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Research Article

Growth Performance and Economics of Feeding Hydroponic Maize Fodder with Replacement of Concentrate Mixture in New Zealand White Rabbit Kits

Rachel Jemimah Ebenezer[1*], Paul Pandi Tensingh Gnanaraj[1], Thangasamy Muthuramalingam[1], Thirunavukarasu Devi[2], Ayyadurai Bharathidasan[3], Arunachalam Shanmuga Sundaram[1]

[1]Livestock Farm Complex, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu India; [2]Department of Veterinary Preventive Medicine, Madras Veterinary College, Chennai, Tamil Nadu, India; [3]Department of Animal Nutrition, Madras Veterinary College, Chennai, Tamil Nadu, India.

Abstract | The objective of the current study is to study the effect of hydroponic maize fodder with replacement of concentrate mixture on the growth performance of New Zealand white kits. Twenty-four New Zealand white kits of either sex at the age of two months were randomly divided into three groups namely treatment 1 (100% concentrate mixture), treatment 2 (75% concentrate & 25 % hydroponic maize fodder) and treatment 3 (50% concentrate & 50% concentrate hydroponic maize fodder) each consisting of 8 kits. Palatability study was conducted for a period of 10 days to assess the acceptability and maximum intake of hydroponic maize fodder by the kits. At the end of the palatability study, maximum intake of hydroponic maize fodder was found to be 100 + 0.25 g/day/kit. Feeding trial was formulated on as fed basis and the trial was conducted for a period of 30 days. Production parameters such as total body weight gain, daily body weight gain; total feed intake /head/30 day (g) (DM basis), feed efficiency and economics such as the cost of feeding/animal/30 days and cost of feeding/animal/day were studied. 50% replacement of concentrate with hydroponic fodder significantly (p< 0.01) improved the final body weight (1214.5+5.19g), total body weight gain (410+5.55g), daily body weight gain (13.66+ 0.58g), total feed intake /head/30 day (1482.9+0.29g) on DM basis and significantly lowered the feed conversion ratio (3.61+ 0.15), cost of feeding/animal/30 days (35.25+0.39 IR (Indian Rupees)) than other two treatment groups. Hence, hydroponic maize fodder can be used as an alternate for concentrate mixture in the diet of rabbit kits.

Keywords | Hydroponic maize fodder, Rabbit kits, Growth performance, Economics, Feed conversion ratio

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***Correspondence** | Rachel Jemimah Ebenezer, Livestock Farm Complex, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu India;
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INTRODUCTION

Hydroponic cultivation is an eco-friendly method of growing fodder and hydroponically grown cereals grow up to 50% faster and produce higher yields of better quality fodder. (Kide et al., 2015). Hydroponic fodder production is a method of fodder production, in which fodder seeds are germinated into a high quality, highly nutritious, disease free animal food in a hygienic environment (Jensen and Malter, 1995; Al-Hashmi, 2008). Hydroponic fodder production takes place in an intensive hydroponic growing unit in which only water and nutrients are used to produce nutrient rich grass and root combination (Emam, 2016). Hydroponically grown green fodder is highly water efficient and reduces water waste and essential natural and manmade resources required to grow fodder while controlling the effects of climate and growing conditions (Anonymous, 2015). There is a great nutritional benefit provided by hydroponic sprouted fodder to optimize the general health and performance of young animals while

minimizing feed costs (Anonymous, 2013).

Different types of fodder crops *viz.* barley (Reddy et al., 1988), oats, wheat (Snow et al., 2008); sorghum, alfalfa, cowpea (AI-Karaki and AI-Hashimi, 2012) and maize (Naik et al., 2011; Naik et al., 2012) can be produced by hydroponics technology. However, the choice of the hydroponics fodder to be produced depends on the geographical and agro-climatic conditions and easy availability of seeds. In India, maize grain should be the choice as the grain for production of hydroponics fodder due to its easy availability, lower cost, good biomass production and quick growing habit (Naik et al., 2015). Growing of hydroponic maize fodder proved improved nutrient content with less water, less space used and cost effective (Kide et al., 2015).With this background, the current study was conducted to study the growth performance of New Zealand white rabbit kits by replacing the concentrate mixture with hydroponic yellow maize fodder at 25% and 50 % level in their diet.

MATERIALS AND METHODS

Production of Hydroponic Fodders

Hydroponic maize fodder was produced ina fully automated environmentally controlled hydroponic green fodder production machine of 1-ton capacity. Good quality yellow maize seeds with less than 12% moisture were selected for the study. Seeds were washed in tap water to remove chaffs and dirts. The seeds were then soaked in tap water for 20 hours. Later water was drained, and the seeds were kept in gunnybags for 24 hours for germination. After germination, seeds were 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 in every 3 hours for about 4 minutes. The trays were shifted to next rack daily. On the 5th day the tray enters the growth cycle in which each tray is supplied with two sprinklers. After 8 days of total growth period in the machine the fodders were taken out, weighed and then fed to rabbit kits.

Palatability Trial

Palatability study was conducted for a period of 10 days to assess the acceptability and maximum intake of hydroponic maize fodder by the rabbit kits. Measured quantity of hydroponic maize fodder was fed and the left over in the next morning were measured to estimate the actual intake of hydroponic maize fodder by the rabbit kits.

Feeding Trial

A feeding trial was formulated on as fed basis based on the results observed from the palatability study and the nutritional composition of hydroponic yellow maize fodder, as given in Table 1. The trial consists of three treatment group namely, treatment 1 (100% Concentrate mixture), treatment 2 (75% concentrate & 25 % hydroponic maize fodder) and treatment 3 (50% concentrate & 50% concentrate hydroponic maize fodder).

Table 1: Feeding schedule (On as fed basis)

Type of feed	Treatment 1	Treatment 2	Treatment 3
	Control	25% replacement of Concentrate	50% replacement of Concentrate
Concentrate	50 g	37.5 g	25 g
Hydroponic maize fodder	0	76.78 g	153.56 g

Experimental Design, Housing and Feeding Management

A total of 24 New Zealand white kits of either sex at the age of two months were randomly divided into three groups each consisting of 8 kits. Rabbit kits were reared in cages placed inside a well-ventilated shed. All the kits under the trial were fed with calculated quantity of concentrate mixture (yellow maize 50%, bajra 10%, wheat bran 5%, de oiled rice bran 7%, soya bean meal 20%, sunflower oil cake 6%, mineral mixture 1% and salt 1%) having 18.05% crude protein, M.E. 2809 Kcal/kg, and hydroponic yellow maize fodder. All the kits were provided with *ad libitum* clean drinking water through nipple drinking system. The study was conducted for a period of 30 days. All rabbits were kept under similar managerial, hygienic and environmental conditions.

Statistical Analysis

Weighment of kits was done at weekly interval. Production parameters such as total body weight gain, daily body weight gain; total feed intake /head/30 day (g) (DM basis), feed efficiency and economics such as the cost of feeding/animal/30 days and cost of feeding/animal/day were studied. Accumulated data was analyzed for statistical significance by unpaired 't' test using Graph Pad prism software.

RESULTS AND DISCUSSION

Nutritional Composition of Fodder

The nutritional composition of hydroponic yellow maize fodder under study was given in Table 2. Kide et al. (2015) and Naik et al. (2015) have observed the nutritional composition of hydroponic maize fodder in the ranges as follows; CP 13.57 -14.56%, CF 10.00 - 10.67%, EE 3.49 - 4.67%,TA 2.83 - 3.84% and NFE 66.72 - 68.47%. However, the nutritional composition of hydroponic maize fodder utilised in the study had slightly lower CP, CF, TA but higher NFE content. The variation may be attributed to the varieties of maize and probably the duration of storage

Table 2: Nutritional composition of hydroponic yellow maize fodder

SI. No.	Fodder	Moisture %	% Dry matter basis				
			CP	CF	EE	TA	NFE
1.	Hydroponic yellow maize fodder	76.75	10.55	5.51	4.62	1.8	77.52

CP – Crude protein; CF – Crude fibre; EE –Ether extract; TA – Total solids; NFE – Nitrogen free extract.

Table 3: Production parameters and economics of feeding of hydroponic maize fodder

Attributes	Treatment 1	Treatment 2	Treatment 3
No. of kits per treatment	8	8	8
Initial body weight (g)	800±9.21[a]	797.5±4.87[a]	804.5±6.61[a]
Final body weight (g)	1062±5.18[a]	1073±7.39[b]	1214.5±5.19[c]
Total body weight gain (g)	262±10.57[a]	275.5±7.18[b]	410±5.55[c]
Daily body weight gain (g)	8.73± 0.46[a]	9.18± 0.52[a]	13.66± 0.58[b]
Total feed intake /head/30 day (g) (DM basis)	1395± 0.43[a]	1438.95± 0.38[b]	1482.9±0.29[c]
Feed conversion ratio	5.32± 0.21[a]	5.22± 0.19[a]	3.61 ±0.15[b]
Economics of feeding			
Cost of feeding/animal/30 days(IR)*	39 ± 0.58[a]	36.94±0.42[b]	35.25±0.39[c]
Cost of feeding / g body weight (IR)*	0.15±0.58[a]	0.13±0.42[a]	0.10±0.39[a]

Means bearing different superscript in the same row differ significantly ($p< 0.01$)
Results were presented as mean ± SE.
* IR: Indian Rupees (1 IR is equal to 0.015 US Dollar)

or the number of days after harvest, geographical location and irrigational strategies.

Palatability Trial

Rachel Jemimah et al. (2015) have reported the intake of hydroponic fodder in rabbits to be 0.1 to 0.2 kg/animal/day. At the end of the 10 days palatability study the maximum intake of hydroponic maize fodder per kit was found to be 100 ± 0.25 g/day (data not shown) which is in par with the above results.

Growth Performance and Economics of Feeding

The productive and economic parameters studied were given in Table 3. A 50% replacement of concentrate with hydroponic yellow maize fodder has significantly ($p< 0.01$) increased the body weight gain in kits compared to 25% replacement group and control group. The better body weight gain in the hydroponic yellow maize fodder fed group may be attributed to the enhanced nutritional value of sprouted grain which is due to the modification of heterogeneous compounds into intelligible and essential form by minimizing the effect of anti – nutritional factors while sprouting (Chavan and Kadam, 1989) and increase in quantity and quality of protein, sugars, minerals and vitamin during sprouting (Lorenz, 1980). Moreover, sprouted grains (hydroponics fodder) are rich in enzymes and enzyme-rich feeds are generally alkaline in nature, therefore, feeding of the hydroponics fodder improves the animals' productivity by developing a stronger immune system due to neutralization of the acidic conditions. Besides, helping in the elimination of the anti-nutritional factors such as phytic acid of the grains, hydroponics fodders are good source of chlorophyll and contain a grass juice factor that improves the performance of the livestock (Finney, 1982; Chavan and Kadam, 1989; Sneath and Mclntosh, 2003; Shipard, 2005). Mohsen (2015) also reported that the inclusion of hydroponic barley at 30% in the diet of rabbits has no adverse effect on the initial and final live body weight and total and daily weight gain.

Moreover, 50 % replacement of concentrate mixture with hydroponic yellow maize fodder significantly ($p< 0.01$) reduced the feed conversion ratio (3.61 ± 0.15) and cost of feeding/animal/30 days (IR: 35.25±0.39) comparable to concentrate fed group (5.32 ± 0.21 and IR: 39 ±0.58). Thus, feeding of hydroponic maize fodder not only influences the growth of rabbit but also considerably reduces the economics of feeding.

CONCLUSION

Rabbit kits in the 50% replacement of concentrate mixture with hydroponic yellow maize fodder group showed significantly higher body weight gain, better FCR and low cost of production. Thus, study suggested that, the hydroponic yellow maize fodder can be included in the diet of rabbit up to 50% level without any deleterious effect on their growth and profitability.

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CONFLICT OF INTEREST

The authors have no conflict of interest.

AUTHORS CONTRIBUTION

P. Tensingh Gnanaraj and A. Bharathidasan: Study conception and design.
Rachel Jemimah E, T. Muthuramalingam and T. Devi: Acquisition of data.
Rachel Jemimah E: Analysis and interpretation of data and drafting of manuscript.
A. Shanmuga Sundaram: Critical revision.

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