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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(10): 1853-1857

www.thepharmajournal.com
Received: 14-08-2022
Accepted: 18-09-2022

Anusha V
Senior Veterinary Officer, Department of AH&VS, Government of Karnataka, Karnataka, India

Ramachandra B
Professor and Head, Department of ANN, Veterinary College, KVAFSU, Bidar, Karnataka, India

Shantkumar
Senior Veterinary Officer, Department of AH&VS, Government of Karnataka, Karnataka, India

Thirumalesh
Professor and Head, Department of ANN, Veterinary College Gadag, KVAFSU, Bidar, Karnataka, India

Jayaprakash JG
Senior Veterinary Officer, Department of AH&VS, Government of Karnataka, Karnataka, India

Anjaneya S
Senior Veterinary Officer, Department of AH&VS, Government of Karnataka, Karnataka, India

Corresponding Author:
Anusha V
Senior Veterinary Officer, Department of AH&VS, Government of Karnataka, Karnataka, India

Effect of feeding banana pseudostem silage supplemented with slow release nitrogen compound on the growth performance of osmanabadi kids

Anusha V, Ramachandra B, Shantkumar, Thirumalesh, Jayaprakash JG and Anjaneya S

Abstract
The present research was conducted to evaluate the effect of banana pseudostem silage supplemented with SRNP on the performance of Osmanabadi kids. Eighteen kids of about 4-6 months age, having an initial body weight of 10.62 ± 0.09 kg were divided into three groups (T-1, T-2, and T-3) of six animals each. The growth trial of 12 week duration was carried out. Each group was allocated to one of the following three dietary treatments in a completely randomized design Treatment 1 (T1-Control) comprised jowar stover with conventional concentrate mixture. Treatment 2 (T2) comprised 50% silage plus 50% Jowar stover with conventional concentrate mixture. Treatment 3 (T3) comprised 50% silage plus 50% Jowar stover and concentrate mixture containing only maize grain supplemented with SRNP (10 g). All the three diets were made iso-nitrogenous and the goats were fed as per requirement of NRC (1981). The average body weight gain and mean finishing body weight (kg) in T1 was significantly (p<0.01) higher than T2 and T3. The total dry matter intake observed was 487.38, 474.95 and 464.89 g/d in T1, T2 and T3 groups. T1 group had significantly higher (p<0.01) total dry matter intake followed by T2 and T3. The digestibility co-efficient of DM, OM, CF, NFE and ADF were found to be non-significant among groups while CP, EE and NDF were significant. T3 had significantly (p<0.01) higher CP, EE and NDF digestibility compared to T1 and T2 groups, while T1 and T2 groups found to be non-significant among themselves. Based on the observations, it can be concluded that there is a further scope of improving the banana utilization in the form of silage either by wilting to reduce the moisture content to 70% before ensiling or addition of any dry roughage and fermentable carbohydrates to obtain good quality silage DMI.

Keywords: Banana silage, kid, Jowar stover, SRNP

Introduction
Banana (*Musa sapientum*) is one of the perennial crops grown in tropical regions, where only fruits are commercially used and banana leaves are also used commercially to certain extent. Due to greater demand for cereal grains for human consumption and higher cost of oil cakes, ruminant farmers of India are only left with crop residues as option for feeding of ruminants. Among several cereals, legumes and other industrial byproducts available throughout India, there is a need for exploring the new feed resources to meet the nutrient requirements of ruminants at least for maintenance level. As existing feed resources are not sufficient to meet the requirement, some farmers in various parts of the country are using locally available crop wastes as ruminant feed some fruit plant wastes are regularly used along with one among them is banana fruit plant waste particularly stem and leaves. The banana plant wastes mainly comprise stem and leaves. As farmers harvest bananas all at a time and the pseudostems are available in bulk which cannot be stored for long due to its high moisture content. Banana plant wastes are low digestibility, fermentable energy and crude protein (Nangole *et al*., 1983) [22]. Therefore it's necessary to provide energy and protein source particularly for high milk yield and fast growing animals to meet energy and protein needs of animal along with banana pseudo stem. So supplementation of commercial concentrates or cereal grains as energy source and urea or non-protein nitrogen as a nitrogen source is the common practice in various part of the country. The rapid release of ammonia from urea may result in inefficient N utilization. A partial solution could modify urea to control its rate in the rumen so that ammonia production more closely parallels carbohydrate digestion (Rodriguez. *et al.*, 2010) [29]. The effect of SRNP on rumen fermentation parameters such as rumen pH, ammonia and volatile fatty acid production, have shown to improve (Davis and Stallcup, 1967; Thompson *et al.*, 1972;

Cass *et al.,* 1994; Huntington *et al.,* 2006 and Edward *et al.,* 2008) [8, 31, 5, 14, 10], whereas on contrary some observed no beneficial effects (Males *et al.,* 1979; Rodriguez *et al.,* 2010; Xin *et al.,* 2010) [20, 29, 34]. The improved rumen fermentation characteristics, however did not reflect in improving growth performance of lambs or steers (Huston *et al.,* 1974; Tedeschi *et al.,* 2002 and Tufarelli *et al.,* 2009) [15, 30, 32]. Hence, the present study is designed to study the effect of feeding banana pseudostem (*Musa sapientum*) silage supplemented with slow release nitrogen compound (SRNP) on the performance of osamanabadi kids.

Materials and Methods

Study site

The experiment was carried out during winter season in the Experimental Unit of Animal Nutrition, Veterinary College, KVAFSU, Bidar (Karnataka), India. The minimum temperature during the experimental period ranged between 15.0 and 22.0 ◦C while the maximum temperature varied from 20 ^{0}C to 42 ^{0}C. Bidar is situated at 17.912◦N latitude and 77.520◦E longitude and at an altitude of 2300 ft above sea level. Annual rainfall 123.31 mm and the location falls under semi-arid region with poor availability of grazing and lopping biomass in most seasons of the year.

Experimental animals and diets

Eighteen 4-6month old Osmanabadi kids (10.62 ± 0.09 kg BW) were used for the study. They were divided equally into three groups of six animals per group. The diet of experimental kids was made from compound feed mixture (CFM) and maize grain. The roughage used was jowar stover and banana silage. Banana silage had more moisture and palatability was less as observed in pilot study hence banana silage and jowar stover were mixed in the ratio of 50:50 on w/w basis, kids were allocated the different treatments. Treatment-1 (T1): Jowar stover and compounded feed mixture (CFM) which served as control group. Treatment-2 (T2): Comprised 50% silage plus 50% jowar stover (MS-Mixed silage) (w/w) and CFM. Treatment-3 (T3): 50% MS and CFM containing maize grain + 10 g SRNP and mineral mixture. All three groups were fed as per requirement of NRC (1981) [23] to support 100 gm gain per day. All the experimental animals were housed in well-ventilated pens. The animals were dewormed with fenbendazole at the beginning of the experiment. The kids were vaccinated against foot and mouth disease as per standard schedule. The experimental kids in each group were fed for 84 days with respective feed at 4% of their body weight. Clean water was freely available to all the animals throughout the experimental period. The feeding trial was followed by a metabolic trial comprising five days collection of urine and faeces. The samples of feed, fodder and dung were analysed for proximate constituents (AOAC, 1995) [1]. The obtained data was subjected to statistical analysis by SAS.

Results and Discussion

Intake and Growth performance

The chemical composition of different feed stuffs used in experiment were banana silage, jowar stover, mixed silage (MS- 50% banana stem silage plus 50% jowar stover), CFM and maize grain. The detailed chemical composition of these is presented in Table 1. The banana silage. The total dry matter intake observed was 487.38, 474.95 and 464.89 g in T1, T2 and T3 groups. T1 group had significantly higher total dry matter intake followed by T2 and T3. There was variation in the intake of roughage in the form of jowar stover and mixed silage. The roughage intake observed was 218.06, 204.8 and 202.68 g in T1, T2 and T3 groups, respectively. T1 group had significantly higher jowar stover intake compare to T2 and T3 which were fed with mixed silage. The T2 and T3 groups were found to be non-significant among themselves. There was no significant difference in roughage DMI (g/day) in T2 and T3 groups and were fed with MS. The T2 group was supplemented with CFM while T3 group was offered with maize grain mixed with SRNP. This finding corroborated with the results of previous studies with the use of SRNP in comparison with control group did not affect DMI in ruminants (Cherdthong *et al.*, 2011a: Bourge *et al.*, 2012) [6, 4]. In the present study the amount of CFM/maize grain offered to individual kids was fixed and completely consumed. Feeding of SRNP did not influence the intake of MS, therefore it was concluded that supplementation of SRNP in the diet had no influence on the intake of MS in growing kids. Le Dividich *et al*. (1978) [18] noticed 1.8-2.2% dry matter intake based on per cent body weight in lactating goats. When banana silage was blended with forages it was found that intake of dry matter increased with the increasing content of banana silage in the ration from 0-20%, beyond this level dry matter intake remained relatively constant. Khattab *et al*. (2000) [17] observed significantly higher intake of banana waste ensiled with molasses compare to the fresh banana wastes in lactating buffaloes. Rahaman and Huque (2002) [27] noticed significantly higher roughage dry matter intake in banana ensiled with molasses and straw (2.73%) compared to banana waste ensiled with molasses (BEM) (1.33% BW), total dry matter intake per kg metabolic live weight was significantly higher in banana ensiled with molasses straw (115 g) compared to banana ensiled with molasses (59 g) in mature bulls. There was a significant difference in OM, NDF and ADF intake (on per cent body weight) among treatment groups. The significant difference of these intakes might be attributed to the significant difference in the roughage intake and total dry matter intake. The OMI and ADFI were non-significant in T2 and T3 groups and were significantly lower than T1 group. The addition of SRNP in T3 group did not affect the intake of either OM or ADF in ruminants. These findings corroborated with results of previous studies conducted by Edward *et al.* (2009) [9] and Bourge *et al.* (2012) [4]. The NDFI was significantly different in among treatment groups where T1 group had significantly higher (p<0.01) NDFI compared to T2 and T3 groups. Reddy and Reddy (1991) [28] reported 1.61 percent dry matter intake in cross bred bulls fed with banana plant without any supplementation. The OMI intake was in agreement with Rahaman and Huque (2002) [27] observed significantly higher OMI based on metabolic body weight in banana ensiled with molasses (33 g) in mature bulls. Similarly, Ally and Kunzikutty (2003) observed 1.65% dry matter intake and 37.5 g dry matter intake per kg metabolic body weight in native goat fed with banana leaf which was low when compared to the other tree leaves

The cumulative body weight gain observed in this study was 5.57, 4.53 and 3.28kg in T1, T2 and T3 groups respectively. The average daily gain observed was 66.31, 53.87 and 39.07 g in T1, T2 and T3 groups respectively. Statistically T1 group had significantly higher cumulative body weight gain and average daily gain compared to T3 and T2 group. It was observed that experimental goats didn't consume expected

levels of DM as per NRC (1981) [23], which led to lower energy intake. The T1 and T2 groups were fed with CFM and T3 group was fed with maize and SRNP. There was a numerical difference between T1 and T2 groups but statistically they were not significant. The supplementation of concentrate feed had provided amino acid and peptide in the rumen. The peptide and amino acids are required for ruminal bacteria (NRC, 2001) [24] for improved microbial growth efficiency evident when peptides or amino acids were replaced with ammonia or urea as sole source of nitrogen (Cotta and Russel 1982; Russel and sniffen 1984; Griswold *et al*., 1996) [7, 12]. Meang and Baldwin (1976) [21] reported increased microbial growth and growth rate at 75% urea nitrogen. In this experiment, the beneficial effect of CFM supplementation by providing amino acid increased growth rate in T1 and T2 compared to T3 group. Similarly Vishwanathan *et al*. (1989) [33] observed 27, 31, 39 and 29 g of ADG in lambs fed with dried banana stalks in the ration at 0, 20, 40 and 50 percent level respectively in diet comprised with paragrass and concentrate feed mixture. Rahaman and Huque (2002) [27] reported significantly lower weight gains by feeding banana ensiled with molasses (614 g/d), or banana ensiled with molasses and straw (159 g/d) compared to control group (920 g/d) in mature bulls. Khamparn and Preston (2008) [16] observed that average daily gain in growing male goats was 21, 72, 80 and 95 g in banana, jack, erythryna and mulberry leaves fed along with Tithonia leaves and stem, respectively.

Nutrient utilization and nitrogen balance

The apparent nutrient digestibility (%) of DM, OM, CF, NFE and ADF in T1, T2 and T3 groups were found to be non-significant except CP, EE and NDF which were significant (P<0.01) in T3 group. Galina *et al.* (2004b) [11] reported significantly (P<0.05) higher digestibility of nitrogen and NDF in fattening lambs fed with slow intake of urea supplements. The higher digestibility of CP in T3 group could be attributed to higher intake of CP. No difference in digestibility of DM, OM, NDF and ADF was noticed in sheep (Puga *et al*., 2001) [26], in steers (Loest *et al*., 2001) [13]. Cherdthong *et al*. (2011b) [6] reported no significant difference in digestion of CP in beef cattle fed with urea. Bhuyan *et al*. (1989) [3] observed 65.13, 60.23, 63.20, 67.50 and 68.3% digestibility of DM, CP, EE, CF and NFE, respectively in kids fed with banana leaves in the diet. On contrary Rahaman and Huque (2002) [27] observed significantly higher digestibility of DM, OM, CP, and ADF (78, 81, 86 and 79%) in banana ensiled with molasses straw (BEMS), compared to banana ensiled with molasses (BEM) (59, 61, 74 and 62%), respectively. Ally and Kunzikutty (2003) observed 68.9, 72.7, 76.9, 54.1 and 59.7% digestibility of DM, CP, CF, EE and NFE, respectively in banana leaf fed in native goats. The body weight gain among the three groups was statistically significant (p<0.01). . The total dry matter intake observed was 487.38, 474.95 and 464.89 g/d in T1, T2 and T3 groups. T1 group had significantly higher (p<0.01) total dry matter intake followed by T2 and T3. . The initial body weight (kg) for T_1, T_2 and T_3 groups were 10.99, 11.06 and 11.09 and final body weight (kg) was 16.57, 15.59 and 14.37, respectively. The mean total body weight gain (kg) for the T_1, T_2 and T_3 groups during the experimental period was 5.57, 4.53 and 3.28 respectively. The average daily weight gain (g) per day for T_1, T_2 and T_3 groups during experimental period was 66.31, 53.87 and 39.07 respectively. The initial body weight of different treatment group was non-significant. The final body weight and average daily gain were found to be significant (p<0.01). In which T_1 group had significantly higher final body weight, body weight gain and average daily gain compared to T_3 group, Whereas T_2 group was found to be non-significant with T_1 and T_3 groups.

The positive nitrogen balance among the treatment groups was suggestive of nitrogen supply much higher than the maintenance requirement, the results were similar to the findings of Owens *et al.* (1980) [25] who observed that slow nitrogen release from urea had no benefit in increasing nitrogen balance in comparison to soybean meal urea based diet in steers. Similar findings were also reported by Gupta *et al*. (2001) [13] where he noticed positive balance of nitrogen, calcium and phosphorous as 20.36, 10.63 and 4.48 g per day per animal respectively in bullocks fed with chopped banana plants without any supplementation. Further, Rahaman and Huque (2002) [27] reported 2.19 and 0.74 g positive nitrogen balance per Kg metabolic body weight per day in native bulls fed with banana ensiled molasses plus straw and banana ensiled with molasses respectively. Ally and Kunzikutty (2003) observed 4, 5.2, 2.5 and 2.9 g of positive nitrogen balance in subabul, jack, venga and banana leaves fed groups in goats.

Table 1: Chemical composition (% on DMB) of CFM and feed stuffs used in experiment.

Parameter	Jowar Stover	Mixed Silage	CFM	Maize
Organic Matter	89.57	84.87	90.57	96.11
Crude Protein	04.94	05.18	18.56	09.52
Ether extract	02.02	02.03	02.99	03.88
Crude fibre	33.12	24.79	10.12	02.36
Nitrogen Free extract	49.48	52.86	58.90	80.35
Total ash	10.43	15.13	09.43	03.89
Acid insoluble ash	07.67	06.73	03.98	01.42
Neutral detergent fibre	76.50	70.46	21.77	11.50
Acid detergent fibre	51.30	45.24	06.54	03.50

Note:
CFM-compound feed mixture, DMB-Dry matter basis
Mixed silage (MS) - 50% banana stem silage plus 50% jowarstover.

Table 2: Mean Feed intake (g/d), body weight gain (g/d) and digestibility of nutrients (%) of experimental goats.

Parameter	T1	T2	T3
Total DMI	487.38[a]	474.95[b]	464.89 [c]
Roughage DMI	218.06[a]	204.80[b]	202.68 [b]
ADG	66.31[a]	53.87[ab]	39.07[b]
Nutrient digestibility			
DM	79.72	80.65	85.92
OM	82.35	83.22	87.14
CP	66.89	67.97	75.63
CF	85.50	82.12	83.38
EE	84.74[a]	81.58[a]	91.95[b]
NDF	73.49[a]	72.22[a]	74.95[b]
ADF	75.35	73.12	78.81

Note: T1-Jowar Stover + CFM, T2-MS, T3-MS with urea + maize.
a,b,c -Means with different superscripts differ significantly in a row.

Table 3: Mean nitrogen balance of experimental kids during the metabolic trial (g / day) Parameters

	T1	T2	T3
Nitrogen intake N-outgo	9.74	9.82	9.95
Dung- N	3.46	3.66	3.63
Urine- N	4.91	5.09	5.18
Total-N-outgo	8.37	8.75	8.81
N balance	1.37	1.07	1.14
N retained as % of intake	14.16	10.81	11.47

Conclusion

In this experiment, the beneficial effect of CFM supplementation by providing amino acid increased growth rate in T1 and T2 compared to T3 group. All the animals were in positive nitrogen balance. Addition of SRNP or maize didn't improve DMI and weight gain in goats. It can be concluded that there is a further scope of improving the banana utilization in the form of silage either by wilting before ensiling or addition of any dry roughage and fermentable carbohydrates.

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