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Effect of sorghum *stover*-oat silage on intake and utilization of nutrients in lactating cows

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Abstract
Sixteen lactating crossbred cows were randomly divided into 2 groups of 8 animals in each. The cows of control group (T_1) were fed on dry sorghum *stover* based ration along with concentrate mixture, while the cows of group T_2 were offered ensiled forage (prepared by ensiling mixture of dry sorghum *stover* and oat) along with concentrate mixture for a period of 60 days. The results indicated that the *stover*-oat silage fed cows (T_2) had a significantly ($P<0.05$) higher DM intake (8.91 kg/d) as compared to the *stover* (8.24 kg/d) fed group (T_1). The apparent digestibility coefficient of nutrients was significantly ($P< 0.05$) higher for stover-oat silage (T_2) as compared to *stover*-based diets (T_1). The average daily milk yield (6.79 kg/d) was relatively higher in cows consumed *stover*-oat silage diet than those of *stover* based diet (6.24 kg/d). It was concluded that the *stover*-oat silage could be used as summer forage as it has a significant effect on feed intake accompanying with economic benefits in lactating cows.

Keywords: Feed intake, Lactating cows, Nutrient utilization, Sorghum *stover*, S*tover*-oat silage

Abbreviations: **ADF:** Acid detergent fiber; **CF:** Crude fiber; **CP:** Crude protein; **DCP:** Digestible crude protein; **DM:** Dry matter; **EE:** Ether extract; **N:** Nitrogen; **NDF:** Neutral detergent fiber; **NFE:** Nitrogen free extract; **OM:** Organic matter; **SNF:** Solid not fat

Introduction

One of the important challenges in the management of livestock during summer is to maintain the adequate intake of dry matter and nutrients to support the desired level of production. Roughage based ration usually causes diminution in dry matter intake due to low protein and high fiber contents, mainly during summer when ambient temperature is above 27 ^{0}C (NRC, 1981). These situations are further aggravated when animal diets composed of mainly low quality roughages like cereal straws, *stovers* and other fibrous feed resources leading to low production performance. Dry matter intake and animal performance can be enhanced through modification in the diets that promote higher intake e.g., by supplementing good quality forage or by improving the biological efficiency through supplementation of protein and energy rich concentrates. To promote higher intake of DM, a practical approach could be the ensiling of *stover* or fibrous roughages with high moisture green forage crops like fodder oat (Dar *et al*., 2014). Hence, an experiment was conducted to study the effect of dry sorghum *stover*-oat silage on nutrient intake and milk production performance in lactating cows.

Materials and Methods

For the preparation of silage, sorghum *stover* was collected at mature stage in the month of October-November from the Experimental Farm of Indian Grassland and Fodder Research Institute, Jhansi. During the end of February, the sorghum *stover* (around 90% DM) and oats (around 15% DM) were then chaffed and mixed in the ratio of 15:85 (on fresh basis). Whole contents were then put in to a concrete silo, compacted by trampling using tractor and covered with polythene sheet for a period of 45 days. After completion of ensiling period the silos were opened and silage quality was evaluated using analytical techniques of Singh and Pandit (1978).

Sixteen lactating crossbred cows (weighing 321$\pm$11.17 kg) were randomly divided into 2 groups of 8 animals in each group. The cows of control group (T_1) were fed on dry sorghum *stover* based rations along with concentrate mixture-1 (consisting of mustard cake, maize grain, wheat bran, mineral mixture and common salt in the ratio of 22:35:41:1:1, respectively). While the cows of group T_2 were offered ensiled forage along with concentrate mixture-2 (consisting of mustard cake, maize grain, wheat bran, mineral mixture and common salt in the ratio of 9:35:54:1:1, respectively for a period of 60 days as per requirement (ICAR, 1998). Milk yield of each animal was recorded daily. At the middle of the experimental feeding,

a metabolic 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 25.44 and 41.45 ^{0}C, respectively. Proximate composition of biological samples *viz*., feed, urine and faeces were estimated as per AOAC (1990) and their fiber fractions were analyzed as per Van Soest *et al.* (1991). Milk composition was analyzed as per the methods of ISI (1961). Data were analyzed to test the significant differences between means using 't' test as described by Snedecor and Cochran (1968).

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

Particulars	Dry sorghum *stover*	*Stover* oat silage	Concen-trate mixture-1	Concen-trate mixture-2
CP	3.44	18.07	9.83	13.23
NDF	76.22	36.85	59.49	35.22
ADF	47.44	25.03	41.08	17.11
CF	46.55	11.22	36.78	10.24
EE	1.40	4.42	2.30	4.06
NFE	41.66	67.53	40.41	59.75
Ash	6.95	7.52	10.68	3.96

Results and Discussion

Nutrient intake: The nutrient contents of concentrate mixtures, dry sorghum stover and *stover*-oat silage were within the normal range (Table 1). Sorghum *stover* contained 3.44% CP while sorghum *stover*-oat silage contained 9.83% CP. The *stover*-oat silage exhibited good aroma and low pH value (4.45). The lactic acid content was 4.88 % and had low content of ammonia-N (12.40%). The results showed that the *stover*-oat silage fed cows (T_2) had a significantly ($P<0.05$) higher roughage intake (5.91 kg/d) compared to the *stover* (4.17 kg/d) fed group (T_1) while the intake of concentrate mixture was reverse (Table 2). The significantly higher roughage intake in T_2 resulted in a higher total DM intake (8.91 kg/d) as against (8.24 kg/d) in T_1. Higher intake of roughage in T_2 might be due to the better quality of roughage. Yang *et al.* (2010) reported that acid 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 cows usually try to eat more frequent meals of smaller size that might be another cause for reduction in total DM intake in T_1 as has been reported earlier (Cheng *et al.*, 2011). The intake of CP, DCP and TDN were non-significantly higher in T_2 as compared to T_1 group.

Table 2. Effect of stover silage on intake and utilization of nutrients in lactating cows

Parameters	T_1 group	T_2 group
Body wt. (kg)	329.00±14.55	314.88±7.79
DM intake (kg/d)	8.24±0.22^a	8.91±0.18^b
Roughage DM intake (kg/d)	4.17±0.18^a	5.91±0.26^b
Concentrate DM intake (kg/d)	4.07±0.25^b	3.00±0.18^a
DM intake (kg/100 kg wt.)	2.54±0.25^a	2.84±0.12^b
DM intake (g/kgW$^{0.75}$)	106.20±3.66^a	119.50±2.64^b
CP intake (g/d)	873.08±48.10	927.34±40.77
DCP intake (g/d)	492.02±24.75	501.05±20.79
TDN intake (kg/d)	4.47±0.12	5.09±0.26
Digestibility coefficient (%)		
DM	57.88±1.31^a	63.23±1.02^b
OM	58.48±0.70^a	62.42±0.81^b
CP	56.35±1.93	54.06±0.80
CF	54.37±1.44^a	61.88±1.72^b
NFE	55.94±2.11^a	64.51±3.02^b
EE	67.65±2.05	69.85±1.55
NDF	46.26±0.70^a	52.19±0.81^b
ADF	43.53±1.35^a	47.96±0.96^b
Nitrogen balance		
N intake (g/d)	139.73±10.96	148.28±6.52
Faecal N (g/d)	61.00±6.09	68.11±2.99
Urine N (g/d)	27.13±0.34	25.36±1.03
Milk N (g/d)	39.99±2.95	42.45±3.20
N balance (g/d)	11.60±0.18	12.36±0.15
N retention (% of intake)	8.19±0.82	8.42±0.43
Plane of nutrition		
DCP (%)	6.01±0.49	5.64±0.23
TDN (%)	55.15±2.35	56.96±4.25

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

Nutrient utilization: The apparent digestibility coefficient of DM, OM, CF, NFE, NDF and ADF was significantly (P< 0.05) higher for *stover*-oat based diet i.e., in T_2, which might be due to the lower fiber content of roughage, corroborating the results of Tafaj *et al*. (2005) who observed significantly higher DM and fiber digestibility in cows fed low fiber roughage diet. Similarly, Dewhurst *et al*. (2010) also reported higher DM and fiber fraction digestibility in dairy cows maintained on red clover and maize silage based ration. No difference was observed in N retention between treatments. DCP and TDN content of different treatment diets were also comparable.

Lactation performance: The average daily milk yield was relatively higher in cows consumed *stover*-oat silage diet (6.79 kg/d) than those of *stover* based diet (6.24 kg/d) but the difference was non significant statistically (Table 3). The difference in milk yield might be the result of higher DM and other nutrients intake corroborating the earlier findings (Dewhurst *et al*., 2010). The milk composition was almost similar between groups corroborating the previous findings of Kennelly *et al*. (2000). The difference between treatments were non-significant as far as cost of feed consumed per day as well as cost of feed per kg milk produced was concerned. A similar range of cost (Rs. 9.70- 11.60) per kg of milk was reported in cows for different category of commercial farms (Ghule *et al*., 2012).

It was concluded that the *stover*-oat silage could be used as summer forage as it has a significant effect on DM intake accompanying with an economic advantage in product expenses in lactating cows.

Table 3. Effect of *stover*-oat silage on milk yield and cost of milk production in cows

Parameters	T_1 group	T_2 group
Milk production (kg/d)	6.24±0.46	6.79±0.53
Fat (%)	4.45±0.12	4.35±0.11
Protein (%)	4.01±0.11	3.98±0.25
SNF (%)	8.52±0.05	8.59±0.06
Total solid (%)	16.97±0.14	16.91±0.31
Cost of feed (Rs./d)	70.66±4.00	63.75±2.79
Cost of milk production (Rs./kg)	11.60±0.60	9.70±0.63

References

AOAC. 1990. *Official Method of Analysis* 15th ed. Association of Analytical Chemists. Washington D.C.

Cheng, L., E. J. Kim, R. J. Merry and R. J. Dewhurst. 2011. Nitrogen partitioning and isotopic fractionation in dairy cows consuming diets based on a range of contrasting forages. *Journal of Dairy Science* 94: 2031-41.

Dewhurst, R. J., L. J. Davies and E. J. Kim. 2010. Effect of mixtures of red clover and maize silages on partitioning of dietary nitrogen between milk and urine by dairy cows. *Animal* 4: 732-738.

Dar, N. A., K. N. Singh, L. Ahmed, J. A. Sofi, M. E. Bhat and R. Kotru. 2014. Influence of dates of sowing, cultivars and different fertility levels on fodder oat (Avena sativa L.) under temperate conditions of Kashmir valley (India). *Range Management and Agroforestry* 35: 51-55.

Ghule, A. K., N. K. Verma, A. K. Chauhan and P. Sawale. 2012. An economic analysis of investment pattern cost of milk production and profitability of commercial dairy farms in Maharashtra. *Indian Journal of Dairy Science* 65: 329-336.

ICAR. 1998. Nutrient Requirement of Livestock and Poultry (2nd revised edition). India Council of Agricultural Research, New Delhi.

ISI, 1961. Determination of total solids in milk (Gravimetric method). Methods of test for dairy industry: Part II-Chemical analysis of milk. *Indian Standard Institution*, New Delhi. pp. 6.

Kennelly, J. J., D. R. Glim and L. Ozimek. 2000. Potential to alter the composition of milk explored. *Feedstuffs* 72:11-17, 27.

NRC. 1981. Effect of environment on nutrient requirement of domestic animals National Academic press, Washington DC.

Singh, A. P. and N. N. Pandit. 1978. Studies on fermentation of sorghum silage during storage: effect of urea and molasses. *Animal Feed Science and Technology* 3: 299-307.

Snedecor, G. W. and W. G. Cochran. 1968. *Statistical Methods*. I.B.H. Publishing Company, Calcutta.

Tafaj, M, V. Kolaneci, B. Junck, A. Maulbetsch, H. Steingass and W. Drochner. 2005. Influence of fiber content and concentrate level on chewing activity, ruminal digestion, digesta passage rate and nutrient digestibility in dairy cows in late lactation. *Asian-Australian Journal of Animal Science* 18: 1116-1124.

Yang, X., Z. Wang, Z. Yu, Q. Sun and X. Zhang. 2010. Effect of different roughage composition on fermentation quality of total mixed ration. *Pratacultural Science* 27: 139-143.

Van Soest P. J., J. B. Robertson and B. A. Lewis. 1991. Methods for dietary fiber, neutral detergent fiber and non-starch polysaccharide in relation to animal nutrition. *Journal of Dairy Science* 74: 3583-3797.