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RESEARCH ARTICLE.....

Effect of formaldehyde treated concentrate, urea and soybean meal on proximate analysis and feed intake in lactating cows

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ABSTRACT..... Present investigation entitled "effect of formaldehyde treated concentrate, urea and soybean meal on proximate analysis and feed intake in lactating cows" was undertaken at Department of Animal Husbandry and Dairy Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Feeding of 1.5 per cent formaldehyde treated 70:30 sugras : SBM concentrate mixture with 2 per cent added urea diet to lactating cows (T_3) was evaluated in relation to sugras untreated ration (T_1). SBM contained 49.50 and CP against a content of 17.60 per cent CP in sugras concentrate. The untreated 70:30 mixture had 27.47 per cent CP and 1.5 per cent HCHO treatment to mixture did not influence the proximate principles, though there was slight decrease in the constituents of mixture. The average DMI was 7.97, 7.78, 7.85, 7.01 and 7.21 kg/cow on feeding control (T_1), 70:30 untreated (T_2) and HCHO treated (T_3) concentrate mixture with 2 per cent added urea and 70:30 untreated (T_4) and HCHO treated (T_5) concentrate mixture with 3 per cent added urea supplementation diets, respectively. Per cent BW DMI under different treatments clearly indicated that the cows received sufficient DM to fulfill the appetite and consequently supply of nutrients to the body. The unit body size intake of all the cows met out the nutritional standards of 2.5 kg DM/100 kg body weight. Hence, it seems no reason to consider the adverse effect of feeding formaldehyde treated (1.5 g/100 g CP) concentrate with added urea ration to cows in reference to express their optimum performance.

KEY WORDS..... Formaldehyde, Sugras, Urea, Soybean meal, Proximate analysis, Feed intake, Dry matter intake

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INTRODUCTION.....

Animals exert sufficient physiological stress during lactation as a cow weighing 350 to 400 kg produces 1000 to 2000 kg of milk in a lactation which amount to 4 to 5 times of its own body weight. Obviously it becomes necessary to have a sound balanced feeding management in order to relieve the physiological stress on one hand and allow the animal to express its genetic potential of milk production. Feeding management in reference to DM and protein intakes has positive significant impact on milk production and feeding of required amount of concentrates to fulfil nutritional

demands would favour milk production (Garg *et al*., 2007). Moreover, about 70 per cent of the total expenditure is increased on feeding of animals, there by directly related to economics of the dairy business. Considering these aspects, one has to pay due attention to feeding of cows in order to harvest maximum possible production.

On this background soybean meal or cake (SBM) offers an alternative to conventional GNC, CSC, mustard cake, til cake, rape seed etc. During couple of years it is noticed that the area under soybean crop has shown a growth of 15 per cent in Maharashtra, giving a setback to cereals, pulses and oil seeds crops. Secondly increased cost of GNC oil, people have motivated to soybean oil, resulting established of number of oil extraction plant at district level. This will boost to the availability of soybean meal on large scale. It is rich in protein (48 to 50% CP) against the established cakes (20 to 40% CP). As a result on protein basis it appears that SBM would be cheaper protein supplement for livestock feeding. There are many ways to minimize excess rumen ammonia in ruminant diets and improve nitrogen utilization. It can be achieved by formaldehyde treatment. This treatment has been considered most economically viable approach to optimize RDP and UDP without changing neutral detergent insoluble nitrogen and acid detergent insoluble nitrogen in reference to high energy cost in heat treated protein meals and cakes (Garg *et al*., 2003b) studies on feeding of formaldehyde treated GNC, mustard cake, sesame cake, rape seed cake and sunflower cake to large and small ruminants have been conducted in past. The results did suggest favourable effect on different productive functions. However, limited studies with regards to the effect of feeding formaldehyde treated soybean meal to lactating cows and buffaloes have been conducted so far as apparent from documented literature. Where a positive significant effect on increase in milk yield of cows, goats and sheeps was noticed due to feeding of formaldehyde treated SBM (Compeneere *et al*.,2010 and Doskey *et al*., 2012). Thus, an attempt has been made in the present study to enhance the rumen by pass protein value of soybean meal (SBM) by treating with 1.5 per cent formaldehyde/ 100 g CP and its feeding effect on lactating cows with main objectives to find out the proximate analysis and dry matter intake.

RESEARCH METHODS.....

Research methodology deals with the description of research methods and techniques used as empirical measures for testing hypothesis developed earlier. The present investigation entitled "effect of formaldehyde treated concentrate, urea and soybean meal on proximate analysis and feed intake in lactating cows" was carried out at Livestock Instructional Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola for a experimental period of 90 days with 10 days prior pre- experimental period. Twenty five early to mid-lactation stage lactating cows were selected from the herd on the basis of nearness in stage of lactation, milk production and body weight. The selected cows were divided in the five groups on the basis of nearness in different productive characters.

The maintenance and milk production requirements of the cows were worked out on the basis of the thumb rules suggested by Prasad and Neeraj (2008) and Banerjee (2008). The cows in all the treatments (T_1 to T_5) were given 5 kg green Hy. Napier and one kg sugras milk ration grade 1 (17.60% CP) to fulfill the maintenance requirements. Treatments were planned like T_1 - Wheat straw + sugras concentrate (17.60 % CP) 40 per cent of milk yield (production ration), T_2 – Wheat straw + untreated 70:30 sugras:SBM mixture (27.47 %CP) 30 per cent of milk yield (75 % of production ration) + 2 per cent urea of the production quantity, T_3 – Wheat straw + 70:30 sugras:SBM mixture (27.47 %CP) treated with HCHO at 1.5 g/100CP 30 per cent of milk yield (75% of production ration) + 2 per cent urea of the production quantity, T_4 - Wheat straw + untreated 70:30 sugras:SBM mixture (27.47 %CP) 20 per cent milk yield (50% of production ration)+ 3 per cent urea of the production quantity and T_5 – Wheat straw + 70:30 sugras : SBM mixture (27.47 %CP) treated with HCHO at 1.5 g/100CP 20 per cent milk yield (50% of production ration) + 3 per cent urea of the production quantity.

Analysis of feed stuffs :

The dry matter (DM), crude protein (CP), ether extract (EE), nitrogen free extract (NFE). Crude fibre (CF) and total ash (TA) was determined as per the standard procedures recommended by Indian Institute of Science BIS, ISI : 7874 (Part-1), 1975.

Feed intake :

The dry and green roughage intakes were quantitively monitored once in a week to assess the

intake of feeds while record of concentrate intake was kept daily and separately for morning and evening milking shift. The data collected on intake of roughages and concentrates were further consolidated on fortnight basis after considering average value of two weeks for statistical analysis purpose.

Body weight of the experimental animals were recorded for three consecutive days before start of experiment and at the end of trial on "Avery weighing balance" before feeding and watering in between 7 to 8 AM. and its average was obtained to assess the actual weigh of the animals.

The data were arranged in Factorial Randomized Block Design (FRBD) and analyzed by standard statistical method as per Amble (1975).

RESEARCH FINDINGS AND ANALYSIS.....

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Chemical composition of feed stuffs :

The term quality refers to the chemical composition of feed, particularly the concentrate as it has direct impact on supply of different nutrients to animal body. The chemical composition is, therefore, one of the index to indicate the nutritive value of feeds. In view of this the chemical composition of FA treated SBM with wheat straw, Hy. Napier and concentrate mixture (Sugras) are presented in Table 1.

A reference to Table 1 indicates that wheat straw (WS) a main dry roughage component was containing 90.10 per cent DM with 2.30, 1.15. 34.50, 51.25 and 10.80 per cent CP, EE, CF,NFE and ash on dry matter basis, respectively. The present CP values of WS are marginally lower than those reported by Agarwal *et al*. (1989); Vardonk *et al.* (1989); Jaikishan and Khan (1990) and Sihag *et al*. (2008) as these authors observed the CP content of WS ranging from 3.4 to 3.8 per cent. Perhaps the method of harvesting crop and possibility of inclusion of low grade and cut grains in the straw might be the reasons to give variation in the present CP content of straw and past reported values.

The green Hy. Napier contained 24.12 per cent DM along with 7.50, 2.40, 35.80, 44.10 and 10.20 per cent CP, EE, CF, NFE and ash on dry matter basis, respectively. A wide variation in CP content of Hy. Napier is reported in past literature. The CP content of Hy. Napier reported by Reddy and Reddy (1986) are comparable with that of present values as the CP content reported by them was ranging from 7.2 to 8.9 per cent on the DM basis. In contrast, the CP content of Hy. Napier between 4.30 to 6.40 observed by Gupta and Murdia (2007) are substantially less than that of present values. On the other hand the past workers like Balaraman (1995) reported the CP content as 13.50, 10.60, 11.80 and 11 per cent, respectively appear to be substantially higher than present value. Concentrate mixture prepared by Maharashtra Agro Industrial Development Corporation (MAIDC) under the trade name "Sugras: Milk Ration Grade I" contained 17.60 and 20.85 per cent CP and CF on DM basis, respectively.

Soybean meal (SBM) was also used to replace 30 per cent of sugras concentrate mixture which was containing 90.50 per cent DM along with 49.50, 9.80, 25.70, 7.90 and 7.10 per cent CP, EE, CF, NFE and ash on DM basis, respectively. The most remarkable observation was that SBM was almost 2.8, 2.3 and 2.0 times rich than that of sugras mixture in respect of CP, EE and ash, respectively, but NFE content of SBM was almost 6.8 times lower in relation to sugras mixture, while the CF content was marginally higher in SBM in comparison to sugras mixture. This trend did indicate that use of SBM in the ration of lactating cow not only fulfill the nutritional requirement but would help to reduce the daily requirement of concentrate for feeding the cows.

Table 1: Average proximate composition of different feed stuffs (%DM basis)

Sr. No.	Feed stuff	DM	CP	EE	CF	NFE	Ash
1.	Wheat straw	90.10	2.30	1.15	34.5	51.25	10.80
2.	Hybrid napier	24.12	7.50	2.40	35.80	44.10	10.20
3.	Sugras (Milk ration grade I)	90.10	17.60	4.20	20.85	53.85	3.50
4.	Soybean meal	90.50	49.50	9.80	25.7	7.9	7.1
5.	Mixture 70% sugras: 30% soybean meal	90.20	27.47	5.80	22.31	39.84	4.58
6.	Formaldehyde treated mixture	90.00	27.34	5.78	22.10	40.30	4.48

The CP content in SBM reported by Compeneere *et al.* (2010) and Anonymous (2012) are comparable with present values as they observed the content in between 43.70 to 47.50 per cent. While Dust *et al*. (2005) observed marginally higher (49.60 to 51%) CP in SBM in comparison to present value.

Table 1 further indicates that the concentrate mixture consisting of 70 per cent sugras and 30 per cent SBM was containing 90.20 per cent DM with 27.47, 5.80, 22.31, 39.84 and 4.58 per cent CP, EE, CF, NFE and ash on DM basis, respectively. This concentrate mixture was fed to experimental group animals. The composition did indicate that there was increased in all proximate constituents except NFE due to inclusion of SBM in Sugras mixture. The decrease in NFE was expected as 30 per cent SBM inclusion raised the CP level by 1.5 times, resulting decrease in NFE level.

This concentrate mixture was treated with FA (1.5 g/100 g CP) to increase UDP levels in concentrate. It is therefore essential to know the effect of treatment on proximate principles. It was seen that there was slight decrease in the proximate constituents except NFE as a results of HCHO treatment while NFE levels showed a slight increase. Treated concentrate mixture contained 90.00 per cent DM along with 27.34, 5.78, 22.10, 40.30 and 4.48 per cent CP, EE, CF, NFE and ash on DM basis, respectively. Yadav and Chaudhary (2004) reported that HCHO treatment to GNC did not influence on composition, though in another trial they observed that there was marginal decrease in DM, CP and CF as a result of treatment (Yadav and Chaudhary, 2010). However, treatment of SBM with HCHO reduced CF, ash, NDF and starch level with increase in CP content according to Compeneere *et al*. (2010). This trend agreed with present results except with regards to CP content as in the present study there was slight depression in CP content due to FA treatment.

Thus, considering the chemical composition of concentrate mixture fed to cows it seems that the nutrient content particularly CP level was sufficient to meet out nutritional requirements. Moreover, treatment with FA at 1.5 g/100 g CP of concentrate mixture had no adverse effect on chemical composition.

Feed intake :

Dry matter intake (*DMI*) :

The supplies of different nutrients are related to DMI in animals. Generally wide variation in DM content of the feeds is noticed which has direct influence on DMI of animals. It is, therefore, necessary to know the DMI of cows through feeding different feeds on fresh basis. With this view the DMI of cows under different treatment was worked out from TFI *viz.*, WS, Hy. Napier and concentrates offered to cows. The average DMI of cows under different treatments during various periods are presented in Table 2.

A reference to Table 2 revealed that DMI in cows was influenced significantly by feeding treatments. The cows from T_1 control consumed more DM (7.97 kg/d/cow) over that of either urea added untreated

Table 2: Effect of treatments, periods and its interaction on DMI of cows under different treatments. (kg/d/cow)

Periods	Treatments					Mean
	T_1	T_2	T_3	T_4	T_5	
P_1	7.76	7.50	7.63	6.94	7.25	7.42 [a]
P_2	7.86	7.62	7.73	6.93	7.00	7.43 [a]
P_3	7.89	7.68	7.77	7.01	7.17	7.51 [a]
P_4	7.95	7.79	7.85	7.01	7.01	7.52 [a]
P_5	8.10	7.94	7.97	7.05	7.36	7.69 [b]
P_6	8.26	8.16	8.14	7.12	7.47	7.83 [c]
Mean	7.97 [a]	7.78 [b]	7.85 [ab]	7.01 [c]	7.21 [c]	7.56
	Period		Treatment		Interaction P x T	
F test	Sig.		Sig.		Sig.	
S.E.±	0.045		0.041		0.0502	
C.D. (P=0.05)	0.126		0.115		0.139*	
CV%			2.968			

Pooled treatments means in row and pooled period means in column with similar superscripts do not differ significantly
(* Calculated at same level of main treatment)

concentrate (T_2 and T_4) or added urea formaldehyde treated concentrate groups (T_3 and T_5). However, the higher DMI in T_1 cows did not differ significantly from that of T_3 DMI of cows. But DMI of cows observed in T_4 and T_5 was significantly lower than that of T_1, T_2 and T_3 groups. Moreover, DMI of cows in T_5 was significantly higher than that of DMI of T_4 group cows. On an average the cows received 7.97, 7.78. 7.85., 7.01 and 7.21 kg of DM/day from feeding T_1, T_2, T_3, T_4 and T_5, respectively. This mean the cows maintained on feeding untreated concentrates with 3 per cent urea (T_4) and formaldehyde treated concentrate with 3 per cent urea (T_5) received 12.04 and 9.54 per cent less dry matter in relation to feeding of (T_1) control diet. In contrast, feeding of 2 per cent added urea untreated concentrate (T_2) and formaldehyde treated concentrate with 2 per cent urea (T_3) had given a marginal decrease by 2.38 and 1.53 in DMI as compared to T_1 control group.

Moreover, DMI of cows noticed in T_5 group was lower by 8.15 per cent over that of feeding T_3 ration. Thus feeding of formaldehyde treated concentrate (1.5 g/100 g CP) with 2 per cent added urea was more effective not only for increasing the DMI in cows but had achieved DMI at par with that of T_1 control group. Probably more intake of WS and concentrate in T_3 group over T_5 group might be the reason to raise the DMI in cows. Majority of the past workers opined that feeding of protected concentrate either did not influence DMI in animals or influenced non-significantly. The past workers like Chatterjee and Walli (2003) and Garg *et al*. (2003 and 2004) reported that feeding of HCHO treated soybean cake to lactating cows, mustard cake to crossbred calves, soybean cake and mustard cake to Murrah buffaloes and rape seed meal and guar meal to lactating cows, respectively had no effect on DMI of animals. These results do agree with present results of feeding 2 per cent added urea formaldehyde treated concentrate mixture (T_3) to cows in relation to control (T_1). Moreover, the observations of Bugalia *et al*. (2008 b) are partially in agreement with present results as they noticed increase DMI in cows on feeding FA treated sesame cake as compared to control.

Thus, the lower DMI in cows in T_4 and T_5 groups in relation to other groups could be looked upon from the angle where the lower intake was not of greater magnitude to influence the supply of nutrients to cows. To confirm this contention, the DMI of cows was compared with standard norms of 2.5 kg DM/100 kg body weight (Prasad and Niraj, 2008). The data in this respect are shown in Table 3.

It is evident from Table 3 that the cows from all the treatments received sufficient dry matter to fulfill the feeding norms. On the contrary the cows reared on T_1 control and 2 per cent added urea formaldehyde concentrate mixture (T_3) ration had a advantage of receiving substantially more dry matter by 13.19 and 11.03 per cent over that of feeding norms, respectively.

While the cows maintained on 2 per cent added urea untreated concentrate mixture (T_2) consumed marginally more (8.81%) DM than that of feeding standards. In contrast, DMI on 3 per cent added urea untreated concentrate mixture (T_4) and 3 per cent added urea formaldehyde treated concentrate diets in cows were just sufficient to meet out the feeding norms, being excess by 0.14 and 2.71 per cent, respectively. As a result, one could except no adverse effect of feeding HCHO treated concentrate with added urea to cows in reference to provide different nutrients for harvesting optimum milk production. The past workers like Yadav and Chaudhary (2004) recorded higher (2.57 kg) per cent BW DMI in crossbred cows on feeding FA treated GNC diet over an intake of 2.41 kg on untreated diet while Bugalia *et al*. (2008 a) also observed higher intake (3.14 kg) of per cent BW DM in crossbred cows on feeding HCHO treated sesame cake against an intake of 2.63 kg per cent BW DMI on untreated diet. These observations do not agree with present as per cent BW DMI was more in control group over that HCHO treated

Table 3: Average DMI (kg)/day of cows in comparison to feeding standards

Treatments	Body weight (kg)	DMI	DM requirement (2.5 kg % BW)	Per cent excess/deficit
T_1	282	7.98	7.05	+13.19
T_2	286	7.78	7.15	+08.61
T_3	283	7.85	7.07	+11.03
T_4	280	7.01	7.00	+00.14
T_5	281	7.21	7.02	+02.71

group, but the per cent BW DMI noticed in the present study was higher than that of their values. On the other hand, Chatterjee and Walli (2003) noticed non-significant differences in per cent BW DMI on feeding formaldehyde treated mustard cake to crossbred calves and Murrah buffaloes against the intake on respective untreated straw which do not support the present trend. However, their per cent BW DMI values in the range of 2.08 to 2.38 kg appeared to be substantially lower than the present values of 2.56 to 2.77 kg/d/cow.

Thus, the results on per cent BW DMI under different treatments clearly indicated that the cows received sufficient DM to fulfill the appetite and consequently supply of nutrients to the body. Because due to the unit body size intake of all the cows met out the nutritional standards of 2.5 kg DM/100 kg body weight. Hence, it seems no reason to consider the adverse effect of feeding formaldehyde treated (1.5 g/ 100 g CP) concentrate with added urea ration to cows in reference to express their optimum performance.

Conclusion :

SBM emerged out as an alternative leguminous cake in the diet of lactating animals to replace the conventional cakes like GNC and cotton seed cake. SBM possesses higher feeding value containing 49.50 per cent CP. Enrichment of sugras milk ration with 30 per cent SBM can increase CP content to 27.47 per cent. Protection of protein with the formaldehyde treatment @ 1.5 g/100 g cp to 70:30 sugras:SBM concentrates has no adverse effect on its proximate principles. Per cent BW DMI under different treatments clearly indicated that the cows received sufficient DM to fulfill the appetite and consequently supply of nutrients to the body. The unit body size intake of all the cows met out the nutritional standards of 2.5 kg DM/100 kg body weight. Hence, it seems no reason to consider the adverse effect of feeding formaldehyde treated (1.5 g/100 g CP) concentrate with added urea ration to cows in reference to express their optimum performance.

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LITERATURE CITED.....

Agrawal, I.S. M.L., Singh, A.K. and Pandey, Y.C. (1989). Feeding value of ammonia (urea) treated straw in term of milk production. *Indian J. Anim. Nutr.,* **6** (2) : 89-96.

Amble, V. N. (1975). *Statistical method in animal science*. I[st] Ed., Published by Indian Society of Agriculture Statistics. New Delhi, India, pp .199-219.

Anonymous (2012). Area and production estimates of soybean in India *Kharif* (Monsoon) 2012 (Based on crop survey conducted by SOPA).

Balaraman, N. (1995). Nutritive value of hybrid napier grass. *Indian J. Anim. Nutr.,* **12** (4) : 245-246.

Banerjee, G.C. (2008). *A Text book of animal husbandry*. Ed. 8[th]., Oxford and IBH Publishing. Co. Pvt. Ltd, New Delhi, India, pp. 340-345.

Banerji, G.C. (1998). (Reprint 2005), *A textbook of animal husbandry*, Oxford and IBH Publishing Co-Pvt. Ltd., New Delhi, India, pp. 661-677.

BIS, ISI: 7874 (Part 1) (1975). *Methods of tests for animal feeds and feeding stuffs* : General methods.

Bugalia, H.L., Chaudhary, J.L. and Gupta, Lokesh (2008a). Effect of feeding formaldehyde treated til cake on milk yield and composition of lactating crossbred cows. *IJDS*, **61**(2): 116-121.

Bugalia, H.L., Chaudhary, J.L. and Gupta, Lokesh (2008b). Effect of feeding formaldehyde treated sesame (*Sesamum indicum* L.) cake on reproductive efficiency and physiological responses of crossbred cows. *Anim. Nutr. & Feed Technol*., **8**: 219 - 226.

Chatterjee, A. and Walli, T.K. (2003). Effect of feeding formaldehyde treated mustard cake as bypass protein on milk yield and milk composition on Murrah buffaloes. *IJDS*, **56**: 299 - 305.

Compeneere, Sam De., Boever, Joha L. De, Vanacker, Jose, M. Daniel, L. and De, Brabander (2010). Reducing nitrogen excretion and soybean meal use by feeding al lower rumen degradable protein balance and protected soybean meal to dairy cattle. *Anim.*

Nutr., **64** (2) : 85-97.

Doskey, Kamal Noman, Dhiaa, Omar, Al-Mallah and Sulaiman, Nihet hajji (2012). Effect of feeding urea treated wheat straw and formaldehyde treated barley grains on milk composition and some blood metabolites of Meriz does. *Roavs*, **1**(1): 700-703.

Dust, J.M., Grieshop, C.M., Parsons, C.M., Karr-Lilienthal, L.K., Schasteen, C.S., Quigley, J.D., III, Merchen, N.R. and Fahey, G.C. (2005). Chemical composition, protein quality, palatability and digestibility of alternative protein sources for dogs. *J.Anim. Sci*., **83** : 2414-2422.

Garg, M.R., Sherasia, P.L., Bhandari, B.M., Gulati, S.K. and Scott, T.W. (2003a). Effect of feeding rumen protected protein on milk production in lactating buffaloes. *Anim. Nutr.& Feed Technol.*, **3**: 151-157.

Garg M. R., Sherasia P.L., Bhandari, B.M., Gulati, S.K. and Scott, T.W. (2003b). Effect of feeding formaldehyder treated guar meal on milk production in crossbred cows. *Indian J. Anim. Nutr*., **20** (3) : 334-338.

Garg M.R., Sherasia, P.L., Bhandari, B.M., Gulati, S.K. and Scott, T.W. (2004). Effect of feeding protected protein on milk production and composition of lactating cows. *Indian Vet. J.*, **81** : 48-50.

Garg, M.R., Bhandari, B.M. and Sherasia, P.L.(2007). Assessment of macro and micro minerals status of milch animal in Jodhpur district of Rajasthan. *Indian J. Dairy Sci*., **60** (3) : 191-198.

Gupta, L. and Murdia, P.C. (2007). Effect of feeding urea treated wheat straw with of without sulphur on nitrogen utilization and growth rate in crossbred heifers. *Indian J. Anim. Res.*, **4** : 293 - 295.

Jai Kishan and Khan, M.Y. (1990). Effect of modified practice of urea supplementation on nutrient utilization from wheat straw based diet in buffaloes. *Indian J. Anim. Nutr.*, **7**(4): 263-266.

Prasad, Jagdish and Neeraj (2008). *Principles and practices of animal nutrition*, II[nd] Ed., Kalyani Publishers, NEW DELHI, INDIA.

Reddy, G.J. and Reedy, B.S. (1986). Nutritive value of ratoon regrown Hybrid Napier (NB-21). *Indian J. Anim. Nutr*., **3**(2): 128 - 131.

Sahoo, B. and Walli, T.K. (2005). Effect of feeding bypass protein as formaldehyde treated mustard cake along with energy supplement on blood metabolites and milk production in lactating goats. *IJDS*, **58**(3): 184-189.

Sihag, Zile S., Punia, B.S., Barwal, R.S. and Sihag, Sajjan (2008). Influence of feeding urea molasses mineral blocks (UMMB0 on blood parmeters in buffaloes. *Indian J. Anim. Nutr.*, **26**(1): 56 - 60.

Vardonk, Han, Singh, G.P. and Gupta, B.N. (1989). Nutrition utilization and passage rate of digestion on feeding of urea supplemented and urea ammoniated wheat straw in crossbred cattle. *Indian J. Anim. Nutr.*, **6** (4) : 295-300.

Yadav, C.M. and Chaudhary, J.L. (2004). Effect of feeding protected protein on nutrient utilization, milk yield and milk composition of lactating crossbred cows. *IJDS*, **57**(6):394-399.

Yadav, C.M. and Chaudhary, J.L. (2010). Effect of feeding protected protein on growth performance and physiological reaction in crossbred Heifers. *Indian J.Anim. Nutr.*, **27**(4): 401-407.