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Effect of Urea Molasses Mineral Block Supplementation on Milk Production in Murrah Buffalo under Small holder's Production System

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ABSTRACT

The present study was conducted at farmer's field in Muzaffarnagar district of Uttar Pradesh to assess the response of urea molasses mineral block (UMMB) supplementation on milk production and body condition score in buffaloes. Twenty Murrah buffaloes in early lactation stage were selected and divided into two groups of 10 each. Animals of T_1 group were given free access to urea molasses UMMB for two-three hours in the morning in addition to their normal ration for eight weeks after adaptation period of two weeks. However, the buffaloes in control (T_0) group did not receive any supplement. The buffaloes were managed as per the standard feeding practices followed by the farmers. Significant increase in milk yield ($P<0.05$) was recorded due to feeding of UMMB as compared to control group. The daily milk yield of buffaloes was increased by 26.95 % due to supplementation of UMMB. Considering the present cost of feed supplement and the market price of milk, UMMB supplementation appears to be both economical and cost effective. Supplementation had a positive effect on milk production and BCS of buffaloes maintained under small holder conditions. However, there is need for long-term studies on more number of milch animals to assess the response of UMMB supplementation on animals' health, production and reproductive performance under smallholder conditions.

Key words: Buffaloes, Milk production, Small holders production system, Urea molasses mineral block

INTRODUCTION

Dairy animals are an important source of regular cash income and livelihood under smallholder production system in developing countries. The demand of milk and milk products is increasing, day-by-day due to increase in the human population, income and urbanisation (Herrero and Thornton 2013). However, the average productivity of dairy animals in India is far below as compared to the productivity levels of dairy animals in developed nations (Misra *et al.,* 2019). The major reason for low productivity is poor nutrition, as majority of dairy animals are maintained on low quality cereal crop residues such as wheat straw, stovers and dry grasses (Misra *et al.,* 2009). These crop residues are low in nitrogen and high in crude fibre and lignin, characteristics that restrict intake and digestibility and are insufficient to support satisfactory milk production (Duncan *et al.,* 2013) and often result in low daily milk yields, short lactation periods (6-8 months) and long calving intervals. Supplementation with the locally available concentrate is a common practice among smallholder farmers (Sharma *et al.,* 2003).

The use of urea molasses mineral blocks (UMMB) for supplementing crop residues based diet of livestock has been well documented in ruminants (Sansoucy 1995; Garg *et al.,* 1998; Singh and Singh 2003) and has the potential to improve general, productive and reproductive health of animals and to overcome the detrimental effect of deficiencies on animal performance (Leng *et al.,* 1991; Singh and Singh 2003; Misra *et al.,*2006), to increase dry season milk supplies and increase household income (Garg *et al.,* 1998; Patel, 2002; Singh and Singh, 2003). However, very limited studies have evaluated effects of UMMB supplements at farmers' field. Therefore, the present study was conducted to assess the effect of UMMB supplementation on milk production in Murrah buffaloes at farmer's field in Muzaffarnagar district of western Uttar Pradesh.

MATERIALS AND METHODS

The present study was conducted in Lalukheri and Salahkehri villages of Baghara block, Muzaffarnagar,

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Uttar Pradesh, India. The study area are located at 29°47'N latitude, 77°71'E longitude and 233 m altitude from mean sea level. Semi-arid climate conditions prevail in the area with an average annual rainfall around 929 mm, and highest precipitation falls in July with an average of 261.4 mm. June is the warmest month with average temperature of 30.2°C, and January is the coolest month with average temperature of 12.5°C. Urea Molasses Mineral Blocks were prepared as per the method described by Bohra *et al.*(2012) at Agricultural Technology Information Centre of the institute. The principal feed ingredients and their proportion used for preparation of UMMB along with cost is given in Table 1.

Sixteen farmers, each having at least one Murrah buffalo in early lactation stage (about 5-6 weeks after calving), preferably of second to fourth parity, were selected for the on-farm feeding trial based on their willingness to participate. This was achieved through a Participatory Rural Appraisal exercise. The body weight of the selected buffaloes was in the range of 400-450 kg approximately with an average daily milk yield of about 9.0 kg/buffalo. The selected animals were dewormed before the commencement of the experiment and were managed by the farmers according to their farm practice. Based on the local feeding practices, body weight, milk yield, stage of lactation and parity, the buffaloes were divided into two groups (ten each) as Control (T_0) and Treatment (T_1). The animals in the control group were fed according to the farmers' practice and those in the treatment group were additionally offered UMMB lick. All the selected animals were reared under semi-intensive system of management. The UMMB was kept in front of the animals in the feed manger to allow free licking for two-three hours in the morning. The animals were provided both dry and green roughage, and homemade concentrate, and were housed in semi loose housing system with concrete, sand and brick flooring. The sugarcane tops and wheat straw was the major source of roughage used for feeding along with some amount of available green fodder (Berseem, Maize/MP Chari) and homemade concentrate. Fresh water was made available to the animals at all the time of the day. Hand milking was done twice a day, at 5 to 6 AM and 5 to 6 PM and milk yield of individual animal was recorded by the farmers on milk recording sheet provided to them. The on-farm experiment was conducted during March and May 2019, and data were recorded over a period of eight weeks after an adaptation period of two weeks. Field visits were carried out once a week to monitor the intake of feed and UMMB, milk production and general health of the animals. The body weight of buffaloes was estimated at the beginning and end of the feeding trial

Table 1. Principal feed ingredients of Urea Molasses Mineral Feed block

Ingredients	%	Quantity, kg	Cost, ₹/kg	Total feeding cost, ₹/animal
Urea	5.0	8	7	56
Molasses	25.0	41	13	533
Mineral mixture	5.0	8	100	800
Salt	4.0	7	8	56
Wheat bran	32.0	53	14	742
GNC	23.0	38	32	1216
Dolamite	6.0	10	10	100
Total	100	165		3503
Labour charge, *etc.* (₹)		-	-	497
Grand total				4000
Dry weight of UMMB				150 kg
Cost of UMMB, ₹ /kg				26.67

indirectly by measuring heart girth of the animals as suggested by Sastry *et al.* (1988) and body condition score was assessed using the scale of 1 to 5 (1 poor and 5 excellent) according to the procedure designed by Braun *et al.* (1985).The participating farmers daily recorded the intake of concentrate, green and dry fodder, block and milk production on pre-designed data sheets. These sheets were checked at each visit for accuracy and consistency.

Feed and fodder samples fed to experimental buffaloes were collected at fortnightly intervals, bulked, ground and analysed for proximate composition according to standard procedures of AOAC (1995). The total digestible nutrients (TDN) content of feed were estimated using equations reported by Van Soest (1982) and Chandler (1990). The partial budget analysis was done to estimate the likely economic impact of supplementation technology (Stemmer *et al.,* 1998) and cost-benefit ratio was calculated to assess the economical profitability of supplements (Amir and Knipscheer (1989). In partial budget analysis, only those items of income and expenses were considered that change (Peso, 2002). Therefore, the costs of ingredients used in preparation of UMMB only have been considered, since all other variable costs are the same for both the groups. The following assumptions were made in the calculation of partial budget analysis. The green fodder was fed in the mixed form consisting of Berseem/MP Chari and sugarcane tops in the ratio of about 25:75. The cost of feed and fodders (₹/100 kg) was calculated on the basis of market rate prevalent during the experimental period in the study area, as berseem/MP Chari-₹ 200, sugarcane tops-₹ 150, wheat straw-₹ 500, concentrate-₹ 2000, and UMMB-2670/ 100 kg. Selling price of milk received by the farmer during the experimental period was taken (₹ 41/litre). The data collected was analysed using statistical software SPSS 22 (SPSS version 22, SPSS Inc. Chicago, Illinois). One way ANOVA was used to test the level of significance.

RESULTS AND DISCUSSION

The intake of feed and fodder offered to experimental animals and their proximate composition is presented in Tables 2 and 3. The sugarcane tops and wheat straw were the two major source of roughage along with some amount of seasonal green fodder (berseem/Maize/MP chari) and homemade concentrate.Wheat straw and sugarcane tops was of low quality (4.2 – 5.2% crude protein(CP); 70-74% neutral detergent fibre (NDF); Maize/ MP Chari were of medium quality (> 7% CP and 62-71% NDF) and berseem and concentrate was of good quality (Table 2).

Data pertaining to the response of UMMB

Table 2. Proximate composition of feedstuffs offered to experimental animals

Nutrient	Concentrate	UMMB	Wheat straw	Sugarcane top	Berseem	MP Chari	Maize
DM	90.75±1.3	92.79±0.21	91.13±1.2	32.31±1.8	21.31±1.9	26.38±1.8	21.44±2.1
				on % DM basis			
OM	89.59±2.4	78.51±1.5	91.78±2.1.	90.68±2.3	86.79±1.9	90.82±1.7	91.95±1.9
CP	17.17±1.3	35.49±2.4	4.23±0.4	5.17±0.7	19.17±1.3	7.23±0.5	7.72±0.6
CF	9.74±0.7	4.58±0.4	33.73±2.2	33.17±2.0	21.04±2.1	32.15±1.8	27.81±1.9
EE	2.86±1.5	0.69±0.3	1.17±0.2	1.49±0.3	2.78±0.3	1.29±0.2	2.07±0.4
NDF	39.39±0.4	16.11±0.3	74.13±4.1	70.16±3.7	37.85±2.4	62.58±3.9	71.38±3.4
ADF	14.75±0.3	10.23±0.3	43.24±0.6	38.21±0.9	22.11±1.0	39.87±1.1	31.92±1.3
Ash	10.41±0.4	21.49±1.6	8.22±1.1	9.32±0.9	13.21±0.8	9.18±0.7	8.05±0.6
Ca	0.71±0.02	5.41±0.6	0.49±0.03	1.32±0.04	1.79±0.13	0.37±0.04	0.53±0.04
P	0.93±0.03	1.97±0.16	0.18±0.05	0.51±0.04	0.31±0.03	0.24±0.06	0.43±0.04

DM, dry matter; OM, organic matter; CP, crude protein; CF, crude fibre, EE, ether extract; NDF, neutral detergent fibre; ADF, acid detergent fibre

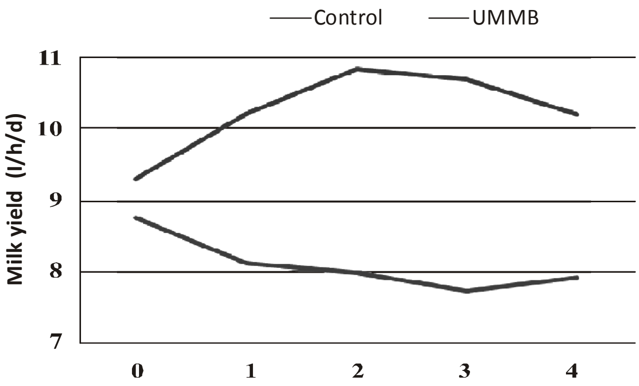

Fig. 1. Effect of UMMB supplementation on milk yield of buffaloes

supplementation on milk production and body condition score of buffaloes have been presented in Table 4. The buffaloes supplemented with UMMB produced 26.95 % more milk than those of without supplementation. The average intake of UMMB was 250 g/day/animal, and it was ranged from 210 to 315 g/animal/day. Significant difference in DM intake was recorded due to UMMB supplementation. Improvement in DM intake due to UMMB supplementation has been well established depending on quality of basal diet. This variation in intake is understandable given the variability in lactation stage, parity, age and basal feeds provided by the different farmers. Supplementation of UMMB enhanced the milk yield of buffaloes significantly (P<0.05). The fortnightly change in milk yield is depicted in Figure 1. Increase in milk production due to UMMB supplementation has been reported by various researchers (Singh and Singh 2003; Misra *et al.,* 2006) and may vary widely depending on nature of basal feed and feeding system. Similar results were reported by Patidar *et al.* (2014) under field condition in Nagaur district of Rajasthan. Findings of the present study confirm the results of earlier workers indicating an extra yield of 0.5-1.5 kg milk (Misra *et al.,* 2006; Tanwar *et al.,* 2013; Upadhyaya *et al.,* 2018) and/ or saving of 20-30% concentrate with a reduction of feed wastage of 20-30% (Leng *et al.,* 1991; FAO 2007).

On-farm experiment conducted in Uttaranchal, India indicated that the addition of blocks to the diet increased milk production by about 37% in buffaloes and 34% in local cows, without any adverse effect on the body weight and health of the animals (Singh and Singh, 2003). Leng *et al.* (1991) compared the results of conventionally fed animals with those fed UMMB and by-pass protein along with decreasing quantities of concentrate; showed that after reducing the amount of concentrate by 40%, feeding of UMMB and by-pass protein maintained the milk yield and increased the farmers net income. The improvement in milk yield may be explained that the energy: protein ratio may be balanced in the ration supplemented with UMMB and led to subsequent maintenance of ammonia content in the rumen resulting to an improved rumen environment for micro-organisms (Leng *et al.,* 1991).

The buffaloes in the on-farm study had good body condition scores ranging from 2.3 to 3.7. The body condition score of supplemented animals was increased significantly as compared to control animals (Table 4). The average BCS of treatment group was 2.98±0.07 at the start of feeding which increased to 3.15±0.06 at the end of experimental feeding, which indicated that daily feed intake was sufficient to meet the nutritional

Table 3. Average feed intake of lactating buffaloes (kg/day/animal)

Particulars	Control	UMMB
Dry matter intake, kg/day		
Green fodder	5.76±0.43	6.99±0.52
Dry fodder	5.24±0.61	5.39±0.71
Concentrate	2.54±0.43	3.49±0.52
Urea molasses mineral block	—	0.23±0.03
Total DM intake, kg/day	13.54±0.41[a]	16.10±0.78[b]
Dry matter intake as % live weight	3.36±0.31[a]	3.90±0.43[b]

Table 4. Effect of UMMB supplementation on DM intake (kg/h/d), milk production (l/h/d) and BCS of lactating buffaloes

Particulars	Control	UMMB
Initial body weight, kg	399±29	405±31
Final body weight, kg	407±25[a]	421±23[b]
Initial body condition score	2.50±0.08	2.98±0.07
Final body condition score	2.43±0.07[a]	3.15±0.06[b]
Average milk yield, litre/day/animal	8.09[a]±0.16	10.27[b]±0.33
Total dry matter intake, kg/day	13.54±0.41[a]	16.10±0.78[b]
Dry matter intake as % live weight	3.36±0.31[a]	3.90±0.43[b]
Dry matter requirement, kg/day	15.34	-
Crude protein requirement, kg/day	1.676	-
Crude protein intake, kg/day	0.983±0.22	1.299±0.32
TDN requirement, kg/day	7.67	-
TDN intake, kg/day	7.31±0.17[a]	8.76±0.26[b]

[ab]Means with different superscripts in the row differ significantly ($P<0.05$); *75 % Sugarcane top and 25 % Berseem/Maize/MP Chari; **400 kg body weight, 10 kg milk yield with 6 % fat content

requirement of lactating buffaloes. The DM, CP and TDN requirement as recommended by ICAR (2013) for buffalo weighing 400 kg and producing 10 litre milk daily with 6 % fat was 15.34, 1.68 and 7.67 kg, respectively. The average daily DM, CP and TDN intake of supplemented group was sufficient to meet their nutritional requirements, weighing 400 kg and yielding 10 liters milk with 6 % fat content (ICAR, 2013). However, the diets of control animals were unable to meet the nutrient requirement, which was reflected in milk yield and BCS.

The net benefit due to supplementation with UMMB on per animals basis was ₹ 54.91/day over the traditional feeding. Feeding of UMMB improved

Table 5. Economic evaluation of UMMB supplementation in buffaloes (₹/day/animal)

Particulars	Control	UMMB
Average milk yield, liter/cow/day	8.09[a]±0.16	10.27[b]±0.33
Increase in milk yield, litre/cow/day	-	2.18
Total milk yield, litre	485.4	616.2
Cost of UMMB, ₹	-	400
Cost of concentrate, ₹	3360	4620
Cost of dry roughage, ₹	1722	1740
Cost of green fodder, ₹	1860	2250
Total variable cost, ₹.	6942	9010
Change in variable cost, ₹	-	2068
Gross return from sale of milk, ₹	19901.4	25264.2
Gross return over control, ₹	-	5362.8
Net return, ₹	12959.4	16254.2
Net return over control, ₹	-	3294.8
Marginal Rate of Return, %	-	159.32
Benefit: Cost Ratio	-	8.23

marginal rate of return by 159.32%, which appears to be lucrative over the traditional feeding system (Table 5). High returns are required from any farm innovations to offset the risks associated with its adoption (Peso 2002). World Bank experiences showed that increased earnings of 200% are needed to assure that small holders will adopt a new technology package (Donaldson 1991). Apart from increase in milk production, significant improvement in reproductive parameters was recorded in supplemented animals that have economic importance for life time productivity of dairy animals. Thus, in the present experiment, the returns of UMMB supplementation may still be higher if likely positive long-term impact of supplementation on general body condition and reproduction is also taken into account. Similar results were reported by Patidar *et al.,* 2014 under field condition in Nagaur district of Rajasthan. Block supplementation with crop-residue-based diets has resulted in increased milk production, with a favourable cost-benefit ratio, varying from 1:2 to 5:5 depending on the purchase price of ingredients and selling price of milk (Makkar 2007).

CONCLUSION

The cost of production of UMMB was ₹ 26.66/kg and net profit was ₹ 54.51/animal /day. Considering the present cost of feed supplement and the market price of milk, UMMB supplementation appears to be both economical and cost effective. Supplementation had a positive effect on milk production and BCS of buffaloes maintained under small holder conditions. Nonetheless, it must be mentioned that farmers in the study area offered good quality feed and fodder to their animals because of that actual response of supplementation may not be realised. Earlier workers (Leng *et al.,*1991; FAO 2007)) also reported that responses of supplementation of UMMB are negligible when animals are offered good quality feed. Therefore, there is need for long-term studies on more number of milch animals to assess the response of UMMB supplementation on animals' health, production and reproductive performance under smallholder conditions.

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