Indian Journal of Animal Sciences **87** (2): 191–194, February 2017/Article

Effect of hydroponic horse gram fodder and hydroponic sun hemp fodder with replacement of concentrate mixture on the post weaning growth performance of Tellicherry kids

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Received: 10 May 2016; Accepted: 22 June 2016

ABSTRACT

Different seeds such as barley, wheat and yellow maize were utilized for fodder production by hydroponic method. However, this novel experiment was aimed to study the effect of hydroponic horse gram fodder and hydroponic sun hemp fodder with 50% replacement of concentrate mixture on the growth performance in Tellicherry kids. Sixty male Tellicherry kids at the age of 3 months were randomly divided into 3 groups each having 20 kids' viz. treatment 1 (100% concentrate), treatment 2 (50% concentrate + hydroponic horse gram fodder) and treatment 3 (50% concentrate + hydroponic sun hemp fodder). Palatability trial was conducted for a period of 7 days to assess the maximum intake of hydroponic fodders by the kids. After analyzing the palatability and chemical composition, feeding trial was formulated on as fed basis. Duration of the study was 30 days. Production parameters such as total body weight gain (kg), daily body weight gain (kg), total feed intake/head/30 day (kg) (DM basis) and feed conversion efficiency (%) and cost of feeding were studied. After analysis of collected data, no significant difference was noticed between the groups in terms of total body weight gain, daily body weight gain, total feed intake/head/30 day on DM basis and feed conversion efficiency. Cost of feeding/animal was lower in sun hemp fodder fed groups. Thus, hydroponic horse gram fodder and sun hemp fodder can be used as an alternative for concentrate mixture in the feed ration of Tellicherry kids.

Key words: Growth performance, Hydroponic horse gram fodder, Hydroponic sun hemp fodder, Tellicherry kids

Feeding goats according to their requirement and avoiding wastage is the basic point in exploiting the production potential for economic growth and sustainability since feed costs are the dominant parts of production that accounts more than 70% (Gupta 2014). So, to resolve livestock's nutrient deficiency, supplementation of inferior quality roughages with hydroponic green fodder is coming up as a practical approach for improving roughages utilization and digestibility (Weldegerima 2015). Hydroponics is now emerging as an alternative technology to grow fodder for farm animals (Naik *et al.* 2011, Naik 2012a, Naik *et al.* 2013a, b, Naik and Singh 2013, Naik 2014, Naik and Singh 2014, Naik *et al*. 2015). Hydroponics technology for fodder production will be very effective for rearing small ruminants (sheep and goats) as these animals have lesser dry matter requirement and are being shifted from extensive to intensive rearing system (Naik and Singh 2013). However, economic viability of production of hydroponics green forage will depend on sprouting systems, type and quality of the grain, particularly the germination rate, culturing conditions, management, and the local conditions that merits further investigation (Fazaeli *et al.* 2011). In India, a limited research has been done on feeding value of hydroponic fodder for small ruminants (Pandey and Pathak 1991). Feeding vitamin-rich green forage that could activate some enzymes (during sprouting) and change the starch, protein, and lipids into simpler forms, might affect the animals performance (Mayer and Poljakoff-Mayber 1975, Kruglyakov 1989). Hence this novel experiment was aimed to study the effect of hydroponic horse gram fodder on the growth rate of Tellicherry kids.

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MATERIALS AND METHODS

Production of hydroponic fodders: Hydroponic horse gram fodder and sun hemp fodder was produced in environmentally controlled hydroponic green fodder machine of 1 ton capacity purchased under NADP scheme 2014–15. Good quality seeds with less than 12% moisture

were selected and weighed. Seeds were washed in tap water by stirring with wooden stick manually to remove chaffs and dirts. The seeds were then soaked in tap water for 20 h. Then water was drained and the seeds were kept in gunny bags for 24 h for germination. After germination, seeds were weighed and placed onto different trays and kept on the sprout section of hydroponic green fodder machine. Each tray in the sprout section is provided with two drippers and one sprinkler which sprinkle water every 3 h for about 4 min. The trays were shifted to next rack daily. After 4 days of total growth period in the machine, the fodder was taken out on the 5th day, weighed and then fed to kid. Proximate analysis of hydroponic horse gram fodder and sun hemp fodder was done as per AOAC 2000.

Palatability trial: Palatability trial for a period of 7 days was carried out to assess the acceptance and intake of hydroponic horse gram fodder and sun hemp fodder by Tellicherry kids. Measured quantity of hydroponic horse gram fodder and sun hemp fodder was fed to a group of 10 different animals and the left over in the next morning was measured to estimate the actual intake of hydroponic fodders.

Feeding trial: After analysing the palatability and maximum intake of hydroponic horse gram fodder along with proximate of hydroponic horse gram fodder (Table 2), feeding trial was formulated on as fed basis as given in Table1.

Table 1. Feeding schedule (on as fed basis)

Type of feed	Treatment 1 Control	Treatment 2 50% replacement of concentrate	Treatment 3 50% replacement of concentrate
Concentrate	150 g	75 g	75 g
Hydroponic horse gram fodder	0	379.2 g	0
Hydroponic sun hemp fodder	0	0	128.78 g

Table 2. Nutritional composition of feed and fodders

Fodder	% Dry matter basis					
	Moisture (%)	CP	CF	EE	TA	NFE
Hydroponic horse gram fodder	90.18	30.26	13.00	2.06	5.43	49.25
Hydroponic sun hemp fodder	77.07	38.73	13.11	4.64	4.48	39.04
Concentrate mixture	9.64	12.13	4.33	2.67	6.06	74.81
Sorghum dry fodder	42.92	3.78	41.71	0.80	9.88	43.83
CO4 grass	75.88	7.73	27.71	2.25	13.99	48.32

Experimental design: Sixty male Tellicherry kids at the age of 3 months were randomly divided into 3 groups each having 20 kids viz. treatment 1 (100% concentrate), treatment 2 (50% concentrate + hydroponic horse gram fodder) and treatment 3 (50% concentrate + hydroponic sun hemp fodder).

Animal housing and feeding management: All Tellicherry kids were reared by intensive system in a well-ventilated clean shed with proper spacing for individual kids. All kids were fed calculated quantity of concentrate mixture (yellow maize 20%, cumbu 15%, wheat bran 24%, de oiled rice bran 26%, groundnut oil cake 6%, soya bean meal 6%, mineral mixture 2% and salt 1%) having 12.1% crude protein and 71.33% TDN and *ad libitum* sorghum dry fodder and green fodder (CO4 grass). All the kids were provided access to *ad libitum* clean drinking water throughout the day. The study was conducted for a period of 30 days. Production parameters such as total body weight gain (kg), daily body weight gain (kg), total feed intake/head/30 day (kg) (DM basis) and feed conversion efficiency (%) and cost of feeding were studied.

Recording and statistical analysis of data: Weighment of kids was done at weekly interval. Accumulated data was analyzed by one-way ANOVA computed using Graphad prism software.

RESULTS AND DISCUSSION

Nutritional composition of fodders: The nutritional composition of feed and fodders used in the study is given in Table 2.

Hydroponic horse gram fodder and sun hemp fodder were found to have higher crude protein content (30.26%, 38.73%) and crude fibre content (13.00%, 13.11%) on dry matter basis. The crude protein content of hydroponic fodders under study were higher than crude protein of hydroponic maize fodder (16.5%) and hydroponic barley fodder (14.44%) reported by Weldegerima (2015) and the crude protein of hydroponic maize fodder (13.30%) reported by Naik *et al*. (2014a). These fodders had lower total ash (TA) than conventional green fodder i.e. CO4 grass. Naik *et al.* (2012b) also reported lower CF and TA percentage in hydroponics maize fodder than the conventional fodder. The increase in CP content may be attributed to the loss in DM, particularly carbohydrates, through respiration during germination and thus longer sprouting time is responsible for greater losses in DM and increase in protein content. Besides, the absorption of nitrates facilitates the metabolism of nitrogenous compounds and thus increases the CP levels (Naik *et al.* 2015). The nutrient contents of hydroponics fodder are superior to certain common non-leguminous fodders but comparable to leguminous fodders (Reddy *et al*. 1988, Pandey and Pathak 1991, Naik *et al*. 2012) in terms of available OM, CP, EE and NFE content.

Palatability trial: The maximum intake of hydroponic horse gram fodder was found to be 300±0.37 g/animal/day and hydroponic sun hemp fodder to be 250±0.42 g/animal/day which showed that both the fodders were accepted as a

Table 3. Production parameters and economics of feeding

Attribute	Treatment 1	Treatment 2	Treatment 3
No. of kids per treatment	20	20	20
Initial body weight (kg)	13±0.25[a]	13.8±0.33 [a]	13.6±0.29 [a]
Final body weight (kg)	17.37±0.39 [a]	16.87±0.39 [a]	16.77±0.36 [a]
Total body weight gain (kg)	4.37±0.37 [a]	3.07±0.38 [a]	3.17±0.41 [a]
Daily body weight gain (kg)	0.15±0.43 [a]	0.10±0.32 [a]	0.11±0.38 [a]
Total feed intake /head/30 day (kg) (DM basis)	4.07±0.58 [a]	4.54±0.43 [a]	2.91±0.23 [a]
Feed conversion efficiency (%)	0.93±0.21 [a]	1.48±0.31 [a]	0.92±0.31 [a]
Cost of feeding for 30 days/ animal (₹)	169.5±0.49[b]	171.33±0.52[b]	130.23±0.68[a]

Means with similar superscript in the same row do not differ significantly (P>0.05). Means with different superscript in the same row differ significantly (P<0.01)

fodder source by the kids.

Feeding trial: The various production parameters studied are given in table 3 and figure 1 and 2. There is no significant difference between the groups except for the cost of feeding. The cost of feeding was significantly lower in treatment 3 (50% concentrate + hydroponic sun hemp fodder) i.e. 130.23+0.68 as compared to treatment 1 and 2.

Weldegerima (2015) reported that the daily body weight gain and feed conversion efficiency in Kongal goats fed with the following composition of hydroponic fodders viz. control (0% hydroponic fodder), T1, 20% maize hydroponic

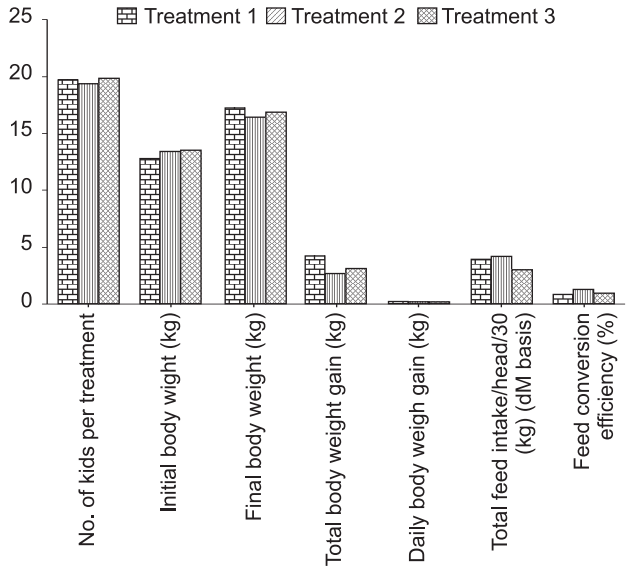

Fig. 1. Effect of feeding hydroponic horse gram fodder and sun hemp fodder with 50% replacement of concentrate in the growth rate of Tellicherry kids.

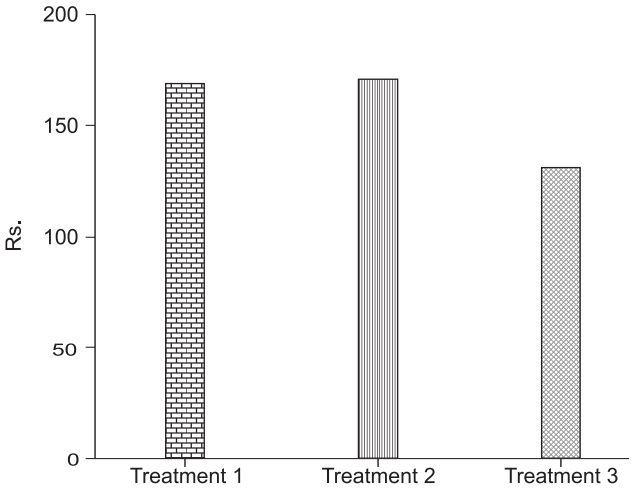

Fig. 2. Cost of feeding/animal/30 days.

fodder; T2, 20% barley hydroponic fodder; T3, 40% maize hydroponic fodder; T4, 40% barley hydroponic fodder; T5, mixed 20% maize:20% barley hydroponic fodder as 1.17±4.93 g, 37.56±4.93 g, 34.74±4.93 g, 61.93±4.93 g, 51.44±4.93 g, 56.70±4.93 g and 0.47±0.90%, 7.32±0.90%, 12.15±0.90%, 8.83±0.90%, 10.56±0.90%, respectively in a study period of 97 days. However, a daily body weight gain of 0.15±0.43 kg, 0.10±0.32 kg, 0.11±0.38 kg and feed conversion efficiency of 0.93±0.21%, 1.48±0.31%, 0.92± 0.31% were observed in the present study in the concentrate fed group (Treatment 1) and the Concentrate + Hydroponic horse gram fodder fed group (Treatment 2) and Concentrate + Hydroponic sun hemp fodder fed group (Treatment 3), respectively which showed a huge difference in the daily body weight gain and feed conversion efficiency obtained from both the studies. Thus, the current study was reported to have higher daily body weight gain and feed conversion efficiency than the study reported by Weldegerima (2015). Meenakshi Sundaram *et al.* (2012) reported a daily weight gain of 0.138 ±0.03 kg in 3– 4 months old Tellicherry kids which is almost equivalent to the daily weight gain in the current study (T1 - 0.15±0.43 kg, T2 - 0.10±0.32 kg, T3 - 0.11±0.38 kg). However, Thiruvenkadan *et al*. (2009) reported a daily body weight gain of 37.46±1.49 g and Murali *et al.* (2014) reported 30.48±1.11g in Tellicherry goats post weaning which is much lower when compared to the daily weight gain observed in the current study.

This is a novel trial as no report has been published yet with the use of hydroponic horse gram fodder and sun hemp fodder as an alternate for concentrate mixture in the diet of kids. Liam McGreevy (2012) also suggested the use of higher protein seeds, such as field beans, which would increase the available protein and potentially increase the weight gain in sheep within the same period for marginally increased costs. Hydroponic sprouts are rich sources of bioactive enzymes and contain grass juice ingredients that improve the performance of livestock (Naik *et al*. 2014a). Hydroponically sprouted barley enhances microbial activity in the rumen which is attributed to increased live weight gain in lambs (Tudor *et al.* 2003).

The cost of feeding/animal/30 days was significantly lower in treatment 3, i.e. concentrate + sun hemp fodder fed group (₹ 130.23±0.68) than the other two groups. The cost of feeding/animal/30 days was almost similar in treatment 1 (₹ 169.5±0.49) vs treatment 2 (₹ 171.33±0.52) group which is due to the higher seed cost of horse gram. However, the cost of production of hydroponic horse gram fodder may further reduce in places where horse gram is commonly cultivated which in turn reduces the cost of feeding. All the kids in the three treatments had uniform growth rate in terms of daily body weight gain, total body weight gain during the trial which implies that hydroponic horse gram fodder and sun hemp fodder can be used as an alternate to concentrate at 50% level in the diet of Tellicherry kids according to the availability without affecting the growth rate. Liam McGreevy (2012) also stated that fresh sprouted barley fodder produced by the hydroponic system is capable of replacing the concentrate ration in a sheep's diet without detrimentally affecting their productivity.

Achieving higher body weight gain in shorter duration of time by efficient feeding is the goal for many goat farmers. Hydroponic horse gram and sun fodders can be used in order to achieve such growth rate in Tellicherry goats. To conclude, hydroponic horse gram and sun hemp fodders has higher crude protein content and can be used as an alternate to concentrate mixture in the diet of Tellicherry goat kids.

AKNOWLEDGEMENT

Authors are thankful to National Agricultural Development Programme (NADP), New Delhi for providing necessary fund and also thank the Vice Chancellor, Tamil Nadu Veterinary and Animal Sciences University for the facilities and support to carry out the research.

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