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Growth Performance of Crossbred Goat (Beetal ×Assam Local) by Feeding Cultivated Fodder under Intensive Farming

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A B S T R A C T

The small ruminant husbandry sector in India is not an organized sector like poultry, however, now-a- days many young entrepreneurs are setting up goat units using scientific rearing practices, because small ruminants play an important role in the food and nutritional security of rural people providing meat, milk and skin specially by goat. Due to higher input and output ratio goat is well suited for marginal and landless labor. After extensive comparison with lamb meat difference in flavour, aromas of goat meat have been noted and found huge demand. So, to increase the production potential of goat in term of milk, meat and skin it is necessary to incorporate proper feeding schedule under intensive or semi intensive system of production to achieve optimum animal productivity and economic sustainability. Twenty crossbred (Beetal Assam Local) male goats lambs (6.72 ± 0.24 kg) were randomly distributed into four groups, each with five animals. All groups (T1, T2, T3 & T4) were offered the same concentrate mixture and also offered individual grass and admixture of three fodder as roughage source (50:50) on DM basis. Statistically non significant ($p>0.05$) difference was observed among the groups in respect of DM intake per 100 kg body weight and per kg $W^{0.75}$. The digestibility coefficient of DM, OM, CP, EE was significantly higher in group fed Teosinte (T2) and Napier (T3) grass compared to Para (T1) and mix (T4) grass fed groups. However, non significant difference was observed among the groups in respect to digestibility coefficient of NFE, CF, NDF and ADF. Significantly (<0.001) higher final body weight, total gain and average daily gain during entire feeding trial were observed in Teosinte (T2) and Napier (T3) grass fed group. Significantly (< 0.05) lower FCE was observed in both the Teosinte (T2) and Napier (T3) grass fed group.

Introduction

Scientific rearing practices of small ruminants play an important role in the food and nutritional security of rural people providing meat, milk and skin especially by goat. Due to higher input and output ratio goat is well suited for marginal and landless labour. Goat is highly prolific animal and can be reared at low cost of maintenance (Benerjee, 2004).Goats are among the main meat producing

animals in India, whose meat is one of the choicest meats and has huge domestic demand. It is highly preferred by all types of consumers as there is no religious taboo in eating chevon. Under grazing or browsing system, they can hardly fulfil their maintenance requirement. To obtain proper growth and production, supplementation of concentrate along with roughage feeding resulted maximum total body weight gain of kid at market age (Khound, 1992). Keeping the above facts in view, in the present study was conducted to study comparative nutritive evaluation of some cultivated fodder on performance of cross bred (Beetal Assam Local) goats under stall fed condition in the agro-climatic condition of the states of Assam.

Materials and Methods

The experiment was conducted in the Goat Research Station, Assam Agricultural University. Twenty crossbred (Beetal X Assam Local) weaned male kids were selected for current research. This study was conducted on twenty healthy growing native male lambs, with 5–6 months of age and of nearly equal body weight (6.72 ± 0.24 kg). These lambs were randomly divided into 4 groups; each group contained five lambs. A standard concentrate mixture having 16 % DCP and 75% TDN was prepared as per ICAR, (2013) with available conventional ingredient like crushed maize, wheat bran, rice polish, deoiled groundnut cake, mineral mixture, common salt available in the Goat Research Station, AAU, Burnihat for experimental kids. Before starting the experiment kids was conditioned for a period of 2 weeks. The kids were offered a standard farm ration @100g per day and *ad- libitum* green grass during the conditioning period.

The experiment was conducted in Randomized Block Design (RBD). After conditioning, the kids were divided randomly into 4 experimental groups of 5 animals each (Table 1). All groups were offered the same concentrate mixture. Group T1, T2, T3 were offered Para (*Brachiaria mutica*), Teosinte (*Zea maxicana*), Napier (*Pennisetum purpureum*) grass as roughage source, respectively but kids for group T4 was offered with the mixture of three fodder as roughage source.

Results and Discussion

Chemical composition and nutritive value

The chemical composition and nutritive value of concentrate mixture and green fodders used to fed experimental crossbred (Beetal x Assam local) kids of different groups during the experimental periods has been presented in Table 1 and Table 2. The DM, OM, CP, EE, CF, NFE, NDF, ADF and TA content in the concentrate mixture were 92.11, 89.40, 20.12, 3.25, 5.30, 60.73, 27.64, 10.73 and 10.60 percent. The results showed that the concentrate mixture used for feeding kids in the present experiment was able to meet the nutrients requirement of crude protein and other nutrients as proposed in the research technique of the present experiment. The CP, EE and TA value for concentrate mixture was similar to the value reported by Reddy (2013). The NFE value were more than to the finding of Kanak *et al.,* (2012) but it was in ranges between 34.9-57.10% for perennial grass as per reported by Jagadamba *et al.,* (2010) and CF value was comparable with finding of Subhash (2011). NDF was more and ADF was similar with the finding of ICAR (2013). The variation in nutritive value could be due to soil type, fertility, age of harvest, cultivation variation, proportion of leaf and stem and agro-ecological zone (Meel *et al.,* 2018).

Feed consumption

The fortnightly feed consumption on DM basis from concentrate, roughage and mix were significantly varied among the groups during the feeding trial.

The fortnightly DM intake from concentrate ration were significantly higher in Teosinte (T2) grass fed group as compared to other groups. However, fortnightly DM intake from roughage source were significantly higher in Napier (T3) grass fed group as compared to other groups. The fortnightly feed

consumption on DM basis from both sources are significantly higher in both the Teosinte (T2) and Napier (T3) grass fed groups.

The significantly higher DM intake in Napier (T3) grass fed group as compared to other groups could be result of more palatability, low NDF and ADF content of Napier grass. Fibre generally forms bulk and slows down the rate of transit of the ingesta through the gastrointestinal tract (Olafadehun, 2013).

The total DMI from 1st fortnight to 6th fortnight for Teosinte and Napier fed group increased linearly whereas the mix fed group and Para fed group kids fluctuated markedly and they showed lack of appetite on several occasions. It was suggested that inappetence of kids partly resulted from fall in rumen PH caused by intensive concentrate feeding (Forbes, 1995). The total DM intake was significantly higher in Teosinte grass fed group as compared to other groups in experimental kids could be because of more concentrate intake, physiological state of animal, type of fodder and agro-climatic condition of region.

Digestibility coefficient

The digestibility coefficient of DM, OM, CP, EE and NFE observed during the digestion trial in kids of different experimental group have been presented in Table 4.Fortnightly changes in body weight (kg) of experimental kids during feeding trial shown in table 4. Significant ($p<0.05$) difference was observed in respect of dry matter, organic matter digestibility coefficient among the groups which was significantly higher in Teosinte (T2) and Napier (T3) grass fed groups compared to Para (T1) and mix grass (T4) fed groups which might be due to reduced forage quality which attribute to decrease in dry matter digestibility, decrease nitrogen content of Para and mix fodder. As low quality CP and high NDF values of the native grass suggested as poor quality roughage (Sebsibe *et al.,* 2007). In the present study, the DM digestibility was found to be within the similar range as stated by the above worker (Ondiek *et al.,* 2013; Gebremedhin, 2015; Mpanza and Hassen, 2015; Tanneru *et al.,* 2018). Baruah *et al.,* (1983) opinioned that digestibility of organic matter decreased due to increase level of fibre in the diet. Similar the OM digestibility coefficient was found comparable with reported by Kishan *et al.,* (1983), Das and Katole (2011) in kids fed with mixed jungle grass- based diet, Hassan *et al.,* (2015) in goats fed with leaves and stems of *Acacia saligna, Leucaena leucocephala* and *Moringa oleifera*, Mpanza and Hassen (2015) in Saanen goats fed total mixed ration containing *Stylosanthes scabra*, Tanneru *et al.,* (2018) in local kids fedon Cumbu Napier hybrid (CO-4) grass silage and concentrate mixture.

The digestibility coefficient of crude protein observed in the present experiment were comparable with Reddy and Raghavan (1987) in Desi kids fed on ration containing roughage and concentrate in different ratio. Increase CP digestibility might be due to more CP concentration of Teosinte and Napier grass fodder which might have provided adequate N concentration for rumen microbes (Russel *et al.,* 1992). Singh and Talapatra (1971) observed that the digestibility increased with increased in crude protein content of the diet.

Significantly ($p<0.05$) higher digestibility of EE observed in the kids fed on Teosinte (T2) grass, followed by Napier (T3) grass, mix grass (T4) fed group and Para (T4) grass fed groups. The higher digestibility of EE in T2 and T3 might be due to higher EE content of Teosinte and Napier fodder as compare to Para and mix grass. This might be due to more CP content of Teosinte and Napier grass since dietary protein improve digestibility of nutrients (Abdel-ghani *et al.,* 2011).Comparable digestibility coefficient were reported by Aregheore *et al.,* (2001) in growing goats fed on Batiki grass, Guinea grass and Signal grass, Dhage *et al.,* (2016) in Berari goats fed complete mixed jungle grass and concentrate containing feed and Tanneru *et al.,* (2018) in local kids fed on ration based on Cumbu Napier grass silage. Statistically no significant ($P>0.05$) difference was observed among the groups

in respect digestibility of crude fibre. However, values were numerically more in Teosinte (T2) and Napier (T3) grass fed groups as compare to Para (T1) and mix (T4) grass fed groups which might be that goats are well known to digest feed rich in fibre than other ruminants. Statistically non significant difference was observed among the groups in respect of digestibility of NDF. However, values were in good agreement with the findings reported by Das and Katole (2011) in growing kids fed ration based on Barhar leaves and mixed jungle grass, Hassan *et al.,* (2015) in goats fed with leaves and stems of *Acacia saligna, Leucaena leucocephala* and *Moringa oleifera* and Dhage *et al.,* (2016) in Berari goats fed complete diet based on mixed jungle grass and concentrate. Das and Katole (2011) studied the replacement of concentrate with Barhar leaves in mixed jungle grass-based diet of kids and reported ADF digestibility of 47.22%, 52.08% and 51.29% in group received supplementary concentrate (Maize35%, mustard cake 32%, rice bran 30%, mineral mixture 2%, and common salt 1%), 25% and 50% of the concentrate was replaced with Barhar leaves. Hassan *et al.,* (2015) reported ADF digestibility of 53.81%, 56.79% and 56.44% in respective forage when goats were fed with leaves and stems of *Acacia saligna, Leucaena leucocephala* and *Moringa oleifera.* Kumar *et al.,* (2015) reported ADF digestibility of 47.86%, 50.45%, 60.83% and 52.83% when rams was fed solely on CO-4 variety of hybrid Napier ad lib, CO-4 fodder ad lib + 150 g crushed maize grain, CO-4 fodder ad lib + 150 g maize grain+ 125g groundnut cake and CO-4 fodder ad lib +150 g maize grain + 125g CSC in rams. Dhage *et al., (*2016) observed ADF digestibility of 47.99% and 47.97% when Berari goats were fed with complete feed of 60 percent mixed jungle grass + 40 percent concentrate (12% CP and 60%TDN), complete feed of 60 per cent mixed jungle grass+ 40 percent concentrate (14% CP and 60% TDN). Tanneru *et al.,* (2018) reported ADF digestibility of 50.20%, 51.68% and 52.48% when local kids were fed with Cumbu Napier hybrid (CO-4) grass silage and supplementing concentrate *ad libitum mixture @* 0.5% - 1.5% body weight.

The observed digestibility of ADF in the present experiment was in good agreement with the above workers. No significant (P>0.05) difference was observed among the groups in respect of acid detergent fibre digestibility.

Fortnightly changes in body weight and Feed conversion efficiency

The fortnightly changes in body weight of experimental kids during the feeding trial have been presented in Table 5. The body weight of experimental kids increased along with age during the feeding trial.

No significant difference was observed in change of body weight during 1st and 2nd fortnight. However, significant difference was observed in body weight among the groups from 3rd fortnight to 6th fortnight. The final body weight at the end of 6th fortnight were significantly higher in Teosinte (T2) and Napier (T3) grass fed groups as compare to Para (T1) and mix (T4) grass fed groups.

The feed conversion efficiency (on DM basis) in the experimental kids during entire feeding trial been presented in Table 6. The feed conversion efficiency (on DM basis) in the experimental groups significantly (< 0.05) lower was observed in both the Teosinte (T2) and Napier (T3) grass fed group as compare to Para (T1) and mix grass (T4) fed group of kids.

All the group exhibited similar trend of fortnightly increase in live body weight throughout the experimental period which revealed the body weight of experimental kids increased along with age The significantly highest gain observed in Teosinte (T2) grass fed group followed by Napier (T3) grass fed group and lowest in Para (T1) and mix (T4) grass fed groups might be due to appropriate utilization of crude protein and other nutrient in Teosinte (T2) and Napier (T3) grass fed groups as compare to Para (T1) and mix (T4) grass fed groups. Similar rate in gain of body weight in crossbred (Beetal Assam local) kids were reported by Saikia *et al.,* (1995).

Table.1 Percent chemical composition of concentrate and green fodders used in the experiment onDM basis

Particulars (%)	Concentrate mixture	Para	Teosinte	Napier	Mix Fodder
DM	92.11	32.82	44.74	21.87	29.38
OM	89.40	87.20	91.00	86.40	89.40
CP	20.12	6.23	9.36	8.74	7.66
EE	3.25	2.30	2.80	2.61	2.00
CF	5.30	26.00	28.50	27.00	26.00
NFE	60.73	52.67	50.34	48.05	53.74
NDF	27.64	64.30	59.30	54.10	60.70
ADF	10.73	34.10	30.80	29.50	31.20
TA	10.60	12.80	9.00	13.60	10.60

Estimated nutritive value of composite rations used in the experiment

Table. 2 Estimated nutritive value of composite rations used in the experiment

	Groups			
Particulars	T_1	T_2	T_3	T_4
CP (%)	9.27	11.14	12.33	11.00
DCP (%)	6.59	9.76	9.69	7.91
TDN (%)	62.34	70.30	67.53	61.60
DE (Mcal/Kg)*	2.74	3.09	2.97	2.71
ME (Mcal/kg)*	2.26	2.54	2.44	2.23

* Calculated value

Table.3 Fortnightly feed consumption (Concentrate Roughage) (on dm basis) by experimental kidsduring feeding trial

Fort-night(Kg)	Group				SEM	P Value
	T_1	T_2	T_3	T_4		
1st	3.26^{a}±0.27	6.42^{c}±4.20	5.45^{bc}±0.57	5.04^{b}±0.33	0.32	0.001
2nd	4.29^{a}±0.22	6.79^{c}±0.44	5.64^{b}±0.55	4.44^{a}±0.19	0.29	0.001
3rd	4.64^{a}±0.22	8.10^{c}±0.37	6.06^{b}±0.26	5.42^{ab}±0.66	0.35	<0.001
4th	5.52^{a}±0.37	8.15^{b}±0.36	6.18^{a}±0.09	5.68^{a}±0.64	0.31	0.001
5th	5.41^{a}±0.55	8.72^{b}±0.48	6.93^{a}±4.3	5.55^{a}±0.65	0.39	0.001
6th	5.83^{a}±0.76	9.43^{b}±0.91	7.71^{ab}±0.81	5.61^{a}±0.64	0.51	0.011

$^{\dagger abc}$ Mean with different superscripts within the same row differ significantly (P< 0.05).

Table.4 Digestibility coefficient of DM, OM, CP, EE, NFE in experimental kids during digestiontrial

Digestibility Co-efficient (%)	Group				SEM
	T_1	T_2	T_3	T_4	
Dry matter	67.29^{a}±1.51	75.74^{b}±1.62	72.82^{ab}±2.41	65.08 ^{a}±3.20	1.61
Organic matter	68.66^{a}±1.15	77.0^{b}±1.71	74.71^{ab}±2.24	67.55^{a}±3.17	1.52
Crude protein	71.16^{a}±1.75	87.57^{c} ±1.29	78.60^{b}±1.46	71.86^{a}±1.87	2.11
Ether extract	76.35^{a} ±1.17	87.64^{c}±0.68	80.72^{b}±1.44	77.66^{ab}±1.22	1.41
Nitrogen free extract	75.22±1.01	79.58±1.89	78.52±2.03	72.48±2.98	1.23
Crude fibre digestibility	49.07±1.10	58.52±0.32	59.02±4.29	45.53±7.18	2.52
Neutral detergent fibre	56.51±1.69	60.17±1.02	58.78±7.86	57.76±4.68	2.04
Acid detergent fibre	46.39±2.13	52.45±1.95	50.82±7.08	47.85±6.32	2.24

Table.5 Fortnightly changes in body weight (kg) of experimental kids during feeding trial

Fortnight	Group				SEM	P value
	T_1	T_2	T_3	T_4		
Initial	6.70±0.22	6.74±0.12	6.70±0.38	6.74±0.24	0.12	0.999
1st	6.98±0.21	7.54±0.19	7.14±0.34	7.24±0.36	0.14	0.576
2nd	7.36±0.14	7.92±0.19	7.80±0.34	7.70±0.34	0.13	0.511
3rd	7.80^{a}±0.55	8.88^{b}±0.23	8.46^{ab}±0.29	8.18^{ab}±0.33	0.15	0.045
4th	8.28^{a}±0.06	9.66^{c}±0.20	9.32^{bc}±0.27	8.78^{ab}±0.31	0.16	0.003
5th	8.66^{a}±0.09	10.56^{c}±0.20	10.10^{bc}±0.30	9.40^{b}±0.29	0.20	<0.001
6th	9.20^{a}±0.12	11.70^{b}±0.14	11.05^{b}±0.26	9.86^{a}±0.42	0.26	<0.001
Total gain in body weight (kg)	2.50^{a}±0.27	4.96^{b}±0.23	4.35^{b}±0.35	3.12^{a}±0.40	0.27	<0.001
Average daily gain (g)	27.78^{a}±2.96	55.11^{b}±2.57	48.33^{b}±3.84	34.67^{a}±4.46	2.96	<0.001

†abc Mean with different superscripts within the same row differ significantly (P<0.05). Fortnightly feed conversion efficiency (on dm basis) in the experimental kids of different groups

Table.6 Fortnightly feed conversion efficiency (on DM basis) in the experimental kids of differentgroups

Fortnight	Group				SEM	P Value
	T_1	T_2	T_3	T_4		
1st	19.07±6.31	8.91±1.66	9.05±3.19	15.04±4.59	2.20	0.301
2nd	16.81±6.67	23.76±6.98	9.01±1.51	10.24±1.19	2.63	0.169
3rd	7.05±1.84	9.55±1.47	9.71±1.28	15.75±5.63	1.61	0.278
4th	11.89^{b}±0.82	11.18^{b}±0.38	7.97^{a}±0.35	9.20^{a}±0.79	0.46	0.001
5th	15.97^{b}±1.57	9.92^{a}±0.43	9.34^{a}±0.76	9.23^{a}±0.69	0.78	<0.001
6th	11.37^{a}±0.94	8.81^{a}±1.32	8.58^{a}±1.16	15.83^{b}±2.03	0.93	0.008

†ab Mean with different superscripts within the same row differ significantly (p<0.05).

Table.7 Economics of feeding

Particulars	Group			
	T_1	T_2	T_3	T_4
Total Concentrate intake (Kg)/animal (DMI)	19.40	36.60	24.00	22.20
Cost of concentrate mixture (Rs) (DM basis)	24	24	24	24
Total feed cost in Rs/animal/90 days	465.60	878.40	576.00	532.80
Total feed cost per day per animal (Rs)	5.17	9.76	6.4	5.92
Total gain in body weight (kg)	2.50	4.96	4.35	3.12
Feed cost per kg gain (Rs)	186.24	177.10	132.41	170.77

The ADG observed in the present study was comparable with that was reported for Barbari breed (Annamman, 1989), Nubian kids fed on Alfalfa hay (Gelaye *et al.*, 1990), Hararghe highland kids fed on hay and concentrate (Tamir and Awuk, 2015), Konkan Kanyal goats fed on hydroponically sprouted maize and barley fodder (Gebremedhin *et al.*, 2015) and in Berari goats fed with complete feed based on jungle grass (Dhage *et al.,* 2016).The present finding in respect of feed conversion efficiency was in good agreement with the findings of Baruah *et al.*, (1988) in Assam local kids, Baruah *et al.*, (1989), Baruah (1994) and Saikia *et al.*, (1995) in crossbred (Beetal Assam local) kid, Wadhwani and Patel (1991) in Marwari goats and Dhage *et al.*, (2016) in Berari goats fed on complete ration based on jungle grass and concentrate. The kids fed Teosinte (T2), Napier (T3) and mix fodder (T4) received the DCP more than 100 per cent of ICAR (2013) requirement but kids fed Para grass (T1) received only 79.39±1.85 per cent of ICAR (2013) requirement might be because of higher level of protein in experimental diets. Similar finding of more than 100 per cent DCP received was reported by Angami (1990) when fed with different level of energy with oat grass as sole source of roughage in crossbred (Beetal Assam local) goats, Goswami (1996) fed concentrate mixture and hybrid napier in Assam local goat, Kalita (2003) fed fodder tree based ration in Assam local kids.The kids belong to Teosinte (T2), Napier (T3) and mix (T4) groups received the TDN more than 100 per cent of ICAR (2013) requirement but kids of Para (T1) group received only 93.16±3.54 per cent of ICAR (2013) requirement. Similar finding of more than 100 percent TDN was reported by Angami (1990) in crossbred (Beetal Assam local) kid fed with different level of energy with oat grass as sole source of roughage. The kids belong to kids belong Teosinte (T2), Napier (T3) and mix (T4) groups received the ME more than 100 per cent of ICAR (2013) requirement but kids of Para (T1) group received only 96.04±1.98 per cent of ICAR (2013) requirement. The result of the present study showed the suitability of all the evaluated fodder for feeding growing kids under stall fed condition. However, better performance of kids were observed in groups fed Teosinte, Napier and mix grass since their inclusion in the goat ration as roughage source were able to meet DM and other nutrient requirement

more than 100 per cent of ICAR recommendation for growing male kids. Ranjhan (1980) reported that a complete feed providing 9-10% DCP and 60- 65% TDN could meet the requirement of the growing kid. In present experiment the level of DCP in composite ration of T2, T3 groups were as per recommendation of Ranjhan (1980), but lower in T1 and T4 groups. The lower nutritive value of composite ration in T1 and T4 groups could be attributes due to low digestibility of nutrients except NFE and fibre. Total cost of feeding per day per animal was lowest in T1 group. The lowest cost of production in terms of growth per kg live weight gain was found in T3 group which might be due to higher body weight gain as compared to the other groups.

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