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Effect of Growing Media on Nutrient Profile of Conventional and Hydroponic Maize Fodder

Veterinary Science

KEYWORDS : Conventional, Fodder, Growing, Hydroponic, Nutrient

Weldegerima Kide Gebremedhin
M.Sc Scholar, Dep't. Animal Husbandry and Dairy Science, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli. 415712, Dist. - Ratnagiri (M.S) – India

ABSTRACT

The study was conducted at the Instructional livestock farm, Agriculture College, D.B.S.K.K. Vidyapeeth, Dapoli, Ratnagiri district (M.S), India. The experiment was aimed to identify the effect of growing media on nutrient profile of conventional and hydroponic maize fodder. Hydroponic maize fodder was procured from hydroponic unit of the department while conventional maize fodder was grown on soil through frequent watering and management and harvested at 60 days of growth stage.100 g of conventional and 6th, 7th and 8th-day hydroponic fodders were sampled for proximate analysis. The Crude protein content of hydroponic maize fodder was highest (P<0.05) 14.56±0.29% than conventional maize fodder 9.82±0.35% and maize seed 7.6±0.63% while Ether extract observed as 4.67±0.19% at 8th-day growth periods was highest (P<0.05) than conventional maize fodder 2.35±0.46% and seed form (2.8±0.20%). The crude fibre content of maize seed was denoted as 6.5±0.55% and progressed (P<0.05) likely to 10.0±0.17% hydroponic and 22.23±0.04% conventional fodder where as NFE value was 68.47±1.63% and 53.46±1.47% in hydroponic and conventional fodder, respectively. The value of total ash and AIA content was highest (P<0.05) in conventional fodder (6.27±0.05% & 1.36±0.06%) than hydroponic maize fodder (2.83±0.03% & 0.32±0.01%). Therefore, hydroponically grown maize fodder had shown increased nutrient profile such as crude protein, ether extract and nitrogen free extract along with improved fresh fodder weight and less fiber content than conventional maizefodder.

INTRODUCTION

Fodder is the most important and profound input in livestock diet. Grass and legume species had been used as major feed for livestock, however, due to less availability and low-quality fodder, the maintenance and productivity of animals is not ensured. Availability of green fodder is attenuated due to severe climate change, extra growing time (averagely 60 days), unavailability of enough land, deterioration of fertile soil and water resources competition between fodder and cereal crops (Morsy et al., 2013), while demand of green fodder is increasing when fodder availability is limited and necessity of feed for animals and its cost increases causing important livestock losses and depressing the national economy. Therefore, it is felt as a need of the hour to explore and develop the possibility of improved fodder production in a better way. Hydroponically growing fodder is the transformation of grains into high quality, very lush, highly nutritious, disease free grass and root combination animal feed produced in a versatile and intensive hydroponic unit (Weldegerima *et al.,* 2005). 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). Since the agriculture sector is greatly enhanced through the introduction of a new form of animal fodder that secures livestock health and production, the present study was focused to identify the "Effect of growing media on nutrient profile of conventional and hydroponic maize fodder".

MATERIALS AND METHODS

Experimental site: The experiment was carried out at the Instructional livestock farm, College of Agriculture, Dapoli. Hydroponic cultivation plan was prepared and a hydroponic unit was installed at the dairy farm using 75% green shed net cover for optimum shed and ventilation with internal structure of 30.3 x 8.2 x 6.0 ft length, height and width, respectively with 0.4% slope for effective drainage of excess water. The racks were prepared by using bamboo stands with three shelves (1 ft^2 distance each) with capacity of 120 plastic hydroponic trays, sized 1.8 ft length × 1.0 ft width × 0.15 ft height equipped with semi-automated sprayer irrigation. The trays with holes at the base were to allow drainage of excess water from irrigation. Water used was tap water free from any additives. The temperature and humidity inside the green-house was controlled through micro-sprinklers irrigation to maintain a range of 22 - 27^0C temperature and 70-80% relative humidity. African tall Maize variety (*Zea mays* L.) was used and soaked for 12 hours in tap water. After 24-36 hours of germination in gunny bag, sprouted seeds were spread on the hydroponic tray at a rate of 500 grams per 2 ft^2 tray size and 1.5-2 cm layer seed thickness. Six (6), seven (7) and eight (8) days were considered for evaluation of the trays produced quality and quantity hydroponic fodder. For cultivation of conventional maize fodder 22m^2 (1mx22m) plot of land was prepared and African tall maize variety (*Zea mays* L.) was sown at loam soil of 1 cm seed space and 1 feet raw space and at seed rate of 41.46 gram/m^2. The plot of land was watered daily and kept for 60 days growth period. 100 gm of 60 days maize green fodder and Six (6), seven (7) and eight (8) days hydroponic maize fodder were sampled to determine the nutrient composition and oven-dried at 100 °C and ground to pass a 1-mm mesh screen sieve and analyzed nutrients content viz Dry Matter (DM), Crude Protein (CP), Ether extract (EE), Crude Fiber (CF), Nitrogen free extract (NFE) Total Ash (TA) and Acid insoluble ash (AIA) as per A.O.A.C. (1995). Data was analyzed using Statistical Analysis System (SAS, 2013).

RESULTS AND DISCUSSION

Growing of conventional vs. hydroponic maize fodder

At 60 days of growth period 14.43 kg/m^2 of fresh conventional maize fodder was produced from 41.46 gm seed along with 2.6 meter average plant height. The whole portion of green maize fodder was measured to estimate the production potential on limited space excluding the root tightly embedded with soil. In the specially designed sprouting trays, a total of 8 kg hydroponic maize fodder embedded with white root and green shoots was produced out of 1kg maize seed (87% germination rate) along with average plant height of 28 cm on 8^{th}-day. The production conversion ratio was based on the amount of fresh fodder produced per unit of seed used (Morgan *et al.*, 1992) and Peer and Leeson (1985). The conversion ratio depends on factors such as type and quality of seed, overall management, sprinkling frequency, temperature inside the greenhouse, relative humidity and growth period (Trubey and Otros, 1969). This data agrees with the concepts of Sneath and McIntosh (2003), viewed from commercial hydroponic fodder producers achievements as 6–10 kg, while ensured from trial yields ranged 5–8 kg and Morgan *et al.*, (1992) and Peer and Leeson (1985) as 4-8 kg out of 1kg maize seed and was superior to the findings of Naik *et al.*, (2013) as 5.5 kg, Naik and Singh (2013) as 5–6 kg fresh hydroponic fodder per kg of maize seed. The average plant height (28 cm) achieved on 8^{th}-day was in line with the results reported by Naik *et al.*, (2013) in maize hydroponic fodder as 20–30cm and Mukhopad (1994) in barley hydroponic fodder as 15-30 cm height.

Variable	Obs.	Maize Seed	Hydroponic Maize Fodder			CMF Harvested at 60 days period
			Day- 6	Day- 7	Day-8	
		Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE
DM	3	95.08±0.64	22.6±0.75	20.1±0.34	18.25±0.12	33.2±0.14
CP	3	7.6±0.63	12.45±0.29	13.89±0.56	14.56±0.29	9.82±0.35
EE	3	2.8±0.20	3.16±0.29	4.22±0.18	4.67±0.19	2.35±0.46
CF	3	6.5±0.55	7.97±0.18	9.33±0.47	10.0±0.17	22.23±0.04
NFE	3	78.67±2.13	74.66±0.93	71.32±1.95	68.47±1.63	53.46±1.47
ASH	3	1.31±0.03	1.83±0.10	2.56±0.11	2.83±0.03	6.27±0.05
AIA	3	0.05±0.01	0.22±0.01	0.28±0.02	0.32±0.01	1.36±0.06

Obs.: observation, CMF: conventional maize fodder, DM: dry matter CP: crude protein EE: ether extract CF: crude fiber, NFE: nitrogen free extract, Ash: ash AIA: acid insoluble ash, SE: standard error, %: per cent.

Table 1*: **Chemical composition of conventional vs. hydroponic maize fodder (%DM).**

Chemical composition: During the present investigation, there was a significant difference (P<0.05) in dry matter content of maize seed, conventional and hydroponic maize fodder (Table 1). As result indicated, the average DM content of maize seed, conventional and hydroponic maize fodder was found as 95.08±0.64%, 33.2±0.14% and 18.25±0.12%, respectively. The lower % DM of maize hydroponic fodder may be due to the large uptake of water initiates increasing metabolic activity of resting seeds leads to complete loss of dry weight (starch) during germinating cycles of hydroponic fodder (Morsy *et al.*, 2013) whereas %DM of conventional maize fodder was significantly higher may be due to the increased photosynthetic activity increased stage of maturity of whole plant portion leading to higher biomass production. Agreement results denoted by Naik *et al.*, (2014) in hydroponic maize fodder 18.30% DM and higher values were reported by Thadchanamoorthy *et al.*, (2012) in hydroponic maize fodder as 26.07% (moisture content 73.93%) where as lower values of conventional maize fodder was reported by Azim *et al.*, (1989) as 26.36±2.97%. The crude protein content presently observed in hydroponic maize fodder was 14.56±0.29% highly superior as compared to 9.82±0.355% in conventional maize fodder harvested at 60 days growth period and 7.6±0.63% in maize seed. Sprouting alters the amino acid profile of maize seeds and increases the crude protein content of hydroponic fodder (Morsy *et al.*, 2013). The crude protein level of conventional maize fodder was reduced significantly due to the age of maturity (Azim *et al.*, 1989). The crude protein value was higher than results reported by Naik *et al.*, (2013) in hydroponic maize fodder as 13.30-13.6%, Singh *et al.*, (2011) as 13.57% and Naik *et al.*, (2014) as 13.30% and lower than findings reported by Thadchanamoorthy *et al.*, (2012) in hydroponic maize fodder as 16.54% where as result of conventional maize fodder was lower than values reported by Azim *et al.*, (1989) as 11.81±2.46% harvested at 30 days age and Dutta *et al.*, (1999) as 14% harvested at blooming stage.

The appreciable ether extract content observed at 8th-day growth periods in hydroponic system (4.67±0.19%) was higher (P<0.05) than in seed form (2.8±0.20%) and conventional maize fodder (2.35±0.46%) may be due to the peak chlorophyll content noticed at 8th-day growth stages and sampled for determination of ether extract. The values reported by Naik *et al.*, (2013) as 3.27-3.50%, Singh *et al.*, (2011) as 3.49% and Naik *et al.*, (2014) as 3.27% were lower than the present findings while Thadchanamoorthy *et al.*, (2012) as 6.42% was higher than the present values in hydroponic maize fodder where as values of the present findings of conventional maize fodder was higher than data denoted by Azim *et al.*, (1989) 1.16±0.19% and Dutta *et al.*, (1999) as 2.0% and lower than values reported by Naik *et al.*,(2012) as 2.27% in conventional maize fodder. The crude fibre content of conventional maize fodder harvested at 60 days growth stage was higher (22.23±0.04%) than 8th-day hydroponic maize fodder (10.0±0.17%) and seed form (6.5±0.55%) might be due to the buildup of cellulose, varied proportions of hemicelluloses and lignin (Cuddeford, 1989). Maturity impresses the crude fibre content of green fodder. The matured stem portion of conventional maize fodder contained more crude fiber than soft portion (stem and leaves) of the hydroponic maize fodder. Comparable CF values were reported by Naik *et al.*, (2013) ranged as 6.37-14.10% where as lower values denoted by Thadchanamoorthy *et al.*, (2012) as 8.21%, Naik *et al.*, (2014) as 6.3% and higher values by Singh *et al.*, (2011) as 14.07% in hydroponic maize fodder. Higher CF values of conventional maize fodder was reported by Naik *et al.*, (2012) as 25.92% and Azim *et al.*, (1989) as 27.86±3.14%. The NFE content of hydroponic maize fodder at 8th-day growth stage was found as 68.47±1.63%.This result was in agreement to the reports of Naik *et al.*, (2013) ranged as 66.70-75.3% and lower values by Singh *et al.*, (2011) as 66.72% in hydroponic maize fodder while in agreement with Naik *et al.*, (2012) in conventional maize fodder as 51.78%.

Value of total ash was found highest (P<0.05) in conventional maize fodder as 6.27±0.05% than 8th-day grown hydroponic maize fodder (2.83±0.03%) and seed form (1.31±0.03%). The above data manifested that the value of ash was found highest with the increased maturity of the conventional maize fodder. Agreement results were reported by Azim *et al.*, (1989) 6.46±0.67% and lower than data denoted by Dutta *et al.*, (1999) 8.15% and Naik *et al.*, (2012) 9.36% in conventional maize fodder harvested at 60 days growth period where as agreement results to the hydroponic maize fodder were reported by Naik *et al.*, (2013) as 1.75-3.80%, higher values reported by Singh *et al.*, (2011) as 8.34% and lower values by Naik *et al.*, (2014) as 1.75% in 8th-day grown hydroponic maize fodder. The AIA content of conventional maize fodder was found 1.36±0.06% than hydroponic maize fodder 0.32±0.01% and seed form 0.05±0.01%. The AIA content was in line with the findings of Naik *et al.*, (2012) 1.40% in conventional maize fodder while Naik *et al.*, (2013) as 0.30-0.57% and Singh *et al.*, (2011) as 0.33% in hydroponic maize fodder, respectively.

From results of the present investigation, it can be concluded that growing of fodder hydroponically increased nutrient content such as crude protein, ether extract and nitrogen free extract along with improved fresh fodder weight and less fiber content than conventional maize fodder.

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