

Performance of growing crossbred female calves fed different ratios of JHB–146 variety of green berseem and straw

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ABSTRACT

Growing female calves (15), divided into 3 groups of 5 each, were fed a mixed ration of barley straw and green berseem (JHB–146, a new variety) with limited supplementation of wheat bran (0.3% of live weight) to record their nutritional and growth performances. Three different combinations of barley straw and green berseem were 50:50, 30:70 and 15:85 (on dry matter basis) and fed to the animals of G₁, G₂ and G₃ group, respectively. Average daily DM intake was 2.47, 2.38 and 2.29% of live weight in calves of G₁, G₂ and G₃ groups, respectively, and the differences were nonsignificant. The digestibility of DM, OM, EE and cellulose were also comparable among the groups ranging from 58.3 to 60.7, 60.1 to 62.1, 46.7 to 48.6 and 53.7 to 59.2%, respectively. However, the digestibility of NDF and ADF was lower and of CP was higher in calves of G₃ group than that in G₁ group. All the animals were in positive nitrogen balance and retained 20.6, 28.5 and 33.9 g N/animal/day in G₁, G₂ and G₃ groups, respectively. Average daily CP and DCP intakes were low in G₁ group than G₂ and G₃ groups. However, average TDN intakes were comparable among the groups, ranging from 2.28 to 2.36 kg/day. Higher intakes of nitrogen and its balances in G₂ and G₃ groups also resulted in higher live weight gain in calves of these 2 groups when compared to G₁ group. Variation in green berseem to barley straw ratio also had no influence on the blood biochemical constituents. It was inferred that the feed intake and nutrient utilization were better and calves sustained around 500 g ADG when fed barley straw and JHB–146 variety of green berseem in 30: 70 ratio.

Key words: Barley straw, Female calves, Green berseem, JHB–146 variety, Performances

Cereal straws and stovers constitute the staple roughages in the rations of farm animals. But these crop residues are low in palatability, digestibility and nutritive value. When they are fed along with green fodder, it increases voluntary feed intake and nutrient availability (Mahanta *et al.* 2009). In the recent past a new high yielding, nutritious and disease resistant variety of berseem, Bundel Berseem–2 (JHB–146) has been developed at this institute through mass selection from indigenous germplasm and released for cultivation in central and north-west zone of India (Faruqui *et al.* 2006). The green berseem (*Trifolium alexandrinum*), a rich source of nitrogen is also fairly good source of energy, vitamin, minerals and high level of readily digestible cellulose and hemicellulose, which stimulate microbial fermentation (Das and Singh 1999). Green berseem supplementation is reported to increase the digestibility of straw based diets (Das and Singh 1999). But the information is inadequate as far as use of barley straw and green berseem in various combinations in relation to their intake and utilization is

concerned. Therefore, the present study was conducted to assess the impact of different combination of barley straw and new variety of green berseem (JHB–146) on feed intake, nutrient utilization and weight gain in crossbred female calves.

MATERIALS AND METHODS

Berseem cultivation: The new variety of forage berseem viz. JHB–146 was grown on the sandy loam soil under the recommended agronomic practices (Hazra 1995) at the Central Research Farm of Institute. Green berseem was harvested and chopped into pieces of 1–4 cm in length.

Animals and experimental feeding: Growing crossbred (Jursey and Tharparkar) female calves (15) of about 1 year of age and average body weight of 154.6 kg, were randomly divided into 3 groups of 5 animals (each of average body weight 154.6 kg) and were fed 3 different combinations of barley straw and green berseem at 50:50, 30:70 and 15:85 (on dry matter basis) to groups G₁, G₂ and G₃ respectively. In all the 3 groups, wheat bran was supplemented @ 0.30% of live weight as source of phosphorus in berseem based rations. The feeding trial was lasted for 71 days.

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Metabolism trial and sample collection: A metabolism trial (Schneider and Flatt 1975) of 7 days was conducted towards end of experimental feeding. During the metabolism trial, records of feed offered, residues left and faeces and urine voided during 24 h were kept. Representative samples of daily faeces voided were dried in oven and pooled for proximate analysis. For the analysis of N, aliquot of faeces and urine were preserved in sulphuric acid (40%) till analysis.

Chemical analysis: Sample of feeds offered, residues left and faeces voided were analyzed for proximate principles and urine for N (AOAC 1990) and cell wall fractions (Goering and Van Soest 1970).

Blood samples analysis: Blood samples were also collected via a jugular vein puncture from the experimental animals into sterilized glass tubes (with cap) containing sodium fluoride (5 mg/ml) and heparin (0.2 mg/ml) for the preparation of plasma. The blood samples were analyzed for haemoglobin (Wong 1928) and plasma samples for glucose (Cooper and McDaniel 1970), protein by Biuret method (Reinhold 1953) and urea nitrogen (Rahamtulla and Boyde 1980).

Body weight recording: The animals were weighed before feeding and watering fortnightly and then at the end of feeding trial for 2 consecutive days to record the pattern of change in live weight gain in different groups.

Statistical analysis: The data were subjected to analysis of variance in one-way classification using completely randomized design (Snedecor and Cochran 1989). The test of significance among the treatment differences was also analyzed (SPSS 1999).

RESULTS AND DISCUSSION

The chemical composition of green berseem, barley straw and wheat barn are presented in Table 1. The green berseem contained 17.68% CP compared with 13.36% in wheat bran on dry matter basis. While barley straw contained 4.44% CP and 73.7% NDF.

Dry matter and nutrients intake: The average daily dry matter intake (DMI) was 4.06, 4.15 and 4.19 kg in calves of G₁, G₂ and G₃ groups, respectively, and the differences were

Table 1. Chemical composition (% DM basis) of feedstuffs

Attributes	Feedstuffs		
	Green berseem	Barley straw	Wheat bran
OM	88.09	91.44	94.32
CP	17.68	4.44	13.36
EE	1.95	1.21	3.02
NDF	43.95	73.72	42.30
ADF	33.94	44.33	11.31
Hemi-cellulose	10.01	29.39	30.99
Cellulose	25.78	35.71	8.01
ADL	7.50	6.26	2.24
Total Ash	11.91	8.56	5.68

nonsignificant (Table 2). DMI expressed on kg/100 kg live weight or g per kg W^{0.75} was also comparable amongst the different groups. This showed that inclusion of green berseem more than 50% (DM basis) in mixed ration of barley straw and berseem did not improve the feed intake in growing calves. On the contrary, feed (DM) intake (kg/d) or as % of body weight increased ($P < 0.05$) with the increase in level of green berseem (20 to 50% on DM basis) in heifers fed different combinations of green berseem and oat straw. Although, feed intakes were statistically comparable in heifers fed combinations containing 20 to 40% and 40 to

Table 2. Nutrient intake and utilization, body weight gain and blood metabolites in crossbred female calves fed different combinations of barley straw and green berseem

Attributes	Treatment/groups			SEM
	G ₁ (50: 50)	G ₂ (30:70)	G ₃ (15:85)	
<i>Nutrient intake</i>				
Total DMI (kg/d)	4.06	4.15	4.19	0.31
DMI (kg/100 kg)	2.47	2.38	2.29	0.11
DMI (g/kg W ^{0.75})	88.32	86.47	84.22	3.98
CPI (g/d)**	476 ^b	601 ^a	690 ^a	37.20
CPI (g/kg W ^{0.75})**	10.34 ^c	12.54 ^b	13.89 ^a	0.42
DCPI (g/d)**	218 ^b	328 ^a	361 ^a	20.81
DCPI (g/kg W ^{0.75})**	4.72 ^b	6.85 ^a	7.26 ^a	0.21
TDNI (kg/d)	2.28	2.36	2.30	0.20
TDNI (g/kg W ^{0.75})	49.25	49.32	46.31	2.83
<i>Nutrient digestibility (%)</i>				
DM	59.36	60.72	58.39	1.53
OM	60.45	62.19	60.10	1.55
CP**	45.56 ^b	54.74 ^a	52.44 ^a	1.65
EE	48.60	47.99	46.78	3.07
NDF*	52.47 ^a	51.19 ^a	43.93 ^b	2.18
ADF*	44.73 ^a	43.50 ^a	35.82 ^b	2.57
Cellulose	59.27	57.50	53.71	1.86
<i>Nitrogen balance (g/d)</i>				
N intake**	76.10 ^b	96.16 ^a	110.4 ^a	5.94
Faecal-N	41.18	43.46	52.62	3.31
Urine-N*	14.28 ^b	24.12 ^a	25.84 ^a	2.90
Balance (NB)**	20.64 ^b	28.58 ^a	31.94 ^a	1.33
NB as % of absorbed-N	59.45	54.62	58.91	2.36
<i>Body weight gain</i>				
Initial wt. (kg)	154.4	153.2	156.2	11.83
Final wt (kg)	178.9	188.9	195.8	13.0
Total weight gain (kg)	24.5	35.7	39.6	4.40
ADG (g)	345	502	557	86.27
<i>Blood metabolites (units/dl)</i>				
Haemoglobin (g)	9.24	9.42	9.37	0.56
Glucose (mg)	50.1	50.5	51.0	2.50
Plasma protein (g)	7.27	7.45	7.50	0.42
Plasma urea-N (mg)	14.1	14.3	14.6	1.24

Ratio of barley straw and green berseem were 50: 50 (G₁), 30: 70 (G₂) and 15: 85 (G₃) on dry matter basis. Means bearing different superscripts in a row differ significantly, * $P < 0.05$; ** $P < 0.01$.

50% berseem (Lal *et al.* 2005). However, the values on DMI (2.29 to 2.47% of body weight) obtained in the present study were comparatively lower and probably attributed to the difference in type of animals as well as rations.

The per cent digestibility of DM, OM and EE was comparable among the groups, however, CP digestibility was significantly ($P < 0.01$) low in calves (G_1) fed barley straw and green berseem at 50:50 ratio compared with other groups (G_2 and G_3), which is probably due to lower protein intake (476 g/d) in calves of G_1 group. While the digestibility of NDF and ADF was significantly ($P < 0.05$) low in calves of G_3 group. Thus, the level of green berseem beyond 30:70 ratio on dry matter basis depressed the digestibility of cell wall constituents and might be due to a preferential selection by rumen microbes for more digestible fibre in green berseem as compared to lignified cellulosic material in barley straw (Sahoo *et al.* 2000). On the contrary, digestibility of nutrients increased with the increase in level of green berseem up to 50% in heifers fed different combinations of green berseem and oat straw (Lal *et al.* 2005), which could be due to decrease in lingo-cellulose complex and NDF content of rations, being negatively correlated with digestibility of nutrients (Nadia *et al.* 1993).

All the growing calves in the present study were in positive nitrogen (N) balance (Table 2). The N intake (g/d) was significantly ($P < 0.01$) lower in calves of group G_1 as compared to those in groups G_2 and G_3 , which was due to lower proportion of green berseem in the rations. However, fecal N excretion (g/d) in calves fed rations containing different combinations of green berseem and barley straw was statistically comparable amongst the groups. On the contrary, N excretion through urine was significantly ($P < 0.05$) low in calves under G_1 group as compared to those under G_2 and G_3 groups, which was attributable to lower N intake. The N balance (g/d) was significantly ($P < 0.01$) different among the treatment groups being lowest in G_1 group (14.2) followed by G_2 (24.1) and G_3 (31.9). However, nitrogen balance (as % of absorbed N) was comparable in calves under different groups. This showed that due to higher CP content in green berseem, there was higher consumption of N with increased level of green berseem in the rations and also comparatively higher excretion of nitrogen through faeces and urine. Similar findings were also observed in growing male calves fed different combinations (40: 60 to 10: 90) of wheat straw and green sorghum (Sahoo *et al.* 2000).

Plane of nutrition and live weight gain

Average CP and DCP intakes (g/d or g/kg W^{0.75}) were significantly ($P < 0.01$) low in calves under G_1 group as compared to those under G_2 and G_3 groups, which was attributable to lower levels of green berseem in the total rations (Table 2). Daily TDN intakes were comparable among the different groups, ranging from 2.28 to 2.36 kg or 46.3 to 49.3 g/kg W^{0.75}. This indicated that level of green berseem

did not have any effect on TDN/energy intakes in growing calves fed barley straws based rations. When compared to the recommended daily nutrient intakes (ICAR 1998) for 500 g ADG in growing calves, all the groups almost met the requirement of DMI, but were deficit (around 15%) in TDN intakes. While CP/DCP intake was lower (by 20%) in G_1 group and higher (by more than 15%) in G_3 group. Buffalo calves fed sole rations of green fodder also had similar level of nutrient intakes (Mondal *et al.* 1995). However, crossbred calves fed different combinations of non-leguminous green sorghum and wheat straw had higher TDN intakes, but lower CP intakes (Sahoo *et al.* 2000) than the values obtained in the present study and this was due to difference in kind of forage fed to growing calves.

The average daily gain (ADG) in weight of female calves was 345, 502 and 557 g in G_1 , G_2 and G_3 groups, respectively, and the differences were significant. Calves fed 50: 50 barley straws and green berseem had lower ($P < 0.05$) ADG than other groups. However, ADG was statistically comparable between G_2 and G_3 groups. This showed that inclusion of green berseem above 70% on dry matter basis did not have any positive effect on body weight gain in growing calves. However, ADG was 9.87% low in calves fed 70% berseem than those on 85% of berseem mixed with barley straw. Sahoo *et al.* (2000) also reported 466 g ADG when fed green sorghum and wheat straw in a ratio of 10: 90 to yearling crossbred male calves.

Blood metabolites: Variation in green berseem to barley straw ratio had no influence on the blood biochemical constituents (Table 2). Concentration (unit per dl) of haemoglobin, glucose, plasma protein and urea nitrogen ranged from 9.24 to 9.42 g, 50.1 to 51.0 mg, 7.27 to 7.50 mg and 14.1 to 14.6 mg in G_1 , G_2 and G_3 groups, respectively and were comparable among the groups and all the values were within the normal range as reported earlier (Mahanta *et al.* 1999, 2001) in growing female calves.

It may be inferred that supplementation of green berseem (JHB-146 variety) in barley straw based rations improved the nutrient intakes and utilization and female calves sustained around 500 g ADG when fed barley straw and green berseem in 30: 70 ratio on dry matter basis. However, further increase in level of green berseem beyond 30: 70 ratio with barley straw had no additional benefit on feed intake and nutrient utilization in forage based diets.

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