

EFFECT OF PARTIAL FEEDING OF HYDROPONIC MAIZE ON PERFORMANCE OF CROSSBRED HEIFERS

Chhaya Thombre¹, V. G. Atkare² and N. S. Chore³

ABSTRACT

Experiment was conducted on six Crossbred Heifers maintained at College dairy farm, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur during the year 2019. Experimental heifers were fed with two different dietary levels of Hydroponic maize 40% and 60 % along with recommended concentrate mixture (Sugras), dry roughage ad libitum (Gram straw) and green maize in addition to natural grazing to determine the dry matter intake (DM) and growth performance. It was noticed that hydroponic maize is reasonably good source of energy and high source of protein in the animal. The crossbred heifers under the treatment dry roughages ad lib + 100% green maize fodder showed significantly ($P<0.05$) higher ($4.57 \text{ kg day}^{-1} \text{ heifers}^{-1}$) DM intake day⁻¹ as compared to the treatment dry roughages ad lib (Gram straw) + 60% green maize + 40% hydroponic maize ($3.84 \text{ kg day}^{-1} \text{ heifer}^{-1}$) and the another treatment dry roughages ad lib (Gram straw) + 40 % green maize + 60% hydroponic maize ($3.36 \text{ kgday}^{-1} \text{ heifers}^{-1}$). Decreased trend in DM intake was observed with increased level of hydroponic fodder in the ration of experimental heifers. Daily dry matter intake increased (4.57 kgday^{-1}) significantly ($P<0.05$) in heifers under the treatment T₁:Dry roughages ad lib (Gram straw) + 100% green maize fodder under the treatment. Higher weekly and daily gain in body weight (5.14 and 0.73 kg) of experimental heifers increased significantly under the treatment T₃ (dry roughages ad lib (Gram straw) + 40 % green maize + 60% hydroponic maize).

The mean gain in body measurement in cm (Chest girth, body length and body height) recorded under the treatment T₁:dry roughages ad lib + 100% green maize (7.01,5.92 and 5.42),T₂:dry roughages ad lib+60% Green maize +40% Hydroponic maize (9.11,7.61and 6.13) and T₃:dry roughages ad lib +40% Green maize+60% Hydroponic maize (10.36,7.68 and 7.03).The differences in gain in body measurement of experimental heifers found to be significant ($p <0.05$).

(Key words:Hydroponics maize, growth, crossbred heifers)

INTRODUCTION

The increase in the livestock population along with the intensive rearing system has resulted in increased demands for feeds and fodder in the country. Green fodder is an essential component of the animal ration, otherwise the production performance of the dairy animal is adversely affected. Therefore, quality green fodder should be fed regularly to the dairy animals. Adequate nutrition is important for body maintenance, growth and reproduction of animals. The major constraints is production of green fodder by dairy owners are unavailability of land for fodder cultivation due to small land holding size, scarcity of water or saline water and labour required for cultivation. Due to these constraints in the conventional method of fodder cultivation, hydroponic technology is introduced as an alternative to grow fodder cultivation for farm animals (Naik *et al.*, 2013).

Hydroponic green fodder plays an important role in conservation of soil, water and time. It requires only about 3-50% of water needed to produce some amount of forage produce under field condition (AI – karaki and Hashimi, 2012). Production of one kg of maize fodder about 1.50 litre to 3.0 litre water is required (Naik *et al.*, 2013). Hydroponic green fodder required less water as compared to fodder produced under conventional system of fodder production. Hydroponic is steadily getting popularity throughout the world and it is an eco-friendly method of cultivation since it minimizes use of water and potentially harmful chemicals.

The aim of good feeding of heifers during their early life is to attain optimum growth and better feed conversion efficiency there by to reach early maturity. The young crossbred are future replacement stock and need special attention including feeding management as growth of crossbred cow determines the future production as well as reproduction efficiency (Singh *et al.*, 2009). Keeping these

1. P. G. Student, Animal Husbandry and Dairy Section, College of Agriculture, Nagpur
2. Professor (CAS), Animal Husbandry and Dairy Section, College of Agriculture, Nagpur
3. Asstt. Professor, Animal Husbandry and Dairy Section, College of Agriculture, Nagpur

in mind, the present paper focused on “Effect of partial feeding of hydroponic maize on performance of crossbred heifers”.

MATERIALS AND METHODS

Six Crossbred heifers maintained at College dairy farm, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur were selected for the present study and randomly divided into three equal groups of two heifers and were fed three dietary treatments by switch over method for 84 days on constant feed as per treatment with a initial period of 10 days with same diet to nullify the effect of prerium feeding thus having six replications. These dietary supplements were T₁: Dry roughages ad lib + 100% green maize fodder, T₂: Dry roughages ad lib + 60% green maize + 40% hydroponic maize and T₃: Dry roughages ad lib + 40% green maize + 60% hydroponic maize. Thus, total period of 84 days were required. The concentrate mixture (Sugras) available in the market and hydroponic maize available in this section were used for feeding. The experimental animals were fed as per ICAR (Anonymous, 1985) recommendation feeding standard to meet the requirement of nutrient. The feed samples were analyzed for nutrient contents according to AOAC (Anonymous, 1990).

The observations were recorded daily upto 84 days for dry matter intake and growth performance after completion of gap of 10 days from the day of changing food as per treatments. Growth performance was judged on the basis of gain in body weight of the experimental heifers along with increment in linear body measurements (Chest girth, Body height and Body length). The observations were recorded daily and continued for 84 days after a gap of 10 days given for changing the diet. The data obtained were subjected to statistical analysis as per the procedure given by Amble (1975).

RESULTS AND DISCUSSION

Chemical composition

It is observed from the table 1 That the per cent DM, CP, CF, EE, NFE and Ash content in concentrate mixture ‘Sugras’ were 89.2, 19.95, 6.10, 6.55, 60.12 and 7.58 per cent, respectively. While in the gram straw were 89.30, 4.8, 44.6, 0.6, 42.23 and 9.2 per cent, respectively. The DM, CP, CF, EE, NFE and Ash for Hydroponic green maize were 18.10, 14.10, 7.17, 4.07, 75.12 and 1.80 per cent, respectively. The corresponding figure for green maize were recorded as 25.75, 9.83, 33.13, 1.79, 49.92 and 8.12 per cent, respectively.

It indicated that the CP content of the concentrate mixture, gram straw, hydroponic green maize and green maize was 19.65, 4.8, 14.10 and 9.83 per cent, respectively. CP content of the concentrate mixture was more than rest of the experimental feeds used for feeding to the heifers. However, CF content of concentrate mixture and hydroponic green maize were 6.10 and 7.17 per cent while, CF content of

green maize and gram straw recorded as 44.6 and 33.13 per cent. Moreover, the EE content of concentrate mixture was more than the content of gram straw, hydroponic fodder and green maize. NFE recorded more in hydroponic green maize followed by concentrate mixture, green maize and gram straw, respectively. The higher (9.20) ash percentage recorded in gram straw, while lowest (1.80) in hydroponic green fodder.

Chemical composition of concentrate mixture, hydroponic green maize and green maize revealed that the values are more or less similar to that reported by Patil (2018), who reported that per cent DM, CP, CF, EE, NFE and Ash from concentrate mixture were 89.2, 19.65, 6.10, 6.55, 60.13 and 7.58 per cent, respectively.

The per cent DM, CP, CF, EE, NFE and Ash content in hydroponic green maize were 11.10, 14.10, 7.17, 4.07, 72.86 and 1.80 per cent, respectively. The corresponding figures for green maize were recorded as 25.75, 9.83, 33.13, 1.79, 49.92 and 8.12 per cent, respectively.

Bhagat (2016) reported that per cent DM, CP, CF, EE, NFE and Ash from concentrate mixture were 89.2, 19.65, 6.55, 60.12, 6.10 and 7.58 per cent, respectively. The per cent DM, CP, CF, EE, NFE and Ash content in hydroponic green maize were 18.10, 14.10, 4.07, 75.12, 7.17 and 1.80 per cent respectively. The corresponding figures for green maize were recorded as 25.75, 9.83, 1.79, 49.92, 33.13 and 8.12 per cent, respectively.

Dry matter intake

The result on DM intake in experimental heifers over an experimental period are given in table 2. The average daily DM Intake of heifers day⁻¹ were 4.57, 3.84 and 3.36 kg for the treatment dry roughages ad lib (Gram straw) + 100% green maize fodder, dry roughages ad lib (Gram straw) + 60% green maize + 40% hydroponic maize and dry roughages ad lib (Gram straw) + 40% green maize + 60% hydroponic maize, respectively (Table 2). The analysis of variance for DM intake indicated significant differences in the heifers under various treatments. However, average DM intake by the heifers under the treatment dry roughages ad lib (Gram straw) + 40% green maize + 60% hydroponic maize feeding was higher as compared to DM intake of the heifers under the treatment dry roughages ad lib (Gram straw) + 60% green maize + 40% hydroponic maize and dry roughages ad lib (Gram straw) + 100% green maize fodder. It was further revealed that with the increase in the level of hydroponic maize feeding, there was corresponding increase in the dry matter significantly.

These results are in agreement with the findings of Naik *et al.* (2017), who noticed decrease (3.2 kg day⁻¹) in DM intake in cows fed with hydroponic maize fodder. Similar to these results, Reddy *et al.* (1988) also observed DM intake (2.74 vs 2.84, kg 100⁻¹ kg BW) and roughages concentrate ratio (65:35 vs 63:37) in milch cattle fed rations containing artificially grown barley fodder vs NB-21 fodder (10 kg day⁻¹).

Growth performance

Body weight

The results obtained in this regard are presented in the table 3. The average weekly gain in body weight animal⁻¹ was noticed as 4.69, 4.96 and 5.14 kg under the treatments dry roughages ad lib (Gram straw) + 100% green maize fodder, dry roughages ad lib (Gram straw) + 60% green maize + 40% hydroponic maize and dry roughages ad lib (Gram straw) + 40 % green maize + 60% hydroponic maize, respectively (Table 3). The average daily weight gain were 0.69, 0.71 and 0.73 kg. The variation among different treatments was found to be statistically significant ($p < 0.05$). Higher total gain was noticed in the treatment where 60% hydroponic maize day⁻¹ heifer⁻¹, were fed in addition to normal diet. Thus, it indicated that supplementation of hydroponic maize increased the growth rate of experimental animals.

These results are in line with the findings of Singh *et al.* (2009). They reported body weight gain as well as average daily weight gain in crossbred heifers fed with green maize, which may be attributed higher energy intake in the form of total digestive nutrients. On contrary, Swati *et al.* (2015) while conducting study on effect of feeding hydroponics barley fodder on nutrient utilization, growth, blood metabolites and cost effectiveness in Haryana male calves observed ADG body weight in T₁, T₂ and T₃ was 375 g, 501.67 g and 490.33 g, respectively.

Body measurement

The result obtained in respect of the chest girth, body length and body height are presented in table 4.

Chest girth

The mean daily gain in chest girth during the 84 days were 7.01, 9.11 and 10.36 cm for the treatments dry roughages ad lib (Gram straw) + 100% green maize fodder, dry roughages ad lib (Gram straw) + 60% green maize + 40% hydroponic maize and dry roughages ad lib (Gram straw) + 40 % green maize + 60% hydroponic maize, respectively. The chest girth was significantly ($p < 0.05$) higher under the treatment dry roughages ad lib (Gram straw) + 40 % green maize + 60% hydroponic maize.

Body length

The mean daily gain in body length during the 84 days were noticed as 5.92, 7.61 and 7.68 cm under the treatments dry roughages ad lib (Gram straw) + 100% green maize fodder, dry roughages ad lib (Gram straw) + 60%

green maize + 40% hydroponic maize and dry roughages ad lib (Gram straw) + 40 % green maize + 60% hydroponic maize, respectively. The variation among different treatment groups was found to be statistically significant ($p < 0.05$) with maximum gain in the treatment where 60% of hydroponic maize were fed in addition normal diet.

Body height

The mean daily gain in body height at wither point during the 84 days were found to be 5.42, 6.13 and 7.03 cm for the treatments dry roughages ad lib (Gram straw) + 100% green maize fodder, dry roughages ad lib (Gram straw) + 60% green maize + 40% hydroponic maize and dry roughages ad lib (Gram straw) + 40 % green maize + 60% hydroponic maize, respectively. The variation among different treatment groups was found to be statistically significant ($p < 0.05$) with different trend.

The results on body measurements mentioned above are in agreement with the findings reported by Bhagat (2016) while studying the effect of feeding hydroponic green maize on growth performance of crossbred calves. She recorded gain in body weight as 6.60, 7.0, 10.62 and 8.80 cm in T₁ (Jowar straw ad-lib + Green maize + Concentrate), T₂ (Jowar straw ad-lib + 30 % Hydroponic Green maize + 70 % Green maize + Concentrate), T₃ (Jowar straw ad-lib + 40 % Hydroponic Green maize + 60 % Green maize + Concentrate) and T₄ (Jowar straw ad-lib + 50 % Hydroponic Green maize + 50 % Green maize + Concentrate), respectively and mean gain in body weight at wither point recorded as 8.80, 9.0, 11.4 and 8.8 cm for the treatments T₁ (Jowar straw ad-lib + Green maize + Concentrate), T₂ (Jowar straw ad-lib + 30 % Hydroponic Green maize + 70 % Green maize + Concentrate), T₃ (Jowar straw ad-lib + 40 % Hydroponic Green maize + 60 % Green maize + Concentrate) and T₄ (Jowar straw ad-lib + 50 % Hydroponic Green maize + 50 % Green maize + Concentrate), respectively. Nisha Kumari (2011) also conducted study on effect of feeding green maize on growth performance of crossbred calves. She recorded mean gain in body height at wither point as 5.80, 6.92 and 7.70 cm in T₁ (Wheat straw ad-lib + 500 gm Concentrate), T₂ (Wheat straw ad-lib + 500 gm Concentrate + 1 kg Maize silage) and T₃ (Wheat straw ad-lib + 500 gm Concentrate + 1.5 kg Maize silage), respectively. It was further noticed that gain in body length recorded as 5.4, 5.7 and 5.9 cm in T₁, T₂ (Wheat straw ad-lib + 500 gm Concentrate), T₂ (Wheat straw ad-lib + 500 gm Concentrate + 1 kg Maize silage) and T₃ (Wheat straw ad-lib + 500 gm Concentrate + 1.5 kg Maize silage) respectively.

Table 1. Chemical composition (on % DM basis) of experimental feeds fed to crossbred heifers

Sr.No.	Attributes	Concentrate mixture 'Sugras'	Gram straw	Hydroponic green maize	Green maize
1	DM	89.20	89.30	18.10	25.75
2	CP	19.95	4.8	14.10	9.83
3	CF	6.10	44.6	7.17	33.13
4	EE	6.55	0.6	4.07	1.79
5	NFE	60.12	42.23	75.12	49.92
6	Ash	7.58	9.2	1.80	8.12

Table 2. Mean daily dry matter intake by experimental heifers under different treatments

Treatments	Avg.body wt.(kg)	DM intake(kg day ⁻¹)	DM intake 100 kg ¹ body wt.
T ₁ (dry roughages ad lib + 100% green maize fodder)	123.58	4.57	3.70
T ₂ (dry roughages ad lib + 60% green maize + 40% hydroponic maize)	124.91	3.84	3.08
T ₃ (dry roughages ad lib + 40% green maize+60% hydroponic maize)	129.46	3.36	2.67
SE(m) ±		0.08	0.07
CD @ 5% level		0.26	0.25

Table 3. Mean weekly and daily body weight gains of experimental heifers

Treatment	Weekly weight gain (kg)	Daily weight gain (kg)
T ₁ (dry roughages ad lib + 100% green maize fodder)	4.69	0.69
T ₂ (dry roughages ad lib + 60% green maize + 40% hydroponic maize)	4.96	0.71
T ₃ (dry roughages ad lib + 40% green maize + 60% hydroponic maize)	5.14	0.73
SE(m)±	0.02	0.02
CD@ 5% level	0.05	0.05

Table 4. Mean gain in body measurement of experimental crossbred heifers at the end of each period under different treatments (cm)

Treatments	Chest girth (cm)	Body length (cm)	Body height (cm)
T ₁ (dry roughages ad lib + 100% green maize fodder)	7.01	5.92	5.42
T ₂ (dry roughages ad lib + 60% green maize + 40% hydroponic maize)	9.11	7.61	6.13
T ₃ (dry roughages ad lib + 40% green maize + 60% hydroponic maize)	10.36	7.68	7.03
SE(m)±	0.54	0.14	0.10
CD @5% level	1.69	0.51	0.33

REFERENCES

- Amble, V. N. 1975. Statistical methods in animal science. Indian Society Agricultural Statistics, New Delhi. (1st Ed.), pp: 199-219.
- Anonymous, 1985. Nutrient requirements of Livestock and Poultry. Indian Council of Agricultural Research, New Delhi.
- Anonymous, 1990. Official method of Analysis, 15th Ed. Association of official Analytical Chemists, Washington, D. C.
- Al-Karaki and Hashimi, 2012. Green fodder production and Use efficiency of some forage crops under hydroponic conditions. ISRN Agronomy volume **2012**, Article ID 924672.
- Bhagat, R.B. 2016. Effect of Feeding Hydroponic Green Maize (*Zea mays*) on Growth Performance of Crossbred Calves. M.Sc (Agri.) thesis unpub.submitted to DR. PDKV, Akola.
- Naik, P.K., S.P.Gaikwad, M.J.Gupta, R.B.Dhuri, G.M.Ghumal and N.P.Singh, 2013. Low cost Devices for Hydroponics Fodder Production. I.C.A.R. Research complex for Goa, Old Goa-India. Indian J. Anim. Nutr. **29** (2) : 161-163.
- Naik, P.K., B.D.Dhawaskar, Fatarpekar, M.Karunakaran, R.B.Dhuri, B.K.Swain, E.B.Chakurkar and N.P.Singh, 2017. Effect of feeding hydroponics maize fodder replacing maize of concentrate mixture partially on digestibility of nutrients and milk production in lactating cows. Indian J. Anim. Sci. **87** (4): 452-455
- Nisha Kumari, R.2011. Effect of maize silage feeding on growth performance of crossbred calves .M.Sc. (Agri.) Thesis unpub.submitted to Dr.P.D.K.V.Akola.
- Reddy, G.V., M.R.Reddy and K.K.Reddy, 1988. Nutrient utilization by milch cattle fed on rations containing artificially grown fodder. Indian J. Anim. Nutr. **5** (1): 19-22.
- Singh, N.P., J.L. Chaudhari and C.M. Yadav, 2009. Effect of feeding of differents levels of green maize on the performance of heifers. Indian J. Anim. Nutr. **26**(3): 151-155.
- Swati V., Anand Singh, Anup Karla and M.J.Saxena , 2015. Effect of feeding hydroponics barley (*Hordeum vulgare*) fodder on nutrient utilization, growth, blood metabolites and cost effectiveness in haryana male calves. Ayurved research foundation, chidana- 131306, sonapat, Haryana, India.

Rec. on 15.7.2019 & Acc. on 28.07.2019