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Effect of Supplementation of Slow Release Non-Protein Nitrogen Compound on the Lactation of Cows

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Abstract

A feeding trial to study the effect of slow release non-protein nitrogen compound was conducted for 180 days in twelve early lactating Gir and crossbred cows that were divided into two equal groups viz., T_0 (Control) and T_1 (treatment). T_0 received farm made concentrate mixture and T_1 received concentrate mixture containing 1% SRNPN (Slow release non-protein nitrogen compound). The animals in both the groups were fed mixed hay as dry roughage and paragrass as green roughage. Dry matter intake in T_0 and T_1 was comparable. The average daily milk yield, 4% FCM yield, TDN and DCP intake of cows inT_1 was significantly ($P \leq 0.01$) higher than T_0. The efficiency in terms of DM, TDN and DCP required per kg FCM were significantly ($P \leq 0.01$) better in T_1 than $T_{0.}$ The specific gravity, milk protein, solids not fat, total solids and total ash contents of milk were comparable in both the experimental groups, however, the average milk fat percentage in T_1 was significantly ($P \leq 0.01$) higher than T_0. Digestibility coefficients of all the nutrients were higher in SR-NPN supplemented group than SR-NPN non-supplemented feed. Profit realized per day over feed cost per cow was higher in T_1 (Rs.108.34) than T_0 (Rs. 90.29). It can be inferred that efficient utilization of poor quality roughages, better productivity and higher profit margin can be achieved by inclusion of SR-NPN at 1 percent level in the concentrate mixture of lactating cows.

Introduction

The crop residues are referred as low quality roughages, because their physical and chemical complications limit their efficient utilization. Supplementation of slow release urea could improve utilization of poor quality roughages by improving fibre digestion. The fibre digesting microbes need nitrogen for their growth and multiplication. By making nitrogen available continuously in rumen, slow release NPN helps in better growth and multiplication of fibre digesting microorganisms. This ensures better fibre digestion from roughages and release of extra energy from roughages. Slow release urea product could improve utilization of roughages and could even replace the costlier protein supplements (Kononoff *et al.,* 2006). Therefore, the study was undertaken to investigate the effect of supplementation of slow release NPN (SR-NPN) compound in concentrate mixture and mixed hay based feeding on the performance of early lactating crossbred cows.

Materials and Methods

The feeding trial involved twelve early lactating Gir breed, Gir x Holstein Friesian and Gir x Jersey crossbred cows. The cows were divided into two equal groups viz., Group T_0 (control) and group T_1 (treatment), having six cows in each group allotted randomly. The group T_0 received farm made concentrate mixture (Percent ingredient composition - maize-8, cottonseed cake-10, wheat bran- 16.85, pulses by-products-62.80, di-calcium phosphate- 1.00, salt-1.30 and trace mineral mixture 0.05) and group T_1 received concentrate mixture containing 1% Slow release NPN (SRNPN) (Percent ingredient composition - maize- 5.90, cottonseed cake-3.80, wheat bran- 54.00, pulses by-products-32.95, slow release NPN- 1.30, di-calcium phosphate- 1.00, salt-1.30 and trace mineral mixture 0.05), respectively. Slow release NPN used in this experiment was procured from Alltech Biotechnology Pvt. Ltd., Bangalore. It acts as nutrient dense nitrogen source. It is a blended and coated non protein nitrogen source with specific structure which ensures slow release of nitrogen in rumen and maintains optimum level of ammonia in the rumen for 24 hrs. Slow release of ammonia is ensured by embedding small urea particles in a lipid matrix achieved through a carefully designed, multi staged, patented process. Slow release NPN contains : Nitrogen -38.4 %; Ether Extract-14%. Concentrate mixtures in both the groups were made iso-nitrogenous. The cows from both the experimental groups received mixed hay as a source of dry roughage and paragrass (*Brachiariamutica*) as a source of green roughage. The hay consisted of a mixture of Ber (*Ischamum aristatum*), Moshi (*Isceileum aloeighetti*) and Marvel (*Dicanthium annulatum*) grasses. The experiment lasted for 180 days. Conventional practice of feeding concentrate mixture and roughages separately was followed throughout the experiment. The farm procured the feed ingredients from local market in bulk quantities. The concentrate mixture was prepared fresh every day by hand mixing, soaked in water for 4 to 5 hours and was fed in two equal portions. Normal standards of hygiene, management, feeding practices, vaccination and deworming were followed throughout the experimental period. At the mid period and towards the end of this study, digestibility trials of seven days duration were conducted in both the groups by adopting total faecal collection method.

The representative samples of concentrate mixtures, mixed hay and para grass used for feeding the animals were collected, oven dried and pooled feed and fecal samples collected during digestibility trial were analyzed. Laboratory analysis of samples for proximate principles and phosphorus was undertaken as per A.O.A.C. (1990). NDF and ADF were estimated as per Van Soest *et al.* (1991).The composition of milk in relation to Fat, Protein, Total solids and Specific gravity was estimated fortnightly by using Milkoscan Complete Milk Analyzer. Total ash was estimated by gravimetric method and SNF was calculated by difference. The fat corrected (4%) milk yield was calculated by using Gain's formula. The data collected on all the parameters was statistically analyzed as per Snedecor and Cochran (1998) by using paired 't' test.

Results and Discussion

The overall performance of cows from both the experimental groups is given in Table 1. The average dry matter intake and mater intake per unit metabolic body size of cows from group T_1 was slightly higher than group T_0, however, difference between two groups was non-significant. This indicated that supplementation of SR- NPN compound at 1% level to farm made concentrate mixture did not affect palatability of the ration; in fact the dry matter intake was slightly higher in cows supplemented with SR-NPN. Similar results were observed by Sahoo *et al.* (2009).

The average milk yield and 4% FCM yield of cows in group T_1 supplemented with SR-NPN compound was significantly ($P \leq 0.01$) higher than control group. The improvement in the performance of cows receiving SR-NPN compound might be the result of enhanced utilization of fibre from the roughages like hay. The SR-NPN might have improved the growth and multiplication of fibre digesting microorganisms by providing continuous supply of nitrogen in the rumen. The SR-NPN has lower rates of ruminal degradation (Taylor-Edwards *et al.,* 2009), which tends to improve the efficiency

Table 1. Overall performance of cows in both the experimental groups

Parameters	**Groups**		**Results of t test**
	T_0	T_1	
DMI (kg/day)	10.33±0.11	10.39 ±00.11	N.S.
DMI (g)/$W^{0.75}$ kg	126.87±3.30	123.58±3.46	N.S.
Milk yield (kg/day)	5.80[a] 0.38	6.44[b]±0.29	**
FCM (kg/day)	5.52[a]±0.36	6.25[b]±0.25	**
TDN intake/ cow (kg/day)	6.62[a]±0.07	6.97[b]±0.08	**
DCP intake/cow (kg/day)	0.828[a]±0.009	0.881[b]±0.01	**
DMI (kg)/kg FCM	1.94[a]±0.11	1.68[b]±0.04	**
TDN intake (kg)/ kg FCM	1.246[a]±0.068	1.127[b]±0.030	**
DCP intake (kg)/FCM	0.156[a]±0.008	0.142[b]±0.004	**
Milk Specific gravity	1.033±0.0006	1.033±0.0004	N.S.
Milk fat (%)	3.68[a]±0.02	3.83[b]±0.04	**
Milk SNF (%)	9.15±0.14	9.18±0.09	N.S.
Milk total solids(%)	12.82±0.15	13.01±0.11	N.S.
Milk protein (%)	3.63[a]±0.01	3.68[bc]±0.02	**
Milk ash (%)	0.741±0.004	0.746±0.003	N.S.
% TDN	64.14	67.10	-
%DCP	8.02	8.48	-
Profit/d/cow over feed cost (Rs.)	90.29	108.34	-

N.S.: Non-significant ** : Significant at 1%

of microbial protein synthesis, probably because of the better capture of released N by rumen microbes. The results of the present experiment are in accordance with Andrieu *et al.* (2008) who reported significantly (P≤0.01) higher milk production in cows supplemented with Optigen (SR-NPN) than that of control. Contrary to the findings of present study, Bruno *et al.* (2015) observed no difference in milk yield in crossbred calves fed on diets supplemented with slow-release urea.

The average specific gravity and solid not fat, total solids and total ash percentage of milk revealed non-significant effect of feed treatments in cows of both the experimental groups. The average milk fat and protein percentage of T_1 group cows supplemented with SR-NPN compound was significantly (P≤0.01) higher than that for T_0group. These findings are in agreement with Andrieu *et al.* (2008) who reported higher milk fat and protein content in cows supplemented with Optigen than that of control. Highstreet *et al.* (2006) reported increased (P<0.01) milk protein content due to replacement of urea with Nitroshure, a controlled rumen release urea in the TMR, of early lactation Holstein cows.

The average TDN and DCP intake of cows from group T_1 was significantly (P≤0.01) higher than control group. The significant improvement in TDN intake in SR-NPN supplemented groups as compared to control, irrespective of source of roughage also indicated beneficial effect of SR-NPN on the nutritive value of roughage. The findings from the present study are in agreement with Stewart *et al*. (2008) who observed greater nitrogen intake for cows receiving Optigen diet than soybean meal. The efficiency of feed utilization in terms of DM, DCP and TDN required per kg FCM was significantly (P≤0.01) better in group T_1 than control group.

The results of digestibility trials indicated (Table 2) that the SR-NPN supplementation to concentrate mixture with hay feeding had resulted in higher digestibility of all the nutrients when compared with that of SR-NPN non-supplemented feed. This, in turn, resulted in higher TDN and DCP contents in SR-NPN supplemented group. The economics of milk production revealed that the profit realized per day over feed cost per cow from groups T_0 and T_1 was Rs.90.29 and 108.34,

Table 2. Average percent digestibility coefficients of nutrients of different feed treatments

Nutrient (%)	Groups	
	T_0	T_1
Dry matter	54.93±0.38	57.00±0.34
Organic matter	67.87±0.24	69.73±0.30
Crude protein	67.87±0.29	70.19±0.38
Ether extract	63.31±0.61	64.42±0.45
Crude fibre	59.93±0.40	62.13±0.39
Nitrogen free extract	71.64±0.12	73.76±0.30
Neutral detergent fibre	52.83±0.47	55.90±0.45
Acid detergent fibre	41.30±0.30	45.05±0.20
TDN (%)	64.14	67.10
DCP (%)	8.02	8.48

respectively. Thus, more profit was recorded from group T_1 supplemented with SR- NPN than that of SR-NPN non-supplemented group T_0.

The overall results of the study indicated that inclusion of slow release NPN compound at 1% level in concentrate mixture of lactating cows had significant positive effect on milk production and its composition. The results also showed that slow release NPN supplementation resulted in improved utilization of poor quality roughage like hay due to better intake, improved digestibility of the nutrients, better plane of nutrition, better feed utilization and efficiency in lactating cows in comparison with that of SRNPN non supplemented group. Thus, it can be inferred that efficient utilization of poor quality roughages, better productivity and profit margin in lactating cows can be achieved by inclusion of SR-NPN at 1 percent level in the concentrate mixture of lactating cows.

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Conflict of Interest:

All authors declare no conflict of interest.

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