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NUTRIENT UTILIZATION AND GROWTH PERFORMANCE OF *JALAUNI LAMBS* FED GRASS PEA (*Lathyrus sativus*) HAY BASED DIET

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Abstract
Grass pea is a very popular crop in many Asian and African countries where it is grown either for livestock feed or human consumption. The most important trait of grass pea consists of its drought tolerance and adaptability to diverse climatic conditions. In spite of the importance of grass pea for human and livestock, the crop has limited uses due to the presence of neurotoxic compound β-ODAP in seeds and plant parts, which causes Lathyrism in human beings and animals. The purpose of this study was to determine the nutrient utilization and growth performance of sheep fed grass pea hay based diet and to compare its feeding value to Berseem hay (Trifolium alexandrinum), a conventional legume fed to livestock in India. Eighteen growing Jalauni lambs of live weight (15.46 ±0.57 kg) were divided in to three groups of six animals in each. Animals of G1 (control) was fed berseem hay ad libitum as basal roughage whereas in the diet of G2 and G3, berseem hay was replaced with grass pea hay 50% and 100%, respectively. All the groups received 200 g crushed maize grain daily for 90 days. At the middle of the experimental feeding, a digestion cum metabolism trial was conducted for 7 days. DM intake (kg per 100 kg live weight and g per kg $W^{0.75}$) was comparable among the groups. Digestibility of nutrients viz., DM, OM, CP, NDF, ADF were none significantly different among the groups. Digestible crude protein (DCP) intake (g/d) ranged from 64.68±4.22 in G2 to 68.00±3.01 in G3. Total digestible nutrients (TDN) intake (g/d) was also comparable among the groups. Nutrient content (%) in terms of DCP and TDN were (8.64±0.56 and 62.89±1.73), (8.42±0.73 and 62.89±0.64), (9.03±0.24 and 64.63±0.63), respectively in different diets. Daily live weight gain (g/d) was (84.10±3.59) in G1, (83.53±4.30) in G2 and (86.05±3.77) in G3, respectively. No adverse effect on feeding grass pea hay on body condition was observed in experimental lambs. It was concluded that nutrient intake and utilization and growth performance were comparable in Jalauni lambs fed either berseem hay or grass pea hay based diet and grass pea hay could safely be incorporated to ruminant's diet without any adverse affection body condition.

Key words: *Berseem hay, Grass pea hay, Growth performance, Jalauni lambs, Nutrient utilization.*

INTRODUCTION

Grass pea (*Lathyrus sativus*) is a dual purpose annual legume grown for its seed for human consumption and for fodder for livestock feeding. The main feature of this legume crop consists of its sturdiness, drought tolerance, and adaptability to a wide range of soil types, including marginal ones (Yan et al., 2006). Grass pea because of its high protein content has made it possible to be a popular crop in subsistence farming in certain developing countries that suffer from adverse weather conditions. In spite of the importance of grass pea for human and livestock, the crop has limited uses due to the presence of neurotoxic compound β-ODAP in seeds and plant parts, which causes Lathyrism in human beings and animals (Hanbury et al., 2000).

The experiment was carried out to determine the nutrient utilization and growth performance of sheep fed grass pea hay based diet and to compare its feeding value to berseem hay (*Trifolium alexandrinum*), a conventional legume fed to livestock in India.

MATERIALS AND METHODS

Grass pea, low ODAP containing variety was harvested at full flowering stage and berseem during the end of February from Experimental farm of Indian Grassland and Fodder Research Institute at Jhansi. Eighteen growing *Jalauni* lambs of live weight (15.46±0.57kg) were used to investigate the effect of different level of replacement of berseem hay with grass pea hay on feed intake, nutrient digestibility coefficients, nitrogen utilization, rumen fermentation and growth performance. The animals were randomly assigned to three experimental groups (six animals in each treatment). The three experimental groups were considered as G1: berseem hay (100%)

+ 200 g crushed maize grain; G2: berseem hay: grass pea hay (50:50) + 200 g crushed maize grain and G3: grass pea hay (100%) + 200 g crushed maize grain. Rations were offered in two portions, crushed maize grain at 8.30 a.m. followed by different roughage sources at 9.30 a.m. for a period of 90 days. Water was offered twice daily at 11.00 a.m. and 4.00 p.m. Fortnightly body weight were recorded. At the middle of the experimental feeding, animals were placed in metabolic cages for quantitative collection of faeces and urine separately and a digestion cum metabolism trial of 7 days collection period was conducted to evaluate the nutritive value, balance of N from various diets.

Dry matter in feed and faeces was determined by oven drying at 100^{o}C overnight. For chemical analysis, pooled samples of feed offered, refusals and faeces were dried at 60^{o}C and ground to pass through a 2 mm sieve. Wet faeces and urine samples, preserved in diluted and concentrated sulfuric acid, respectively were analysed for N by the standard Micro Kjeldahl method. Feed and faecal samples were analysed for CP, EE and total ash contents (AOAC, 2000) and fiber fractions were analysed as per Van Soest et al. (1991).

Before the onset of digestibility trial, rumen liquor was collected at 2 h of post feeding through an oesophageal tube. Ruminal pH was immediately determined using digital pH meter. Rumen liquor samples were analysed for total N (Micro-kjeldahl), ammonia N concentrations were determined applying NH_3 diffusion technique using Kjeldahl distillation method according to A.O.A.C (2000), total VFA (Barnett and Reid, 1957).

Statistical analysis of data was performed using SPSS (13.0) statistical package. Data on nutrient intake, digestibility coefficients, rumen metabolites etc. were analysed by one way analysis of variance (ANOVA). Significance was declared at $P<0.05$; differences between means were tested using least significant difference. All statistical procedures were carried out as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSIONS

Chemical analysis and cell wall constituents of feed ingredients are presented in Table 1. Crude protein (15.69%), crude fiber (28.59%) and organic matter (88.10%) contents of berseem hay were similar to earlier report (Hamed et al., 2012) where as NDF content (53.98%) was higher which might be due to late harvesting of the berseem crop in the present study. The CP content of grass pea hay in the present study was lower than the report of Vahdani et al., 2014, however, similar with the values reported by Tuna et al. (2004). Similarly, NDF and ADF values were also higher in the ongoing study than those reported earlier (Poland et al., 2003). Differences in growing conditions, cultivars used and different vegetative stages at harvest may explain part or more of these differences.

Table 1. Chemical analysis and cell wall constituents of feed ingredients

Item	Maize grain	Berseem hay	Grass pea hay
Dry matter	94.64	92.13	93.47
Chemical analysis on DM basis			
Organic matter	97.6	88.1	93.77
Crude protein	10.28	15.69	14.99
Crude fiber	2.39	28.59	31.85
Ether extract	2.14	2.26	2.18
Nitrogen free extract	78.84	41.56	44.75
Ash	2.39	11.89	6.22
Cell wall constituents			
NDF	15.54	53.98	58.08
ADF	5.46	37.9	41.51
ADL	1.56	7.01	9.3
Hemi-cellulose*	10.08	16.08	16.57
Cellulose**	3.9	30.89	32.21

NDF: Neural detergent fiber. ADF: Acid detergent fiber.
ADL: Acid detergent lignin.
* Hemicellulose= NDF – ADF. * *Cellulose= ADF – ADL.

Dry matter, TDN, DCP intakes by the experimental groups fed different experimental diets are presented in Table 2. The results showed that inclusion of grass pea hay as replacer of berseem hay in lamb diet did not affect feed consumption as DM, TDN and DCP intakes in comparison with the berseem hay containing diet.

Table 2. Nutrient intake and utilization in *Jalauni* lambs fed grass pea hay based diet

Parameters	G_1	G_2	G_3	SEM	P value
Body weight (kg)	20.13	20.25	19.45	-	-
DMI(g/d)	779	775	752	28.61	0.787
DMI% BW	3.87	3.84	3.86	0.18	0.993
CPI (g/d)	114.21	111.76	109.91	3.95	0.749
TDNI (g/d)	488	487	486	17.09	0.993
DCPI(g/d)	67.1	64.68	68	3.79	0.819
Digestibility coefficients (%)					
DM	66.29	65.27	64.28	1.3	0.568
OM	67.75	66.33	65.96	1.24	0.582
CP	58.88	59.32	60.78	3.84	0.935
NDF	53.95	54.32	50.76	1.87	0.377
ADF	54.83	54.1	56.2	1.68	0.68
EE	64.6	63.44	62.11	1.58	0.561
NFE	72.72	72.02	70.45	0.83	0.06
N intake (g/d)	17.9	17.9	17.99	0.79	0.995
Fecal N (g/d)	7.07	7.17	6.77	1.06	0.963
Urinary N (g/d)	5.92	6.19	6.26	0.43	0.835
N balance (g/d)	4.9	4.53	4.95	0.54	0.834
N retention as % NI	27.4	25.77	27.38	3.25	0.921
Nutrient density (%)					
DCP	8.64	8.42	9.03	0.55	0.731
TDN	62.89	62.89	64.63	1.12	0.48

Similar nutrient intake was recorded in sheep fed berseem hay based diet (Hamed et al., 2012). The intake of DCP was comparable among the groups and was within the suggested range (ICAR,1998) whereas TDN intake was 16% higher in all the groups than the requirement for achieving a daily gain of 100 g/d. Digestibility of DM, OM, CP and NDF in the present study was comparable among the groups, however, higher than the values reported in Ossimi sheep fed diets containing different sources of roughages (Hamed et al., 2012) and in Varamini rams fed grass pea hay diet (Vahdani et al., 2014). On the contrary, Abdel-Magid et al. (2008) found that pea forage containing diet and berseem hay diet had similar values of digestibility of OM, CP and CF. N intake as well as N excretion through faeces and urine was similar in lambs fed either sole berseem hay based diet or grass pea hay supplemented diet. The pattern of excretion of N through faeces and urine corroborated with the findings of Das et al. (2013) in lambs fed berseem hay based feed block supplemented with different level of maize grain. N balance was comparable among the groups and similarly, Forster et al. (1988) mentioned that N retention was not affected by diet when lambs were fed 30% ground maize and 70% chopped forage of 0, 25, 50, 75 or 100% pea hay with Lucerne. No significant differences in ruminal pH were observed after 2 h post feeding (Table 3). TVFA's concentration in the rumen is governed by several factors such as dry matter digestibility, rate of absorption, rumen pH, transportation of the digesta from the rumen to the other parts of the digestive tract and the microbial population in the rumen and their activities. Similar pH and digestibility values with different experimental diets in the present experiment indicated comparable TVFA concentration among the groups (128.3-130.3 meq/l). Ruminal ammonia concentration values were also comparable with earlier report (Das et al., 2013).

Table 3. Rumen metabolites in *jalauni* lambs fed different experimental diets

Parameters	G_1	G_2	G_3	SEM	P value
pH	6.41	6.48	6.54	0.14	0.82
TVFA (meq/L)	129.7	130.3	128.3	2.98	0.78
NH3-N (mg/dl)	28.93	29.77	30.24	2.11	0.908
Total N (mg/dl)	79.33	78.86	81.22	3.48	0.884

Average daily gain (g/d) of lambs fed different experimental did not differ significantly (Table 4). Similarly, grass pea hay compared to alfalfa hay as sole forage fed *ad libitum* to pregnant ewes did not change body weight and body condition score (Poland et al., 2003).

Table 4. Growth performance of *Jalauni* lambs fed different experimental diets

Parameters	G_1	G_2	G_3	SEM	P value
Initial body wt (kg)	15.52	15.52	15.3	0.76	0.986
Final body wt (kg)	23.08	23.13	23.04	0.84	0.996
Gain (kg)	7.56	7.51	7.75	0.43	0.926
Daily gain(g/d)	84.1	83.53	86.05	4.75	0.926
Feed intake /kg gain (kg)	9.2	9.05	8.92	0.59	0.982

CONCLUSIONS

It could be concluded that grass pea hay can be used as an alternative sources of legume

roughage successfully in sheep diets instead of berseem hay for similar feed intake, digestion coefficient, nitrogen utilization, ruminal fermentation and growth performance without any adverse affect on body condition.

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