Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2021; 9(2): 170-172
© 2021 JEZS
Received: 13-01-2021
Accepted: 15-02-2021

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Effect of hydroponic maize fodder as partial substitute with concentrate mixture on nutrient intake of gir calves

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DOI: https://doi.org/10.22271/j.ento.2021.v9.i2c.8475

Abstract
An endeavor was made to assess the effect of hydroponic maize fodder as a partial substitute with concentrate mixture on nutrient intake of gir calves. A feeding trial of 120 days was undertaken on 16 Gir calves (6-12 months of age) divided into four groups of four calves using the basal roughage with various levels of hydroponics maize fodder to assess the nutrient utilization efficiency. In the study, a highly significant (P<0.01) effect of feeding of hydroponics maize fodder was observed on DMI (in terms of g/d, kg/100 kg b.wt and g/kg$W^{0.75}$). Highest dry matter intake g/d was observed in T_4 group where 75% of crude protein of concentrate mixture was replaced by hydroponics maize fodder and lowest was observed in control group. Highest dry matter intake kg/100 kg b.wt and g/kg$W^{0.75}$was observed in T_4 group which was comparable with T_3. However, a non-significant effect was observed on organic matter intake (in terms of g/d, kg/100 kg b.wt and g/kg$W^{0.75}$). Looking at the results of the present investigation, it could be concluded that hydroponics maize fodder has a beneficial effect on DMI in terms of g/d, kg/100 kg b.wt and g/kg$W^{0.75}$ in gir calves and it can replace upto 75% of crude protein of concentrate mixture.

Keywords: Hydroponic maize fodder, nutrient intake, GIR calves

Introduction
Hydroponics comes from the Latin language where, 'hydro' means water and 'ponos' means labour by simply putting it together it concludes working water. Hydroponics means the technique of growing plants without soil or solid growing medium, only using water or nutrient rich solution only for a short duration. Hydroponic systems are produced under artificial conditions (i.e. green house or lighted systems in a closed box) with regular watering, producing a crop within 6-7 days (Sneath and McIntosh, 2003; Dung *et al*., 2010) [7, 22]. However, hydroponics fodder can be well produced with the use of fresh water only and the use of nutrient rich solution is not obligatory. The hydroponics fodder can be grown in controlled environmental conditions with a temperature range of 15-32 ^{0}C and relative humidity of 80-85%. The crop is grown in multilayer shelves and planting material is ready in 7-8 days continuous cycle. Required nutrients should be present in proper proportion and concentration. The system of combining water with nutrients is known as fertigation. The optimum pH of nutrient solution ranges from 5.8-6.3.

Hydroponic fodder has higher feed quality, rich in proteins, fibers, vitamins and minerals (Lorenz, 1980; Bhise *et al*., 1988; Chung *et al.*, 1989) [13, 2, 4] it has a high amount of fatty acids (MacLeod and White, 1962) [14] high metabolizable energy, crude protein and digestibility (El-Morsy *et al*., 2013) [8] a rich source of antioxidants in form of Beta-carotene, Vitamin A, E and C (Cuddeford, 1989) [5] and rich in limiting amino acid, lysine (Chavan and Kadam, 1989) [3]. It is reported that hydroponics fodder increases the digestibility of nutrients and milk yield. Hydroponics fodder is a good source of chlorophyll, which is very important with poor quality roughage based diet during drought conditions. This technology may be especially important in regions where forage production is limited (Mukhopad, 1994) [14]. All these special features of hydroponic culture, in addition to others make it one of the most important agricultural techniques currently in use of green forage production (Al-Karaki, 2011) [1]. Keeping in view the aforesaid facts, the present experiment was planned to assess the effect of feeding hydroponics maize fodder on the nutrients intake of Gir calves.

Material and Methods

Experimental Animals, feed and procedure

16 male gir Calves of almost the same age group and uniform conformation procured from the dairy farm of College of Veterinary and Animal Science, Navania, Vallabhnagar were taken in the experiment. Animals were housed in well ventilated, hygienic and protected sheds and acclimatize for 10 days before to experimental feeding. The animals were given prophylactic doses of panacure as anthelmintic. Faecal and blood smears were examined periodically for parasitic infestation. The animals were given a measured quantity of experimental feed and *ad lib.* water every morning. The experimental Gir calves were distributed by randomized block design on the basis of body weight into four groups of four animals in each subjected to different treatment. The production of hydroponics maize was done in a hydroponics chamber of Ayurvet Progreen machine equipped with automatic irrigation having the potential of producing 240 kg fresh hydroponics maize fodder on daily basis. Clean maize seeds were soaked for overnight in tap water and thereafter distributed in trays. On first day, trays were placed in the top most row of growth chamber and then everyday were shifted to the respective lower rows. Inside the growth chamber the plants are allowed to grow for the duration of 7 days and then on eight day, these are harvested and fed to the animals. Daily allowance of concentrate and roughage were offered to meet their nutrient requirements (ICAR, 1985) [10]. The palatability/dry matter intake of experimental feeds in terms of g/d, kg/100 kg b.wt and g/kg $W^{0.75}$ were calculated from the figures of dry matter consumption and live weight recorded during experimental period.

The treatment groups were designated as under

T_1 – Basal Roughage + Concentrate mixture (Control)
T_2 – Basal Roughage + Concentrate mixture + 25% CP of concentrate mixture through Hydroponics maize green fodder
T_3 – Basal Roughage + Concentrate mixture + 50% CP of concentrate mixture through Hydroponics maize green fodder
T_4 – Basal Roughage + Concentrate mixture + 75% CP of concentrate mixture through Hydroponics maize green fodder

Statistical Procedure

The data obtained in the experiment were analyzed using statistical procedures as suggested by Snedecor and Cochran (1994) [23] and significance of mean differences was tested by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1957) [12].

Results and Discussion

Nutrient intake

Dry matter and organic matter consumption was calculated as g/d, kg/100 kg b.wt and g/kg $W^{0.75}$ and has been presented in Table 1. The result of statistical analysis of data showed highly significant (P<0.01) effect of treatment on dry matter intake in terms of g/d, kg/100 kg b.wt and g/kg $W^{0.75}$. Highest dry matter intake g/d was observed in T_4 group where 75% of crude protein of concentrate mixture was replaced by hydroponics maize fodder and lowest was observed in control group. Significantly higher dry matter intake kg/100 kg b.wt and g/kg$W^{0.75}$ was observed in T_4 group where 75% of crude protein of concentrate mixture was replaced by hydroponics maize fodder which was comparable with T_3 where 50% of crude protein of concentrate mixture was replaced by hydroponics maize fodder. However, a non-significant effect was observed on organic matter intake (in terms of g/d, kg/100 kg b.wt and g/kg$W^{0.75}$).

The results of dry matter intake in terms of g/d, kg/100 kg b.wt and g/kg $W^{0.75}$ corroborates with the findings of Maity *et al.* (1996) [15] and Misra *et al.* (1996) [16]. They reported the decrease in dry matter intake of artificially grown barley fodder which was due to change in roughage to concentrate ratio. Fazaeli *et al.* (2011) [9] reported that the decreased dry matter intake of hydroponics fodder which could possibly be due to high water content that have made bulky leading to limited dry matter intake by the experimental animals. Similarly, Reddy and Reddy (1988) [19] reported dry matter intake of artificially grown barley fodder was significantly lower. However, Rule *et al.* (1986) [21] reported that the sprouted wheat included at 25 or 50% of the diet showed no difference in feed intake when compared with the unsprouted wheat but when sprouted wheat included at 75% of the diet, dry matter intake of the unsprouted wheat diet was 21% less than that of the sprouted ones. Verma *et al.* (2015) [24] reported the dry matter intake (% of b.wt) were higher in groups where 50% of crude protein and energy requirements were met through concentrate mixture,T_2 and 100% of crude protein and energy requirements were met through hydroponics barley fodder, T_3 (3.38 kg and 3.35 kg respectively) in comparison to control T_1 (2.93 kg). Whereas, Naik *et al.* (2014) [18] reported the dry matter intake was similar in both the groups, in which one was fed with hydroponics maize fodder and other with conventional green fodder. Similarly, Reddy *et al.* (1991) [20] reported no significant difference in dry matter intake when concentrate quota of production requirement was replaced by machine grown barley green fodder at 50 and 25 percent levels. Kide *et al.* (2015) [11] reported significant improvement in dry matter intake in a group of goats fed with hydroponic maize fodder @ 20%, 40% and Mixed maize + barley hydroponic fodder (20%:20%). Dadhich *et al.* (2019) [6] also reported significant effect (P<0.01) of hydroponics maize fodder on DCP and TDN percent in Rathi calves.

Table 1: Effect of hydroponic maize fodder on nutrient intake of gir calves

Attribute	Treatment Groups				
	T_1	T_2	T_3	T_4	SEM
Dry Matter Intake					
g/d	4469.30^{a}	4522.43^{ab}	4537.74^{b}	4610.58^{c}	9.3
kg/100 kg b. wt	3.33^{b}	3.29^{b}	3.20^{a}	3.15^{a}	0.01
g/kg $W^{0.75}$	113.40^{b}	112.78^{b}	110.49^{a}	109.69^{a}	0.3
Organic Matter Intake					
g/d	3962.95^{a}	3945.12^{a}	4037.15^{a}	4136.04^{a}	37.87
kg/100 kg b.wt	2.9	2.92	2.87	2.82	0.02
g/kg $W^{0.75}$	100.54	98.4	98.29	98.39	0.89

Note: Means with different superscripts in a row differ significantly from each other.

Conclusion

The results from the study confirms that feeding of hydroponics maize fodder has beneficial effect on DMI in terms of g/d, kg/100 kg b.wt and g/kg$W^{0.75}$and could replace concentrate mixture up to 75% on protein basis in gir calves.

Acknowledgement

Authors are thankful to Rajasthan University of Veterinary & Animal Sciences, Bikaner, for financial support during the research work and dean of College of Veterinary and Animal Science, Navania, Udaipur for providing all the facilities during the study.

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