32	14.3	0.43	9.14	11.17	60.4	4.77

^{abc}: Means in the same Column with different superscripts are significantly different (P < 0.05)

DM= Dry matter

NFE= Nitrogen free extract

CP= Crude protein

NDF= Neutral detergent fibre

EE= Ether extract

ADF= Acid detergent fibre

Table 2: The mineral composition (g/kg DM) of the sole maize and mixture of maize/lablab silages and forage from the natural pasture

Treatments	Calcium	Potassium	Phosphorus	Magnesium	Ca:P
Sole Maize silage	4.50 ^c	25.6 ^b	26.7 ^b	3.15 ^b	1:6 ^a
Maize-Lablab silage	8.05 ^a	33.6 ^a	36.6 ^a	6.05 ^a	1:4 ^b
Natural pasture	7.00 ^b	35.7 ^a	33.6 ^{ab}	5.50 ^a	1:4 ^b
±SEM	1.07	1.15	1.36	0.30	0.11

^{abc}: Means in the same Column with different superscripts are significantly different ($P < 0.05$)

Ca:P: The ratio of Calcium to Phosphorus

Error term associated with each record

Results

The DM contents of the three diets ranged from 765 g/kg DM in mixture of maize-lablab silage to 871 g/kg DM in sole maize silage with significant difference ($P < 0.05$) between mixture of maize-lablab silage and forages from the natural pasture. The crude protein content in *sole maize* was half of that in mixture of maize-lablab silage. The mean ether-extract and Neutral detergent fibre contents of maize-lablab mixtures were similar, but significantly higher ($P < 0.05$) than in sole maize silage. There were no significant differences in the Acid detergent fibre and ash contents of the forage materials. Maize-lablab silage mixtures recorded higher ($P < 0.05$) lignin content whereas sole maize recorded the least.

The mineral composition of the silage and the forage samples from the natural pasture been grazed by the animals is presented in Table 2. The results obtained from the study showed that Potassium and Phosphorus

were the most abundant minerals in the feeds. Potassium contents ranged from 25.6 g/kg in sole maize silage to 35.7 g/kg in grazed natural pasture, which was similar ($P > 0.05$) to 33.6 g/kg in maize-lablab silage.

The experimental feeds materials differed significantly ($P < 0.05$) in contents of Ca with values ranging from 4.50 g/kg in *sole maize silage* to 8.05 g/kg in maize-lablab silage mixtures. The contents of magnesium in *maize-lablab silage mixture* and the natural grazed pasture were similar but higher in sole maize silage material. From the result, maize-lablab silage mixture had the highest contents of all the minerals determined, while sole maize had the least.

Silage chemical characteristics were assessed by pH, lactic acid and volatile fatty acids (VFAs) contents of the silage (Table 3). The mean pH value of sole maize silage (3.80) was less ($P < 0.05$) than 4.25 obtained when lablab was incorporated. The buffering capacity (5.37%) of sole maize silage significantly ($P < 0.05$) increased to

Table 3: Fermentation characteristic of sole maize and mixtures of maize-Lablab silage

Parameters	Sole maize silage	Maize-lablab silage	SEM
pH	3.80 ^b	4.25 ^a	0.04
Buffering capacity	5.37 ^b	5.71 ^a	0.13
Total acids (g/kgDM)	12.36 ^a	15.23 ^a	0.88
Lactic acid (g/kgDM)	8.41 ^b	8.59 ^a	0.03

^{abc}: Means in the same Column with different superscripts are significantly different ($P < 0.05$)

Table 4: Rumen fermentation characteristics of grazing cross-bred calves with or without silage supplementation

Parameters	Treatments			
	Grazing / Sole maize	Grazing / Maize-lablab	Sole grazing	±SEM
pH	6.40 ^b	6.31 ^c	6.53 ^a	0.01
NH ₃ (mg/dl)	4.05 ^b	5.63 ^a	2.43 ^c	0.06
Total VFA (μmoles/ml)	75.8 ^b	95.2 ^a	56.7 ^c	3.06
Lactic acid (mol. %)	17.8 ^b	19.9 ^a	6.15 ^c	2.10
Acetic acid (mol. %)	13.2 ^b	13.6 ^a	11.2 ^c	0.69
Butyric acid (mol. %)	3.20 ^a	2.10 ^b	2.10 ^b	0.02
Propionic acid (mol. %)	2.80 ^a	2.20 ^c	2.40 ^b	0.04
Acetic:Propionic ratio	4.71 ^b	6.16 ^a	4.67 ^b	1.63
Total Viable Count (<i>Cf</i> um ⁻¹)	6.91 ^b	7.37 ^a	6.61 ^c	0.01

^{abc}: Means in the same column with different superscripts are significantly different (P < 0.05)

5.71% in maize-lablab silage mixture. Lactic acid contents which tends to differ was influenced significantly (P < 0.05) with a mean value of 8.4% and 8.5% respectively, in sole maize silage and lablab inclusion. The total volatile fatty acid (TVFA) ranged from 12.36% in sole maize silage and increased (P < 0.05) with the inclusion of lablab to 15.23%.

The mean ruminal pH value (6.53) from calves that do not have access to grazing was significantly (P < 0.05) higher than in the other treatments (Table 4). The rumen ammonia concentration was significantly influenced by the treatment. Calves fed maize- lablab silage mixtures recorded the highest (P < 0.05) value of 5.63 mg/dl, while the least (2.43 mg/dl) was obtained from calves without supplementation.

The total volatile fatty acid ranged significantly (P < 0.05) from 56.7 μmoles/ml in calves without supplementation to 95.15 μmoles/ml with the calves fed maize-lablab mixtures supplementation (Table 4). The proportion

of lactic acid in mixed silage was three times higher (**P < 0.05**) than in natural grazed pasture. The content of ruminal butyric acid recorded from calves on sole grazing and on maize – lablab silage mixtures supplement was similar, but lower (P < 0.05) than the content from calves supplemented with maize silage alone.

Calves supplemented with maize – lablab silage recorded the highest (P < 0.05) value (13.6 mol. %) of ruminal acetic acid followed by those on sole maize silage (13.2 mol.%) while the least value (11.2 mol.%) was observed in calves without supplementation. The highest (**P < 0.05**) production of propionic acid was recorded in calves on sole maize silage supplement, and the least from calves without supplementation. The ratio of acetic to propionic acid was significantly (P < 0.05) higher in maize-lablab mixtures silage supplement (6.16) than in sole maize silage and sole grazing (Table 4). Maize-lablab silage had higher (P < 0.05) total viable count, total fungi and total yeast count than

sole maize silage.

Discussion

The crude protein content of silage obtained in this study was adequate as it exceeded the minimum requirement (11-12%) for growth and lactation of a 400kg cow recommended by NRC 1989. It is therefore, adequate for meeting the protein requirements of growing calves to generate an appropriate level of ammonia in the rumen from degradable protein and to ensure an efficient digestion process (Ørskov 1995). The mineral concentrations of the diets varied. Calcium concentration which ranged from 0.4 to 0.7 % was higher than the recommended critical level of 0.30 % (NRC, 1976). Phosphorus concentrations ranged from 2.6-3.6% which exceeded the critical level of 0.25% P, suggested by Bourn and Milligan (1984). Potassium concentration meets the requirements for various classes of ruminants (0.05- 0.12%). The recommended lower and upper critical dietary Ca:P ratios are 1:1 to 1:7 in the tropics (McDowell *et al.*, 1993). The mean Ca:P ratio of 1:4 obtained for silage in the present study is within the recommended range and would meet the Ca:P ratio requirement for ruminant livestock. Although, forages from the natural pasture during this trial appears to have a considerable digestible fibre (671 g/kg/DM) and certain minerals which could supply energy for maintenance during dry season, however, Cattle in the tropics may require less energy for maintenance since they are exposed to lesser cold stress. The energy spared, however, must be supplemented with protein to ensure an appropriate protein to energy (P/E) ratio in the nutrients absorbed for optimum feed efficiency.

The silage used in this trial was of good quality which is an indication that proper

fermentation took place. A good fermentation process does not depend on the type and quality of the forage crop only, but also on harvesting and ensiling techniques (Stefanie *et al.*, 1999). The polyethylene bags silo could be said to have contributed positively to the proper fermentation of the silage. According to the findings of Bazil *et al* (2000), the plastics bag silo technology may have contributed to the production of good quality silage because it seems to provide better anaerobic condition than bunker silage. It is hypothesized that the volatile fatty acids which are produced during the fermentation are retained within the bags and inhibit spoilage yeasts and moulds (Ashbell *et al.*, 2001)

Lactic acid concentrations 8.40 g/kgDM and 8.50 g/kg/DM for sole maize silage and maize – lablab silage contents fell within the interval (3 to 13%) proposed by Catchpoole and Henzell (1971) in silage juice. Addition of forage legume therefore, increased the performance of lactic acid producing bacteria and thus indicating higher fermentation efficiency than the sole maize. Anil *et al.* (2000) also reported an increase in lactic acid concentration when corn was ensiled with other legumes.

The acetic acid concentrations (5.70 g/kgDM and 5.65 g/kgDM) for the silage in this trial were lower than 9.56% for sole maize silage, 9.91% for maize –Leucaena and 7.76% for maize- acacia obtained by Mugweni *et al.* (2001). A high concentration of acids has been reported to reduce the intake of silage with acetic being the major suppressor of intake (Ziggers 2003). This implies that the animal intake of this silage will be enhanced by the moderate acetic content.

The butyric acid concentrations of 0.34% and 0.36% in sole maize silage and maize –lablab silage were above the 0.2%

concentration of DM proposed by Silveira (1975) as the limit for good quality silages. However, the values obtained were lower than 0.47 to 0.96% reported by Mugeweni *et al.* (2001). A butyric acid concentration of less than 1 % of silage was considered desirable (McDonald *et al.*, 1991).

High moisture in the silage has been reported to cause increase in butyric acid content. The maize – lablab silage had higher moisture content than sole maize silage as the DM content reflected, thus the high butyric acid content of maize-lablab than in sole maize silages. This could be as result of legume inclusion which favoured clostridia fermentation with the production of butyric acid (McDonald *et al.*, 1991). Legume stems are tubular and hollow in structure, thus the materials for ensiling would be porous to air leading to production of butyric acids (Yang 2005). This implies that legumes with high moisture content need wilting before ensiling.

Lablab incorporation into the maize silage in the present study increased the buffering capacity of the silage. Legumes are generally low in water-soluble carbohydrate (WSC) but high in buffering capacity (McDonald *et al.*, 1991). The values, 5.31% and 5.71%, obtained in this study were lower than 619 g/kg/DM recorded by Jatkauskas and Vrotniakiene (2004), but higher than the values recorded by Oni (2009) for both non-additive and additive silages. Increase in the buffer capacity of silage supplemented legume had been reported by de Figueiredo and Marais (1994).

The pH values obtained in this study seem to suggest that when lablab was mixed with maize that has high levels of fermentable carbohydrates the buffering effect was reduced and desirable pH level was achieved.

Ruminal pH values were above 5.60 in all cases which, according to Nagaraja and Lechtenberg (2007) should be considered the threshold pH for rumen acidosis in beef cattle fed high concentrate diets. Lowest rumen pH observed in calves supplemented with maize - lablab silage confirms the production of lactic acid which lowers the rumen pH. This suggests that inclusion of forage legumes during ensiling of maize stover will help in addressing the imbalanced nature of the nutrients that arise from digestion of the available forage resources fed without supplements which constitutes the reasons for low productivity of ruminant animals in developing countries (Leng *et al.*, 1991).

The ruminal NH₃ concentration of maize - lablab silage (5.63 mg/dl) was within the recommended range of 5-20 mg/dl (Leng and Nolan 1984). The values observed in sole maize silage and the natural pasture were lower than this recommended values. The higher value recorded for maize - lablab silage could be attributed to its greater buffering capacity (Muck *et al.*, 2003). In addition, the higher values probably reflect degradation of the soluble fraction of supplemental protein in the rumen. Rumen microbes require a source of fermentable nitrogen, usually as ammonia. Forage legumes are relatively good sources of degradable nitrogen and fermentable energy so their inclusion in the diet is likely to increase the rumen population of cellulolytic microbes (Topps, 1995). Supplementation with forage legume should then lead to a significant increase in animal performance.

Higher value observed in concentrations of total VFA in the ruminal fluid of grazing calves supplemented with maize-lablab silage was consistent with results of Ipharraguerre *et al.* (2005), who reported that the concentration of VFA in the ruminal

fluid increased with elevated CP content in the diet. In addition, increasing the CP content in the diet consistently enhanced the concentration of $\text{NH}_3\text{-N}$ in the rumen, but not the molar proportions of branched-chain VFA (Cunningham *et al* 1996). In the present experiment, diet had significant effect on total VFA concentration, molar proportion of acetate, propionate and butyrate as well as acetate: propionates.

The profile of VFAs varied across diets with acetate: propionate ratios always above 2.2 which was suggested as a cut off value for being at risk of ruminal acidosis. Addition of protein supplement to diet has been reported to increase ruminal VFA concentration and affect molar proportion (Delcurto *et al* 1990).

Conclusion

Field observations showed that maize stover is the most abundant crop residue in smallholder crop-livestock production systems, but are poorly handled and stored. The most commonly observed methods of handling the maize stover are harvesting and either stacking in the field for gradual collection as required for feeding, storing under trees or in the home compound usually in the open and very rarely in roofed barns. This leads to loss of considerable amounts and nutrients due to weathering and leaf shattering. This study clearly showed that nutrients deficiency in tropical forages during dry season may be those critical to growth of rumen microbes which ferment or digest the feed or those nutrients required to balance the products of digestion that are absorbed to meet requirements.

Therefore supplements required are a source of fermentable N, minerals for the rumen organisms. Maize - lablab silage in this trial is locally sourced by intercropping

lablab with maize, which imposed no negative effect of the maize yield. The mixed maize-lablab silage tends to increase the utilization of maize stover and thereby, create a rumen environment which is more capable of fermenting and digesting of poor quality forage. Legume based silage supplements to roughage were beneficial to cattle because they provide essential nutrients to the rumen micro- organisms, enhanced activity of micro- organisms in the rumen resulting in better digestibility. They provide nutrients for cattle, and help to maintain their weights during the dry season.

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