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Effect of sorghum stover-oat silage on intake and utilization of nutrients in growing heifers

K K SINGH[1], M M DAS[2] and S B MAITY[3]

Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh 284003 India

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Roughage-based ration usually causes reduction in dry matter intake due to low protein and high fiber contents, mainly during summer when ambient temperature is above 27°C (NRC 1981). These conditions are further aggravated when animal diets consist of mainly low quality roughages like straw, stover and other fibrous feed leading to low production performance. To promote higher intake of DM, a practical approach could be the ensiling of stover or fibrous roughages with high moisture forage crop like fodder oat. Hence, an experiment was conducted to see the effect of dry sorghum stover-oat silage on dry matter intake and growth performance in heifers.

For the preparation of silage, sorghum stover was collected at mature stage in October-November from the Experimental Farm of Indian Grassland and Fodder Research Institute, Jhansi. In February, the sorghum stover (about 90% DM) and oats (about 15% DM) were chaffed and mixed in the ratio of 2: 1 (on DM basis) with the solution containing 2% molasses. Whole contents were put into a concrete silo, compacted by trampling and covered with polythene sheet for 45 days. After completion of ensiling period the silos were opened and silage quality was evaluated (Singh and Pandit 1978).

Growing Tharparkar heifers (14), weighing around 138±13.78 kg, were randomly divided into 2 groups of 7 animals in each group. The heifers of control group (T1) were fed on dry sorghum stover based ration along with concentrate mixture 1 (consisting of maize grain, mustard cake, wheat bran, mineral mixture and common salt in the ratio of 22: 35: 41: 1: 1, respectively). While the heifers of group T2 were offered ensiled forage along with concentrate mixture 2, consisting of maize grain, mustard cake, wheat bran, mineral mixture and common salt in the ratio of 9: 35: 54: 1: 1, respectively, for 90 days as per requirement (ICAR 1998). Live weight of each animal was recorded fortnightly.

Present address: [1-3]Senior Scientist, Plant Animal Relatioship Division (mmdas1964@rediffmail.com).

At the middle of the experimental period, a digestibility trial of 6 days was conducted to evaluate the intake as well as nutrient digestibility of experimental diets. During digestibility trial, average minimum and maximum ambient temperature was 25.43 and 41.43 °C, respectively. The chemical composition of biological samples, viz. feed and faeces, nitrogen were determined as per AOAC (1990) and their fiber fractions were analyzed as per Van Soest *et al*.(1991). Data were analyzed to test the significant differences between means using 't' test as described by Snedecor and Cochran (1968).

The chemical composition of concentrate mixtures, dry sorghum stover and stover-oat silage are presented in Table 1. Sorghum stover contained 4.88% CP while sorghum stover-oat silage contains 8.01% CP. The stover-oat silage exhibited good aroma and low pH value (4.40). The lactic acid content was 4.90 % and had low content of ammonia-N (11.20%).

The stover-oat silage fed heifers (T2) had a significantly ($P<0.05$) higher roughage intake compared to the stover fed group (T1) without affecting the intake of concentrate mixture (Table 2). The significantly higher roughage intake in T2 resulted in a higher total DM intake as against in T1. Higher intake of roughage in T2 might be due to the better quality of roughage. Yang *et al*. (2010) reported that acid

Table 1. Chemical composition (%) of feed and forages

Particulars	Dry sorghum stover	Stover-oat silage	Concentrate mixture 1	Concentrate mixture 2
CP	4.88	8.01	12.20	15.03
NDF	81.42	75.21	44.82	42.97
ADF	51.79	51.31	13.15	12.99
CF	48.06	43.79	11.76	10.17
EE	1.31	2.32	4.36	4.52
NFE	39.57	39.74	66.45	64.78
Ash	6.18	6.15	5.23	5.50

Table 2. Effect of stover silage on intake and utilization of nutrients in growing heifers

Parameters	T1	T2
Intake of dry matter and nutrients		
DM intake (kg/d)	3.39±0.31[a]	4.30±0.33[b]
Roughage intake (kg)	1.10±0.10[a]	2.40±0.13[b]
Concentrate intake (kg)	2.29±0.22	1.90±0.12
DMI % body weight (kg)	2.46±0.18[a]	2.95±0.09[b]
CP intake (g/d)	406.03±25.29	461.29±30.70
TDN intake (kg/d)	2.12±0.32	2.89±0.21
Digestibility coefficient of nutrients (%)		
DM	66.08±1.54	64.75±0.86
OM	67.67±1.51	67.28±0.77
CP	66.29±2.88	61.83±1.34
NDF	55.69±2.13	56.98±2.66
ADF	49.20±0.96[a]	56.43±1.48[b]
CF	62.47±0.65[a]	68.69±1.01[b]
EE	75.83±1.30	75.89±1.14
NFE	72.28±1.22[b]	68.08±0.93[a]
Plane of nutrition (%)		
DCP	7.20±0.37	6.68±0.23
TDN	65.54±1.41	67.53±0.78

produced during ensiling soften the forage material, thus making the roughage more palatable leading to higher DM intake. Further, under hot climatic conditions, it was observed that heifers usually try to eat more frequent meals of smaller size that might be another cause for reduction in total DM intake in T1. The intake of CP, DCP and TDN were non-significantly higher in T2 as compared to T1.

The apparent digestibility coefficient of DM, OM, CP, NDF EE and NFE was similar between treatment groups, however, the digestibility coefficient of ADF and CF was significantly ($P< 0.05$) lower for stover based diet i.e., in T1, which might be due to the proportionately higher intake of concentrate (67%) as compared to group T2 (44%), corroborating the results of Tafaj *et al*. (2005) who observed significant lower fiber digestibility in cows fed low fiber high concentrate diet. Similarly, Choi *et al*. (2003) also observed the depressive effect of concentrate level on the roughage fiber digestion on increasing the concentrate in the diet over 60 %.

The average daily weight gain (Table 3) was significantly ($P< 0.05$) higher in heifers consumed stover-oat silage diet than those of stover based diet. The higher average daily gain in group T2 might be due to the significantly higher DM intake. The intake of CP, DCP and TDN did not differ significantly. The difference between treatments were nonsignificant as far as feed consumed per kg body weight gain was concerned, however, for a unit gain in body weight less feed was consumed in stover-oat silage based diet than in stover based diet. A similar range of feed to gain ratio was reported by Mahanta *et al*. (2005) in growing crossbred heifers and Singh *et al*. (2009) in heifers fed with different

Table 3. Effect of stover silage on growth performance and feeding cost in heifers

Parameters	T1	T2
Initial body weight (kg)	138.14±14.21	138.71±13.34
Final body weight (kg)	170.28±14.79[a]	180.00±13.35[b]
Weight gain (kg)	32.14±1.03[a]	41.28±1.34[b]
Average daily gain (g)	357.14±11.48[a]	458.73±14.89[b]
Feed to gain ratio (kg)	10.16±0.45	9.45±0.32

Means bearing different superscript in a row differ significantly ($P<0.05$).

levels of berseem hay and sorghum silage based diets. From the experiment it was concluded that the stover-oat silage could be used as summer forage as it significantly improved the dry matter intake leading to significantly higher average daily gain with a positive effect on feed to gain ratio in growing heifers.

SUMMARY

Growing Tharparkar heifers (14) were randomly divided into 2 groups of 7 animals in each. The heifers of control group (T1) were fed on dry sorghum stover based ration along with concentrate mixture, while the heifers of group T2 were offered ensiled forage prepared by ensiling mixture of dry sorghum stover, oat with 2% molasses along with concentrate mixture for 90 days. The results indicated that the stover-oat silage fed heifers (T2) had a significantly higher DM intake as compared to the stover fed group (T1) without affecting the intake of concentrate mixture. The apparent digestibility coefficient of nutrients was similar between groups; however, the digestibility coefficient of ADF and CF was significantly lower for stover-based diet (T1). The average daily weight gain was significantly higher in heifers consumed stover-oat silage diet than those of stover based diet. Thus it was concluded that the stover-oat silage could be used as summer forage as it has a significant effect on DM intake as well as average daily gain in heifers.

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