

EFFECT OF LEVELS OF LUCERNE STRAW IN TOTAL MIXED RATION ON NUTRIENT INTAKE AND DIGESTIBILITY IN BULLOCKS

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Abstract: The study was planned to examine effect of 50 (T₁), 60 (T₂) and 70 (T₃) % lucerne straw in total mixed ration (TMR) on nutrient intake and digestibility in Kankrej crossbred bullocks. Two bullocks were assigned in each treatment using 3 x 3 Latin Square design. The nutrient intake was measured every day and averaged on weekly basis. The metabolic study for digestibility and balance of nutrients was conducted for seven days at end of experiment. Average body weight gain was similar amongst treatments. Daily intake of dry matter (DM) on per cent body weight and on metabolic body weight as well as of crude protein (CP), digestible crude protein (DCP) and TDN of bullocks differ non-significantly amongst treatments. The digestibility of DM organic matter, CP, ether extract, nitrogen free extract, neutral detergent fibre and hemicellulose were also similar amongst treatments. The digestibility of acid detergent fibre was higher ($P<0.05$) in T₂ and T₃ than in T₁. The cellulose digestibility was significantly different amongst treatments, the highest being in T₃, followed by T₂ and the least in T₁. The balance of nitrogen, calcium and phosphorus were positive for bullocks under all treatments. The results suggest that lucerne straw can be incorporated up to 70% in TMR for maintenance of bullocks without adverse effect on body weight, nutrients intake and digestibility of nutrients.

Keywords: Bullock, Lucerne straw, Total mixed ration, Nutrient intake, Digestibility.

INTRODUCTION

Livestock play a pivotal role in livelihood of the majority of the population living in developing countries under the natural resource-based. However, most of these regions face the problem of acute shortage of feed resources (Walli *et al.*, 2012). In India, the green roughage, dry roughage and concentrate are deficit by 62.76, 23.46 and 63.00% of the requirements (Kore, 2014). The deficit feed resources necessitates efficient use and improvement in feeding system. The feeding of total mixed ration (TMR) serves both these purposes as it is fed sole to meet all the nutrients requirements. The main roughages used in TMR so far are cereal crop residues and a very few studies on legume straw are available as sole roughage. After harvesting seeds of lucerne, the remaining part of the crop has low

nutritional value. Since meager data are available on incorporation of lucerne straw in TMR, the present study was aimed to examine the effect of three levels of incorporation of lucerne straw in TMR on body weight, nutrients intake, digestibility and nutrient balance for maintenance of bullocks.

MATERIALS AND METHODS

The study was conducted on six Kankrej crossbred bullocks at the Animal Nutrition Research Department, Anand (Gujarat) following 3×3 Latin square design with each period of six weeks duration. Two bullocks with uniform body weight (299.11 kg-Square-I and 375.33 kg-Square-II) were assigned to each treatment. The bullocks were weighed every week for three consecutive days before feeding and watering in the morning. The 2 kg green NB-21 of hybrid napier was fed in the morning to meet vitamin A requirement. The total mixed ration containing 50 (T_1), 60 (T_2) and 70 (T_3) % lucerne straw (Lunagariya and Pande, 2016) was fed individually in two equal part in the morning and afternoon to meet the nutrients requirement (ICAR, 1985). Bullocks were let loose daily for two hours in the morning and evening throughout experimental period, except during metabolism trials, and had free access to fresh clean drinking water. During metabolism trials water was offered four times daily *i.e.* 9.30 am, 11.30 am, 3.00 pm and 5.00 pm.

The representative samples of feed offered and leftover were analyzed for proximate composition and fibre fraction as per Tiwari *et al.* (2012) and Gylean (2010). The digestion trial of seven days was conducted on all the bullocks at the end of each period to study digestibility and balance of nutrients. During digestion trial measured quantities of green NB-21 and total mixed ration (TMR) were offered and leftover recorded. The faeces voided were quantitatively measured and representative samples were kept for moisture estimation. The dry matter resulted of each day samples was pooled and preserved for proximate composition and fibre fractions. The representative samples of acid faeces were preserved for nitrogen estimation. The data generated were analyzed as per procedure laid down by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Composition and Body weight:

The chemical composition of total mixed ration (TMR) and fodder fed to bullocks are given in Table 1. The proximate composition of three TMR was nearly the same, however NB21 had higher CP, EE, silica, phosphorus and hemicellulose and lower NFE, ADE, ADL and cellulose as compared to Lucerne straw, while all three TMR had intermediate values. The

extent of nutrients utilization is reflected in body weights of animals. The overall results on change in body weights amongst treatments revealed that the bullocks maintained their body weight. Average gain in body weight over the experimental period was 18.39, 14.86 and 20.48 kg, respectively for bullocks fed TMR with 50, 60 and 70% lucerne straw (Table 1). The inclusion of lucerne straw up to 70% in TMR had no adverse effect on body weights of bullocks. Tatsapong *et al.* (2010) reported non-significant changes in the body weight of growing male swamp buffalo on feeding diet having rice straw from 65.39 to 66.22%.

Table 1: Chemical composition (%) of fodder and total mixed ration on DM basis

Constituents	Total Mixed Ration			Hybrid Napier NB-21	Lucerne straw
	T1	T2	T3		
Crude protein	11.84 ± 0.35	12.21 ± 0.15	12.23 ± 0.33	13.29 ± 0.95	10.62
Ether extract	3.52 ± 0.10	3.88 ± 0.24	3.73 ± 0.17	4.84 ± 0.25	1.89
Crude fibre	25.25 ± 0.08	28.54 ± 0.69	27.60 ± 0.72	28.40 ± 1.80	31.14
NFE	46.78 ± 1.17	44.51 ± 0.96	45.71 ± 0.69	40.75 ± 0.35	44.90
Ash	12.60 ± 0.75	10.92 ± 0.36	10.97 ± 1.42	12.72 ± 0.57	11.45
Silica	1.80 ± 0.15	2.67 ± 0.26	1.99 ± 0.37	5.21 ± 0.55	3.53
Phosphorus	0.60 ± 0.03	0.57 ± 0.04	0.60 ± 0.03	0.47 ± 0.09	0.27
Calcium	1.20 ± 0.09	1.37 ± 0.08	1.28 ± 0.06	1.02 ± 0.02	1.76
NDF	69.15 ± 0.40	70.12 ± 0.70	70.54 ± 0.10	72.99 ± 0.86	75.84
ADF	33.11 ± 0.23	35.22 ± 0.51	35.62 ± 0.25	33.96 ± 0.69	51.71
ADL	9.08 ± 0.09	10.27 ± 0.11	10.50 ± 0.09	3.78 ± 0.54	11.62
Cellulose	24.03 ± 0.16	24.95 ± 0.48	25.11 ± 0.13	30.18 ± 0.22	40.09
Hemicellulose	30.03 ± 0.17	34.09 ± 0.27	34.92 ± 0.32	39.02 ± 0.77	24.13

Dry matter and Nutrients intake:

The dry matter intake of bullocks was significantly ($p<0.05$) higher when fed 50% lucerne straw based TMR (T1) than for 60% lucerne straw based TMR (T2), while for 70% lucerne straw based TMR (T3) it was intermediate. The per cent DM intake and DM intake on metabolic body weight of bullocks also followed the same trend, but did not differ statistically (Table 2), and similar were the observations for daily crude protein (CP) intake, DCP intake and TDN intake by bullocks under T1, T2 and T3 ration. The CP, DCP and TDN intakes of bullocks were highest with T1 TMR followed by T3 and the least in T2 TMR

(Table 2). The incorporation of lucerne straw up to 70% in TMR had no adverse effect on dry matter and nutrients intake of bullocks. Kishore *et al.* (2013) reported 1.70, 1.68 and 1.67 kg/100 kg body weight daily DM intake by Murrah buffalo bulls on feeding TMR having roughage 60% as maize stover, red gram straw and black gram, respectively. Lunagariya (2016) reported slightly lower daily intake of DM (6.74 kg/day, 1.52 kg/100 kg body weight, 68.76 g/kg W^{0.75}), CP (0.674 kg/day) and DCP (0.391 kg/day) while intake of TDN (3.773 kg/day) was slightly higher in non-lactating dairy cows fed TMR with 60% sorghum hay and 40% concentrate during rumen fermentation and digestibility study of 56 days.

Table 2: Body weight and nutrients intake of Bullocks

Parameters	Treatments			F
	T1	T2	T3	
Changes in body weight kg	+18.39±4.21	+14.86±5.33	+20.48±3.06	0.89 NS
DMI (kg/day)	7.21 ^a ± 0.51	6.34 ^b ± 0.52	6.60 ^{ab} ± 0.36	7.29 *
DMI (kg/100 kg b. wt.)	1.92 ± 0.08	1.72 ± 0.11	1.78 ± 0.07	4.46 NS
DMI (g/ kg W ^{0.75})	84.52 ± 3.56	75.27 ± 4.70	78.02 ± 2.85	2.06 NS
CP intake (kg/day)	0.871 ± 0.05	0.808 ± 0.50	0.829 ± 0.04	1.67 NS
DCP intake (kg/day)	0.506 ± 0.03	0.492 ± 0.03	0.501 ± 0.03	0.42 NS
TDN intake (kg/day)	3.47 ± 0.24	3.01 ± 0.26	3.37 ± 0.20	6.10 NS

NS: Non-significant; *Means with different superscript in a row differ significantly (p<0.05).

Digestibility of nutrients:

The average digestibility of dry matter (DM) and organic matter (OM) were higher in T3 followed by T1 and the least in T2 TMR. The digestibility of crude protein (CP) was almost similar in T2 and T3, and non-significantly higher than T1. The digestibility coefficients of ether extract (EE) and NFE were non-significantly lower in T2 than other treatments. The digestibility coefficients of neutral detergent fibre (NDF) and hemicellulose were identical for T1, T2 and T3 TMR. The digestibility coefficient of acid detergent fibre (ADF) was highest in T3 followed by T2 and T1, but did not differ statistically. The digestibility of ADF was significantly higher (p<0.05) under T3 and T2 TMR in comparison to control TMR (T1). The significantly higher (p<0.01) digestibility of cellulose was also found under T3, followed by T2 and least under T1 TMR (Table 3). Tatsapong *et al.* (2010) reported similar apparent digestibility of CP, NDF and ADF, while it was higher for DM and OM on feeding diet having rice straw (65.39 to 66.22%) in growing male swamp buffalo calves. Similar *in vitro*

digestibility values for CP, NDF and ADF were reported by Konka *et al.* (2015) with total mixed ration incorporating 60% of maize stover *vs.* black gram straw. The digestibility of DM and OM was comparable on feeding complete ration (roughage to concentrate ratio of 50:50%) having 30% red gram stalk, but was reduced with 40 and 50% level (Nagalakshmi *et al.*, 2014). Zobell *et al.* (2005) revealed 59.9 and 32.6% digestibility of DM and OM on feeding total mixed ration having 42.0% straw in cannulated beef cows. The lucerne straw can be incorporated up to 70% in TMR without adverse effect on nutrients digestibility in bullocks.

Table 3: Digestibility coefficients of nutrients of Lucerne based TMR

Parameters	Treatments			F
	T1	T2	T3	
Dry matter	47.27 ± 1.43	46.24 ± 1.91	49.52 ± 1.62	3.96 NS
Organic matter	51.44 ± 0.79	49.72 ± 1.44	54.01 ± 1.89	3.83 NS
Crude protein	58.02 ± 0.82	60.82 ± 1.29	60.40 ± 0.89	5.17 NS
Ether extract	70.06 ± 1.78	66.99 ± 2.92	69.12 ± 1.22	0.64 NS
NFE	51.94 ± 1.68	49.45 ± 1.56	53.59 ± 2.27	1.31 NS
NDF	56.01 ± 0.23	56.96 ± 0.91	56.89 ± 1.01	0.55 NS
ADF	41.97 ^a ± 0.19	43.93 ^b ± 1.21	44.78 ^b ± 0.58	8.77*
Cellulose	54.94 ^a ± 0.26	57.93 ^b ± 1.14	60.41 ^c ± 0.95	54.86**
Hemicellulose	68.83 ± 0.49	69.94 ± 0.80	71.07 ± 1.32	0.66 NS

NS: Non-significant; Mean with different superscript in a row differ significantly *(P<0.05), **(P<0.01).

Balance of nutrients:

The retention of nitrogen, calcium and phosphorus was positive under all three TMR with non-significant ($p>0.05$) differences amongst treatments (Table 4). The positive nitrogen retention was found in growing male swamp buffaloes on feeding diet having rice straw from 65.39 to 66.22% (Tatsapong *et al.*, 2010). Incorporation of lucerne straw up to 70% in TMR for maintenance of bullocks also maintained positive balance of nitrogen, calcium and phosphorus in the present study.

Table 4: Balance of Nitrogen, Phosphorus and calcium of Bullocks fed Lucerne based TMR

Parameters	Treatments			F
	T1	T2	T3	
Nitrogen (g/day/bullock)				
Intake	138.87 ± 5.87	130.69 ± 5.64	134.94 ± 7.05	
Voided	122.44 ± 6.03	113.77 ± 5.37	121.11 ± 7.61	
Balance	+ 16.44 ± 1.22	+ 17.93 ± 1.07	+ 13.83 ± 2.12	3.79 NS
Phosphorus (g/day/bullock)				
Intake	43.56 ± 3.02	38.37 ± 2.42	42.50 ± 3.20	
Voided	36.22 ± 3.36	31.01 ± 2.17	34.34 ± 4.04	
Balance	+ 7.34 ± 0.77	+ 7.36 ± 0.85	+ 7.00 ± 1.49	0.29 NS
Calcium (g/day/bullock)				
Intake	86.94 ± 5.97	90.61 ± 6.09	87.23 ± 5.50	
Voided	78.23 ± 5.77	80.25 ± 7.11	77.97 ± 6.35	
Balance	+ 8.71 ± 1.21	+ 10.36 ± 1.91	+ 9.26 ± 1.31	1.53 NS

NS: Non-significant.

CONCLUSION

The results suggest that lucerne straw can be incorporated up to 70% in TMR for maintenance of bullocks without adverse effect on body weight as well as intake, digestibility and balance of nutrients.

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