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Effect of feeding green maize along with soyabean straw over nutrient digestibility and milk yield of the crossbred lactating cows

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Abstract
The study was conducted to observe the effect of green maize along with soyabean straw over digestibility of nutrients and the performance of crossbred lactating cows. Sixteen lactating crossbred cows were divided into four groups on the basis of their body wt., milk yield, stage of lactation and parity. The study was conducted for the period of five months including 7 days metabolic trial. Group 1: Wheat straw (WS) + Green maize (GM) + Concentrate mixture (CM) (Control); Group 2: Soybean straw (SS) and WS (20:80) + GM + CM; Group 3: SS and WS (40:60) + GM + CM); Group 4: SS and WS (60:40) + GM + CM. Average dry matter intake were 10.83, 10.23, 9.73 and 9.43 kg in T1, T2, T3 and T4 groups, respectively. While, average milk yield was 7.89±0.29, 6.89±0.30, 6.84±0.38 and 6.27±0.34 kg in T1, T2, T3 and T4 groups, respectively. The average intake of digested dry matter, crude protein, ether extract, crude fiber and nitrogen free extract in animals of T1, T2, T3 and T4 groups, respectively, were 7.04, 6.34, 5.94 and 5.66 kg; 0.90, 0.86, 0.81 and 0.80 kg; 0.35, 0.31, 0.29 and 0.28 kg; 1.66, 1.58, 1.49 and 1.48 kg; 3.52, 3.13, 2.86 and 2.70 kg.

Keywords: Crossbred cows, green maize, milk yield, nutrient digestibility and soybean straw

Introduction
Feeding nutritious diet is a pre-requisite for optimum milk yield and efficiency of milk production in animals. Green fodder and concentrates are the ideal component of the diet. But the availability of green fodder of high quality in adequate quantities during most part of the year is a major constraint for the Indian farming to maintain substantial production. Due to increasing human population there is increasing demand for food production as a result cropland is used more extensively for food production. Hence, in future crop residue will play an increasingly important role in the feeding of livestock (Singh and Rangnekar, 1986; Devendra, 1993) [7, 3].

In our country there is deficit of about 23.46% dry fodder (2002-2007, Govt. of India, Planning Commission, August – 2001). In India, production of soybean has increased steeply. The cultivable land, which was used for traditional crop production, has been gradually replaced by soybean. In year 2006-07, the area coverage under soybean production was 8.33 million hectares with its production of 8.85 million tones. While in 2007-08, the area coverage was 8.88 million hectares with soybean production of 10.97 million tones (Agricultural statistics, 2009) [1]. This is true for our state also. In 2006-07, the area coverage for soybean production in M.P. was 4.76 million hectares while, in 2007-08 it increased to 5.02 million hectares. The soybean production was 4.78 million tones in 2006-07 while, in 2007-08 its production was approximately 5.48 million tones (Agricultural statistics, 2009) [1]. Due to higher use of cultivable land for soybean production, availability of soybean straw has increased tremendously but the yield of traditional crop residues has reduced drastically.

The availability of soybean straw is although very high about 2.74 million tons in M.P. but its utilization is very poor (Agricultural statistics, 2009) [1] especially in cross-bred cows. Utilization of soyabean straw will help in minimizing the problem of dry fodder deficit to a greater extent. But the nutritive value of soybean straw as well as its nutrient utilization is very poor. Hence, the studies were undertaken to increase the utilization of soybean straw in crossbred lactating cows.

Materials and Methods

Experiment was conducted to see the optimum combination of green maize along with soybean straw. The experiment was conducted for five months period. Sixteen lactating crossbred cows were randomized into 4 groups (Groups I, II, II, IV) on the basis of their body wt., milk yield, stage of lactation and parity. These animals were fed different diets T1 (control): Straw (Wheat) + green maize + concentrate; T2: Straw (Soybean + Wheat in 20:80) + green maize + concentrate; T3: Straw (Soybean + Wheat in 40:60) + green maize + concentrate; T4: Straw (Soybean + Wheat in 60:40) + green maize + concentrate. The animals were fed to satisfy their nutrient requirement as per ICAR (1998) [6].

Deworming of the animals was done before start of the feeding trial. A metabolic trial of 7 days was conducted at the end of feeding experiment. The digestion trail was conducted during the study. The samples of feed offered, feed left over and faecal samples collected during the study were analyzed for proximate composition, calcium and phosphorus. The digestibility coefficient of different nutrients in different groups of animals was calculated. The chemical composition of feed ingredients used for formulation of diets is given in Table 1. While, the ingredient composition of concentrate mixture is given in Table 2.

Table 1: Chemical composition of feed ingredients and diets used in the experiment.

Ingredients	DM%	CP%	EE%	CF%	NFE%	Ash%	Ca%	P%	AIA%
Soybean straw	95.50	6.60	1.10	41.10	39.60	11.60	1.61	0.14	1.10
Wheat straw	95.4	3.8	1.3	31.3	56.6	7.0	1.35	0.08	1.92
Green maize	20.6	6.74	2.09	35.95	47.07	4.14	0.52	0.28	1.70
Conc. Mix	92.4	19.6	11.3	4.14	47.97	16.5	2.5	0.17	6.44

Table 2: Ingredient composition of concentrate used in the experiment

Feed ingredients	Kg
Maize	30.00
DORP	8.00
GNC	20.00
Tuar Chuni	20.00
Wheat bran	20.00
Mineral mixture	1.50
Salt	0.50
Total	100.00

Results and Discussion

The data recorded during the study were analyzed and presented under different subheads.

Body weight

Body weight of all the experimental animals was taken in the morning before watering and feeding. The body weight of the animals was recorded at the start of experiment which is presented in Table 3.

Table 3: Body weight of the animals before the start of the experiment

No. of animals	Groups			
	I	II	III	IV
01	320	327	342	335
02	347	289	324	315
03	336	352	334	328
04	307	332	316	344
Avg.	327.5±8.79	325±13.15	329±5.68	330.5±6.11

Dry matter intake

The feed offered to each group of animals was more or less same except the variation in the proportion of wheat straw and soybean straw. The data as regard the quantity of feed offered to various groups of animals is presented in Table 4.

Table 4: Feed offered (kg/day/animal) during experiment (As such basis)

Groups	Wheat straw	Soybean straw	Concentrate	Green Maize
I	5.0	-	5	25
II	4.0	1.0	5	25
III	3.0	2.0	5	25
IV	2.0	3.0	5	25

The daily dry matter intake (DMI) of the animals was calculated on the basis of feed offered and left over and their dry matter content in a week. The fixed quantity of feed in weighed quantity was given to animals of the entire group. The amount of concentrate mixture was also kept constant. However, because of variation in the quantity of left over feed there was variation in the actual dry matter intake of the animals.

The daily dry matter intake was maximum and significantly higher in animals of Group -I followed by those belonging to Group II, III and IV. But the DMI on percent body weight was significantly higher in animals of Group-I followed by those belonging to Group II, III and IV. It was inversely related to the level of soybean straw used in their diet. Daily average dry matter of various animals during the experiment is presented in Table 5. Our result was not in agreement with the study of Snitwong (1997) [8].

Table 5: Daily average dry matter intake of various groups of animals during the experiment

Grs.	Wheat straw (kg)	Soybean straw (kg)	Green Maize (kg)	DM from roughage (kg)	Conc. (kg)	DM total offered (kg)	Left over (kg)	DMI/Day (kg)	DMI/100 BW (%)
I	4.76	0	5.15	9.91	4.62	14.53	3.70	10.83	3.30
II	3.81	0.95	5.15	9.91	4.62	14.53	4.30	10.23	3.14
III	2.86	1.91	5.15	9.91	4.62	14.53	4.80	9.73	2.95
IV	1.90	2.86	5.15	9.91	4.62	14.53	5.10	9.43	2.85

Milk Yield

The milk yield of the animals recorded daily and averaged on fortnightly basis is furnished in Table 6. Data clearly revealed that initial milk production was maximum in animals of Group-I followed by Group-III, II and IV. The fortnightly milk yield also indicated slightly better production in animals of Group-I followed by those belonging to Group-II, III and IV. The overall average milk production was maximum and significantly higher in animals of Group-I followed by those pertaining to Group-II, III and IV. As compared to Gr. I, in animals of Gr. II there was no statistical difference in milk production but in other groups of animals there was significant reduction in milk yield. It indicated that increase in the level of soybean straw instead of wheat straw above 20% level caused significant reduction in the milk yield. It was attributed to poor availability of nutrients due to increase in the level of soybean straw. Results were in agreement with the study of Hussain *et al*., (1996) [5].

Table 6: Average milk yield of the animals offered different diets

Fortnights	I (Control)	II	III	IV
1.	9.1	8.2	8.6	7.9
2.	8.7	8.0	8.3	7.4
3.	8.6	7.6	7.9	7.4
4.	8.8	7.2	7.4	6.9
5.	8.2	7.5	7.0	6.3
6.	7.6	6.9	6.6	6.1
7.	7.3	6.3	6.2	5.7
8.	7.5	5.9	5.8	5.3
9.	6.8	5.7	5.2	4.9
10.	6.3	5.6	5.4	4.8
Avg.	7.89±0.29	6.89±0.30	6.84±0.38	6.27±0.34
% Decrease	30.76	31.70	37.20	39.24
% Net decrease	-	0.96	6.44	8.48

Digestibility coefficient

The percent digestibility of nutrients in different groups of animals estimated during the study is given in Table 7.

The results indicated that increase in the level of soybean straw instead of wheat straw along with green maize reduced the digestibility of dry matter in animals. However, the digestibility coefficient of crude protein was maximum in Animals assigned T1 diet followed by T2, T3 and T4 diet. The same was true with the percent digestibility of ether extract. It was maximum in animal's assigned T1 diet followed by T2, T3 and then T4 diet. The digestibility coefficient of crude fiber as well as NFE both was found to reduce with the increase in the level of soybean straw. Thus, the digestibility coefficient of all the nutrients was higher in control diet (T1) than treatment groups (T2, T3 and T4). However, among the treatment groups digestibility coefficient were slightly higher in group II, group III than group IV.

Increase in the level of soybean straw tends to reduce the percent digestibility of most of the nutrients. It was related to higher amount of lignin present in the soybean straw. On account of increase in the level of soybean straw there was increase in the amount of lignin and probably increase in its level has interfered with the fermentation as well as utilization of crude fibre as well as NFE. However, if the soybean straw was chopped along with green roughage its digestibility increases to some extent as describe by Gupta *et al.* (1978) [4].

Table 7: Digestibility coefficient for nutrients in different groups

Nutrients	T1	T2	T3	T4
DM	65.0	62.0	61.1	60.1
CP	86.2	84.6	82.8	82.2
EE	69.8	68.2	67.4	67.1
CF	63.5	62.1	60.4	60.3
NFE	64.6	62.4	61.3	61.1

The average nutrient intake in the animals was calculated based on dry matter intake and its chemical composition. Data is furnished in Table 7. Data clearly revealed that the nutrient intake reduced significantly with the increase in the level of soybean straw in the diet of animals. However, intake of crude protein was maximum in animals of Gr. I followed by those belonging to Gr. II, Gr. III and Gr. IV.

The intake of crude fibre was maximum in animals of Gr. I followed by Gr. II, Gr. III and IV. It was also related to the crude fibre content of the diet and total dry matter intake by the animal. There was not much variation in the ether extract intake in various groups of animals. While, the NFE intake was maximum in animals of Gr. I followed by those belonging to Gr. II, Gr. III and IV, respectively.

Table 8: Average total nutrient intake (kg) in animals of different groups

Nutrients	I	II	III	IV
DM	10.83	10.23	9.73	9.43
CP	1.05	1.02	0.99	0.98
EE	0.51	0.46	0.44	0.43
CF	2.62	2.55	2.48	2.46
NFE	5.45	5.02	4.67	4.42

Based on the digestibility coefficient of various nutrients and its intake, nutrient digested from different diets was calculated (Table 8). The average total digested dry matter was maximum and significantly higher in animals of Gr. I followed by those pertaining to Gr. II, Gr. III and Gr. IV. While, the intake of digested protein was higher in animals of Gr. I followed by group II, III and IV. The total amount of crude fibre digest in the animals was maximum in animals of Gr. I. It was statistically similar between animals of Gr. III and IV. While, there was no significant variation in the intake of digested amount of ether extract among different groups of animals. The intake of digested amount of NFE was maximum in animals of Gr.I followed by those belonging to Gr. II, III and IV respectively. Thus, on an average intake of digested nutrient was maximum in animals of Gr. I followed by those belonging to Gr.II, III and Gr. IV, respectively.

Table 9: Average total intake of digested nutrient (kg) in animals of different Groups.

Nutrients	T1	T2	T3	T4
DM	7.04	6.34	5.94	5.66
CP	0.90	0.86	0.81	0.80
EE	0.35	0.31	0.29	0.28
CF	1.66	1.58	1.49	1.48
NFE	3.52	3.13	2.86	2.70

Conclusion

Use of soybean straw instead of wheat straw over 20% level (40, 60) causes significant reduction in milk yield.

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