Comparative Study on Nutrient Utilization of Cross-Bred and Gir Cows Fed Green Lucerne During Winter Season

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ABSTRACT

The present investigation was conducted Comparative Study on Nutrient Utilization of Cross-Bred and Gir Cows Feed Green Lucerne During Winter Season. Twenty lactating cows (in which 10 Cross-bred and 10 Gir Cows) were divided into four groups on basis of nearest their body weight and milk yield/day at dairy farm of S.K.N. College of Agriculture, Jobner and subjected to four dietary treatments were formulated. i.e. Green Lucerne 10 kg + Wheat straw ad-lib.+ Concentrate for T_1 Crossbred, Green Lucerne 20 kg + Wheat straw ad-lib. + Concentrate for T_2 Crossbred, Green Lucerne 10 kg + Wheat straw ad-lib. + Concentrate for T_3 Gir Cow and Green Lucerne 20 kg + Wheat straw ad-lib. + Concentrate for T_4 Gir Cow and the studied for their nutrient utilization. DMI (kg/animal/day) was significantly (P<0.05) higher in T_2 (12.77) than T_1 (12.18), T_4 (11.49) and T_3 (11.07). Average daily intake of CP, DCP and TDN in kg/100 kg body weight was significantly higher (P<0.05) in T_2 compared to other groups. The nutrient utilization as DM, CP, EE, CF and NFE was significantly (P<0.05) higher in T_4 compared to T_3, T_2 and T_1 group.

HIGHLIGHTS

◉ DMI (kg/animal/day) was significantly higher in T_2 (12.77) than T_1 (12.18) Cross breed and T_4 (11.49) than T_3 (11.07) in Gir Cow.
◉ The nutrient utilization as DM, CP, EE, CF and NFE was significantly (P<0.05) higher in T_4 compared to T_3, T_2 and T_1 group.

Keywords: Nutrient utilization, Cross-bred, Gir Cow, Green Lucerne

Livestock in India has a very important role in the agricultural sector and consequently in its rural economy. India has 190.90 million cattle population, which includes 39.73 million cross-bred and 151.17 million Indigenous cattle (Anonymous, 2012). The cattle herds include a variety of pure bred which have 43 breeds of Indigenous cattle in India (NBAGR, 2018). Cattle are an important farm animal which plays a significant role in the economy of the country by providing milk, manure, and draught power with very little input. Gir is a famous milch cattle breed of India. Cattle of this breed are famous for their tolerance to stress conditions and resistant to various tropical diseases. Cross-breeding programmed of dairy cattle has played significant role in attaining India's top position as highest milk producer country of the world.

Nutrition plays vital role in exploiting the genetic potential of dairy animals but the biomass resources are very limited and there is shortage of feed and fodder. The green fodders are good sources of energy, protein, fat, minerals and vitamins. There for, the present study will be taken to assess to optimum level of green Lucerne (*Medicago sativa*) fodder in ration and the effect of the green fodder on nutrient utilization of cross-bred and Gir cows and to make recommendations for better performance of dairy cows.

MATERIALS AND METHODS

The present investigation was conducted 2018-2019 at the Dairy farm, S.K.N. college of Agriculture, Jobner District Jaipur, (Rajasthan, India) for 90 days to assess the effect of green lucerne (*Medicago sativa*) fodder on nutrient utilization of Cross-bred and Gir Cows. 10 Cross-bred (Tharparkar/Sahiwal × Holstein Friesian) and 10 Gir lactating cows were selected for the experiment. They were randomly divided into four groups of five in each group on the basis of nearest in their body weight and milk yield and four dietary treatments were formulated.

Table 1: Feeding schedule of Cross-bred and Gir cows

Feed and fodder	Quantity of feed and fodders
Green Lucerne	10 kg for T_1 and T_3 group and 20 kg for T_2 and T_4 group.
Wheat straw	fed ad-lib.
Concentrate mixture	2.0 kg for maintenance ration/cow and @ 1kg /2.5 litre milk yield for production ratio

The feed intake data comprising the intake of roughage and concentrate of each animal in all treatments was recorded on two consecutive days at fortnightly interval. A representative sample green Lucerne, dry fodder (wheat straw) and concentrate mixture offered to the animals and refusal left in each treatment was taken fortnightly for estimating the dry matter and crude protein contents. A digestibility trial on all Cross-bred and Gir cows was conducted for 6 days collection period of the end of experiment and feed intake, total dung voided was recorded daily throughout the experiment. The intake of CP, DCP and TDN were also calculated. Crude protein was estimated by Automatic Nitrogen/ Protein estimation system and ether extract analyzed with the help of Automatic Soxhlet's apparatus, crude fibre was analyzed with the help of Automatic PC Competable fiber estimation system.

Calculation of Nitrogen-Free Extract (NFE)

$$NFE (\%) = 100 - (CP\% + CF\% + EE\% + Total\ ash)$$

Where, CP = Crude protein

CF = Crude fibre

EE = Ether extract.

Total Digestible Nutrients (TDN)

A term used in animal feeding that designates the sum of all the digestible organic nutrients. (Digestible fat is multiplied by 2.25 because of its higher energy content). The TDN is calculated by the following formula:-

$$TDN = DCP + DCF + DNFE + DEE \times 2.25$$

Where,

TDN = Total digestible nutrients (kg.)

DCP = Digestible crude protein

DCF = Digestible crude fibre

DNFE = Digestible nitrogen free extract

DEE = Digestible ether extract

Table 2: Chemical composition (% DM basis) of feed and fodder

Feed ingredients	DM	CP	EE	CF	NFE	ASH
Green Lucerne	16.5	17.2	02.1	32.4	37.1	11.2
Wheat Straw	91.5	3.55	1.82	36.58	47.55	10.55
Concentrate mix.	90.5	19.7	03.8	10.2	56.3	10.0

STATISTICAL ANALYSIS

The experiment data were statistically analyzed using standard statistical methods (Snedecor and Cochran, 1994). The experiment planned with subjected to analysis of variance (ANOVA) for a (2X2) factorial randomized block design (FRBD) and the means were tested by least significance difference.

RESULTS AND DISCUSSION

Dry matter intake

The average daily total dry matter intake (TDMI) in T_1, T_2, T_3 and T_4 groups was 12.18+0.044, 12.77+0.036, 11.07+0.030 and 11.49+0.053 kg/cow, respectively DMI per 100 kg body weight basis was significantly higher in 20 kg lucerne fed group compare to 10 kg lucerne fed group in cross-bred and similar trend was obtained in Gir cows. Overall DMI/100 kg body weight was higher in T_2 (2.95+0.013) and T1 (2.82+0.012) cross-bred compare

to T_4 (2.68+0.021) and T_3 (2.58+0.022) Gir cows. This indicates that increasing the amount of green lucerne in diet increase the amount of dry matter intake also. Average daily dry matter intake (kg) of per animal are given in Table 3. Similar values of dry matter intake per 100 kg body weight was reported by Naik *et al.* (2012).

body weight was obtained higher in 20 kg green lucerne fed group T_2 (cross-bred) compared to T_4 (Gir cows) and similar trend was observed in 10 kg green lucerne fed group T_1 (cross-bred) compared to group T_3 (Gir cows). The results are in agreement with the findings of Singh *et al.* (2014).

Table 3: Average daily dry matter intake (kg) of per animal under different treatment

Parameters	Cross Bred		Gir cow	
	T_1	T_2	T_3	T_4
Lucerne	1.65^{cd} ± 0.000	2.34^a ± 0.026	1.65^d ± 0.000	2.22^b ± 0.014
Wheat straw	6.25^a ± 0.009	6.10^b ± 0.019	5.37^c ± 0.014	5.17^d ± 0.015
Concentrate	4.28^b ± 0.072	4.33^a ± 0.050	4.05^d ± 0.053	4.10^c ± 0.078
Total DMI	12.18^b ± 0.044	12.77^a ± 0.036	11.07^d ± 0.030	11.49^c ± 0.053
DMI kg/100 kg BW	2.82^b ± 0.012	2.95^a ± 0.013	2.58^d ± 0.022	2.68^c ± 0.021

Means having different superscripts differ significantly (P<0.05).

Total water intake

The average daily total water intake (litre) in T_1, T_2, T_3 and T_4 groups was 46.31±0.084, 46.49±0.070, 40.47±0.083 and 42.06±0.085 respectively. The total water intake was higher in T2 than T1, T4 and T3. the differences between treatments were significant. The average daily voluntary water intake (litre) in T_1, T_2, T_3 and T_4 groups was 36.93±0.084, 33.63±0.070, 31.20±0.083 and 29.92±0.085 respectively.

Nutrient intake

Average daily intake of crude protein, DCP and TDN in (kg) in different treatment groups were presented in table 4. The daily CP intake in T_1, T_2, T_3 and T_4 group cows was 1.349±0.29, 1.472±0.27, 1.272±0.29 and 1.373±0.27 g, respectively. The CP intake was significantly higher (P<0.05) in T_2 than T_4, T_1 and T_3. The average daily DCP intake in T_1, T_2, T_3 and T_4 groups was 0.843±0.073, 0.932± 0.020, 0.805±0.080 and 0.880±0.043 kg, respectively. The DCP intake was significantly higher (P<0.05) in T_2 than T_4, T_3 and T_1. Overall CP and DCP intake per 100 kg

Table 4: Average daily intake of crude protein, DCP and TDN in (kg) in cows under different treatment

Parameters	Cross Bred		Gir cow	
	T_1	T_2	T_3	T_4
Crude protein intake	1.349^c ± 0.29	1.472^a ± 0.27	1.272^d ± 0.29	1.373b^c ± 0.27
CPI/100 kg BW	0.312^c ± 0.004	0.340^a ± 0.003	0.297^d ± 0.006	0.320b^c ± 0.005
DCP intake	0.843^c ± 0.073	0.932^a ± 0.020	0.805^d ± 0.080	0.880^b ± 0.043
DCP intake/ 100 kg BW	0.195^{cd} ± 0.008	0.215^a ± 0.007	0.188^d ± 0.008	0.205bc ± 0.007
Daily TDN intake	7.15^b ± 0.011	7.55^a ± 0.019	6.47^d ± 0.014	6.77^c ± 0.015
TDN intake /100 kg BW	1.65^b ± 0.13	1.74^a ± 0.11	1.51^d ± 0.19	1.58^c ± 0.15

Means having different superscripts differ significantly (P<0.05).

The daily consumption of TDN by cows was 7.15±0.011, 7.55±0.19, 6.47±0.014 and 6.77±0.015kg in T_1, T_2, T_3 and T_4 respectively. The green lucerne had significant (P<0.05) influence on TDN intake by cows. The average daily TDN intake was higher (P<0.05) in T_2 than T_1, T_3 and T_4. Overall TDN intake /100 kg body weight was obtained higher in T_2 (cross-bred) compared to T_4 (Gir cows) and similar trend was observed in T_1 (cross-bred) compared to T_3 (Gir cows). The results of the present investigation are in line with Mahmoud and Ebeid (2014).

Digestibility Co-efficient of feed nutrients

The average digestibility co-efficient of various nutrients in different experimental groups are presented in Table 5, which indicated that the digestibility coefficient of all nutrients

Dry matter

The average digestibility of DM in T_1, T_2, T_3 and T_4 was 60.99±0.142, 61.09±0.200, 62.05±0.196 and 62.67±0.214

per cent, respectively. The digestibility co-efficient of DM was higher (P<0.05) in T_4 than T_3, T_2 and T_1 groups. T_2 contain higher digestibility co-efficient of DM compared to T_1 in cross-bred and similar trend was observed in T_4 compared to T_3 in Gir cows. Overall digestibility co-efficient of DM was obtained higher in 20 kg green lucerne fed group T_4 (Gir cows) compared to group T_2 (cross-bred) and similar trend was reported in 10 kg green lucerne fed group T_3 (Gir cows) compared to group T_1 (cross-bred).

Crude protein

The digestibility of CP in T_1, T_2, T_3 and T_4 was 62.49±0.294, 63.31±0.202, 63.28±0.229 and 64.09±0.258 per cent, respectively. Which was higher (P<0.05) in T_4 than T_2, T_3 and T_1 groups. T_2 contain higher digestibility co-efficient of CP compared to T_1 in (cross-bred) and similar trend was observed in T_4 compared to T_3 (Gir cows). Overall digestibility co-efficient of CP was higher in 20 kg green lucerne fed group T_4 (Gir cows) compared to group T_2 (cross-bred) and similar trend was observed in 10 kg green lucerne fed group T_3 (Gir cows) compared to group T_1 (cross-bred). Similar findings were reported by Yadav and Chaudhary (2010).

Ether extract

The digestibility of EE in T_1, T_2, T_3 and T_4 was 66.55±0.226, 68.0±0.150, 66.78±0.176 and 68.68±0.149 per cent, respectively. T_2 contain higher digestibility co-efficient of EE compared to T_1 in (cross-bred) and similar trend was observed in T_4 compared to T_3 (Gir cows). Overall digestibility co-efficient of EE was obtained higher in 20 kg green lucerne fed group T_4 (Gir cows) compared to group T_2 (cross-bred) and similar trend was observed in 10 kg green lucerne fed group T_3 (Gir cows) compared to group T_1 (cross-bred).

Crude fiber

The digestibility of CF in T_1, T_2, T_3 and T_4 was 62.85±0.116, 63.26±0.146, 62.88±0.262 and 63.38±0.213 per cent, respectively. The digestibility co-efficient of CF was higher (P<0.05) in T_4 as compared to T_1, T_2 and T_3. T_2 contain higher digestibility co-efficient of CF compared to T_1 in (cross-bred) and also similar trend was observed in T_4 compared to T_3 (Gir cows). Overall digestibility co-

efficient of CF was obtained higher in 20 kg green lucerne fed group T_4 (Gir cows) compared to T_2 (cross-bred) and similar trend was observed in 10 kg green lucerne fed group T_3 (Gir cows) compared to T_1 (cross-bred).

Nitrogen free extract

The digestibility of NFE in T_1, T_2, T_3 and T_4 was 63.28±0.137, 63.70±0.179, 62.50±0.101 and 62.89±0.124 per cent, respectively. The digestibility of nitrogen free extract was higher (P<0.05) in T_2 than T_1, T_4 and T_3 group animals. T_2 contain higher digestibility co-efficient of NFE compared to T_1 in (cross-bred) and similar trend was observed in T_4 compared to T_3 in (Gir cows). Overall digestibility co-efficient of NFE was higher in 20 kg green lucerne fed group T_2 (cross-bred) compared to T_4 (Gir cows) and similar trend was observed in 10 kg green lucerne fed group T_1 (cross-bred) compared to T_3 (Gir cows).

Table 5: Average digestibility coefficient of nutrient under different treatment.

Nutrients	Cross Bred		Gir cow	
	T_1	T_2	T_3	T_4
DM	60.99[cd] ± 0.142	61.09[d] ± 0.200	62.05[b] ± 0.196	62.67[a] ± 0.214
CP	62.49[d] ± 0.294	63.31[bc] ± 0.202	63.28[c] ± 0.229	64.09[a] ± 0.258
EE	66.55[d] ± 0.226	68.0[b] ± 0.150	66.78[cd] ± 0.176	68.68[a] ± 0.149
CF	62.85[d] ± 0.116	63.26[b] ± 0.146	62.88[cd] ± 0.262	63.38[a] ± 0.213
NFE	63.28[b] ± 0.137	63.70[a] ± 0.179	62.50[d] ± 0.101	62.89[cd] ± 0.124

Means having different superscripts differ significantly (P<0.05).

Apparent digestibility

Apparent digestibility for sake of brevity will hereafter be called digestibility. Apparent digestibility of DM, CP, EE, CF and NFE were significantly (P<0.05) higher in T_2 as compared to T_1 in (cross-bred) and similar trend was observed in T_4 compared to T_3 in (Gir cows) due to higher utilization of nutrients. Apparent digestibility of DM, CP, EE, CF and NFE were significantly (P<0.05) higher in Gir cows compared to Cross-bred. The results are in agreement with the findings of Pachauri and Singh (1990),

Sarwar *et al.* (2005), Mahanta and Karnani (2010), Singh *et al.* (2011) and Mahmoud and Ebeid (2014).

CONCLUSION

On the basis of present investigation, it may be concluded that the feeding level of 20 kg green lucerne group was significantly (P<0.05) higher in nutrient utilization as compared to 10 kg green lucerne fed group. And average nutrient utilization was higher in Gir cow group (T_3 and T_4) compare to Cross-bred group (T_1 and T_2). It is also showed that the better performance as well as increased palatability and utility of wheat straw in same group of Cross-bred and Gir cows.

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