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Effect of feeding of urea ammoniated soybean straw on dry matter intake, yield and quality of cow milk

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ABSTRACT

Feeding of untreated (T_2) and 2% urea treated SBS (T_3) was evaluated in reference to Jowar straw diet (T_1) with the main objective to find out its effect on dry matter intake, yield and quality of cow milk. Enrichment of soybean straw with urea increases the palatability and acceptability of SBS in cows, which results in more consumption of straw by 42% in reference to untreated straw. Over the experimental period, T_3 cows produced 26 and 29, and 24 and 25% more milk and 4% FCM despite of reduction in the concentrates feeding by 62 and 42% in comparison to T_1 and T_2 cows, respectively. Similarly, the quality of milk in respect to specific gravity, fat, protein, SNF and total solids contents were significantly improved in T_3 than that of T_1 and T_2 groups. The results do suggest that 2% urea treated SBS can find a place in the ration of lactating cows without any adverse effect on performance of cows.

Key words: Cow milk, Dry matter intake, Milk quality, Milk yield, Urea ammoniated soybean straw

For sustaining profitability of a livestock enterprise, balanced and economic feeding is essential. Inadequate supply of quality fodder with better digestibility has been recognized as one of the reason for poor livestock production in India (Annual report of GCMMF, 2015–16, Kumar *et al.* 2016). The problem of feed shortage is exacerbated by high cost of good quality protein supplements; therefore to introduce available and cheaper unconventional feed resources without compromising the quality is the area of focus in recent years (Datta 2013, Arvindraj *et al.* 2017 and Manjula *et al.* 2017). Soybean (Glycine max L.) is a major crop grown for its protein and oil rich seeds but it also makes valuable feed and fodder (Heuze *et al.* 2016), but soybean straws are coarse and fibrous which cause digestibility (Blount *et al*. 2013).Urea treatment may be the most suitable method for small scale farmers to improve the quality of straws (Hanafi *et al.* 2012, Gunun, *et al*. 2013). Very few and scanty reports are available regarding use of soybean straw. On the basis of these facts, an effort was made to find out the utility of same in the diet of lactating cows and its effect on dry matter intake, yield and quality of milk.

MATERIALS AND METHODS

Present investigation was conducted at Akola located on the latitude of 22.42° North and longitude of 77.02° East with a height 307.4 meter above mean sea level in hot climate area of the tropical region. Fifteen mid lactation stage cows were selected and randomly divided into three groups on the basis of nearness in their average milk production and body weight. Further, each group was allocated randomly to treatments, namely, untreated Jowar straw *ad lib*. + concentrate mixture (1 kg) for maintenance and 40% for milk production (T_1); untreated soybean straw *ad lib*. + concentrate mixture (1 kg) for maintenance and 20% for milk production (T_2) and 2% urea ammoniated soybean straw *ad lib.* + 1 kg concentrate mixture for maintenance (T_3). Beside this, 5 kg green fodder (Hybrid Napier- Yashwant) was fed to all cows and concentrate (Sugras a product of MAIDC) was fed as per treatment. The feed intake was quantitatively measured to assess the dry matter intake. Milk yield was recorded both in the morning and evening for whole experimental period. 4% FCM was calculated by using formula (Sastri and Thomas 1976). Specific gravity, fat, protein, solids-not-fat, total solid content of milk were determined by using standard methods. The experimental data were analyzed statistically by using the procedure as given by Amble (1975).

RESULTS AND DISCUSSION

Dry matter intake (*DMI*): The actual intakes of feeds are important for expressing productivity, considering same DMI of cows under different treatments over the experimental period were worked out from the total intake of different feeds and overall averages DMI kg/day/cow under different feeding treatments were compared with standard norms of 2.5 kg DM/100 kg body weight (Jagdish Prasad and Neeraj 2008) and presented in Table 1.

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It appears from Table 1 that the DMI in cows of all the treatments was sufficient to meet out nutritional norms. The cows reared on Jowar straw and urea treated SBS ration received more DM by 21.97 and 14.82% in comparison to recommended levels. Similar results were also reported by Mudgal (2010) who observed no negative effect on the dry matter intake of SBS. Nguyen *et al.* (2012) reported that urea treatments as nitrogen source improves the intake, digestibility and utilization of low quality roughages. This finding also supports the findings reported by Hanafi *et al*. (2012), Gunun *et al.* (2013), Blount *et al.* (2013), Heuze *et al*. (2016), Arvindraj *et al.* (2017) and Manjula *et al*. (2017).

Milk production: The data related to milk production of cows under different treatments are presented in Table 2.

The weekly total milk production (kg/cow) of the cows differed significantly between the feeding treatments. The cows from 2% urea treated (T_3) group produced 24 to 26% more milk and beneficial to increase the milk production in cows. Soloman (2000) reported increase in milk production of cows by 7 to 10% with feeding of soybean by products. Arriaga *et al.* (2010) observed significant differences in milk yield as a result of different intake of nitrogen, supporting the trends of present study. Perhaps improvement in the intake of CP and its digestibility in T_3 treatment might be the reason to increase the milk production in cows.

Table 1. Average DMI (kg/day/cows) in comparison to feeding standards

Treatment	BW (kg)	DMI (kg)	DM requirement (kg) (2.5 kg % BW)	Per cent (excess/ deficit) intake
T_1	291.29	8.88	7.28	+21.97
T_2	296.38	7.48	7.41	+0.94
T_3	299.42	8.60	7.49	+14.82

Presently milk procurement prices are dependent on fat content of the milk. The milk having fat content more than legal standards (3.5%) received additional bonus price. Considering this, 4% fat corrected milk (FCM) was worked out and presented in Table 2 and the trend indicates that the cows from T_3 group produced approximately 29.71 and 25% more FCM over that of T_1 and T_2 group cows respectively. This means feeding of either untreated or urea treated SBS was advantageous to increase FCM production in cows over that of conventional straw feedings. The trend of results agreed with past work reported by Khalid (2008) and Hanafi *et al.* (2012).

This finding also supports the findings reported by Gunun *et al.* (2013), Blount *et al.* (2013), Heuze *et al*. (2016), Arvindraj, *et al.* (2017) and Manjula *et al*. (2017)

Table 2. Average weekly milk yield and calculated FCM at 4% (kg/cow) over experimental period under different treatments

Week	Week wise mean values of treatments (kg/week/cow)			Pooled means	Means (Daily milk yield, kg/cow)	Calculated means of FCM 4% (kg/day/cow)
	T_1	T_2	T_3			
Week-1	27.79	28.28	27.59	27.89^{a}	3.98	4.28^{a}
Week-2	28.08	28.43	27.83	28.11^{a}	4.02	4.32^{a}
Week-3	28.65	29.00	29.75	29.13^{ab}	4.16	4.51^{ab}
Week-4	29.37	29.41	31.85	30.21^{b}	4.32	4.70^{b}
Week-5	29.55	29.58	33.95	31.03^{b}	4.43	4.85^{c}
Week-6	29.71	29.68	36.75	32.05^{b}	4.58	5.04^{d}
Week-7	29.71	29.75	37.94	32.47^{b}	4.64	5.09^{d}
Week-8	29.69	29.77	40.95	33.47^{b}	4.78	5.29^{e}
Week-9	29.07	29.59	40.81	33.16^{b}	4.74	5.26^{e}
Week-10	28.76	29.38	40.81	32.98^{b}	4.71	5.25^{e}
Week-11	29.17	29.35	40.67	33.06^{b}	4.73	5.27^{e}
Week-12	29.34	29.73	40.46	33.18^{b}	4.74	5.28^{e}
Week-13	29.09	29.49	39.97	32.85^{b}	4.69	5.23^{e}
Week-14	29.41	29.59	39.55	32.85^{b}	4.69	5.22^{e}
Week-15	29.23	29.39	39.27	32.63^{b}	4.66	5.24^{e}
Week-16	28.53	29.18	38.71	32.14^{b}	4.59	5.09^{f}
Week-17	28.28	29.30	38.43	32.00^{b}	4.57	5.07^{f}
Pooled Mean	29.26^{a}	29.59^{a}	36.78^{b}	31.88	4.53	5.01
Daily milk yield kg/cow-Mean	4.15	4.18	5.25	4.53		
FCM 4% Pooled Mean	4.51^{a}	4.68^{b}	5.85^{c}	5.01		
Particular	Treatment		Week		Interaction	
'F' test	Sig.		Sig.		Sig.	
SE(m)±	0.1654		0.3938		0.6821	
C.D. (P<0.05)	0.4586		1.0917		1.3370*	
C.V.%	5.1813					

*At same level of main treatment.

Table 3. Effect of different feeding treatments on milk quality over experimental period

Milk quality parameter	Treatment			F test	SEM±	CD	CV
	T_1	T_2	T_3				
Natural acidity (% LA)	0.126	0.127	0.126	NS	0.00047	—	5.6173
Specific gravity	1.0285	1.0290	1.0292	NS	0.000164	—	0.1470
Fat (%)	4.38	4.57	4.69	Sig.	0.0156	0.0433	3.1660
Protein	3.32	3.48	3.70	Sig.	0.0077	0.0215	2.0034
Solids not fat	8.72 (2.95)	8.83 (2.97)	8.93 (2.99)	Sig.	0.0047	0.0129	1.4997
Total solids	13.10 (3.62)	13.40 (3.66)	13.62 (3.69)	Sig.	0.0036	0.0100	0.9330

Values shown in table were pooled weekly mean values of 17th week period. Figure shown in bracket indicates square root transformation for analysis. Sig., Significant; NS, Non significant; CD at P<0.05.

with respect to problems of feed shortage and effective use of cheaper good quality protein supplementing unconventional soybean straw treated with urea.

Milk quality: The milk quality is judged on the basis of different chemical properties, particularly fat and SNF contents. Considering these aspects, the data obtained in this regard are presented in Table 3.

A reference to Table 3 indicates that natural acidity in terms of % lactic acid and specific gravity did not change significantly by the feeding treatments. This means that feeding of SBS to lactating cows produced the milk of normal quality and had no adverse effect on the salt balance of milk like citrate, phosphate and chlorides and concentration of milk solids in milk.

The fat content of milk was affected significantly by the feeding treatments. Significantly highest fat content in milk (4.69%) was noticed when the cows were reared on T_3 diet, followed by T_2 and T_1 treatments. The increase in fat might be on account of lower intake of concentrate component and promoting more intake of fibrous straw component. This situation might have created favourable conditions for production of more acetic acid in rumen and thereby changing the ratio between acetic acid and propionic acid production in rumen as a result reflecting on the synthesis of volatile fatty acids in rumen. Feeding of either untreated or urea treated SBS was increasing milk proteins by 4.82 and 11.45% over that of conventional Jowar straw and concentrates feeding to the cows. Perhaps increased intake of dietary nitrogen in T_2 and T_3 cows compared to T_1 cows might be the reason to raise the milk nitrogen content and thereby apparently protein levels in milk. Khalid (2008), Mewara *et al.* (2008) and Kamal *et al.* (2012) reported similar results which supports the present results. Inclusion of urea treated SBS in the ration of lactating animals did not hamper the SNF content in milk. Similarly, milk SNF reported by Gopalkrishana (2012) are supportive to present results. Significantly highest TS content was noticed in milk produced by the cows in T_3 group, followed by T_2 and T_1 groups. This trend appears obvious as fat and SNF content of milk in T_3 group were more and these are the contributing constituents for emerging out TS content of milk. Moreover, Pawar (2010) also reported an increase in TS content of milk due to feeding urea treated Jowar straw, while Kampha *et al.* (2009) also observed higher TS content of milk as a result of feeding urea treated corn silage to cows. These views were in agreement with present results. Similarly, Gopalkrishanan (2012) reported TS content of cow milk as 13.12% which seems to be nearer to present values.

Enrichment with urea increases the palatability and acceptability of SBS in cows, thereby more consumption of straw by 42% in reference to untreated straw. Lactating cows reared on 2% urea ammoniated enriched SBS ration produced, 26 and 24% more milk and 4% FCM in comparison to untreated SBS ration. Feeding of 2% urea ammoniated SBS diet to cows was also found beneficial to improve fat, protein, SNF and TS content of milk.

Therefore, the results suggest that 2% urea treated SBS can find a place in the ration of lactating cows without any adverse effect on performance of cows. The results also points out that cow having up to 300 kg body weight and producing 5 kg milk/day can be reared on urea treated SBS + 1 kg concentrates and little green fodder. However, the cows having higher body weight would need more concentrates according to feeding standards to fulfill nutritional requirements.

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