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CHEMICAL COMPOSITION OF WHOLE CROP AND DIFFERENT PARTS OF HYDROPONIC MAIZE FODDER

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Abstract: A study was conducted to quantify the nutrients in whole crop and different parts of hydroponic maize fodder. Fodder maize was cultivated and harvested in eight days in the TANUVAS Hydroponic greenhouse production plant. Samples of whole crop, leaf and stem and root portions were collected and analysed for proximate composition. The leaf and stem component had higher crude protein and crude fibre contents whereas in roots, crude fat and nitrogen free extract contents were higher. Hydroponic maize fodder whole crop contained high protein, fat and soluble carbohydrates but low fibre than the traditionally field cultivated fodder maize. The nutrient content of hydroponic maize fodder was found to be high and suitable for feeding ruminant livestock.
Keywords: Hydroponic maize, proximate composition, whole crop, leaf and stem, root.

Introduction

Nowadays cereal crops are being grown in hydroponic method and used as livestock feed. The hydroponic type of green fodder production is most common during the dry season and it is implemented in urban areas where land is unavailable for cultivation of forage crops. Moreover, hydroponic green fodder could be produced within six to eight days period and hence useful as an excellent feed with high rate of renewal. In comparison to field grown fodder, hydroponic fodder has gained significance due to the ability of the hydroponic fodder production system to deliver the known quantity of green feed every day in spite of seasonal variation such as dry, wet or cold climate (Jagtap *et al.*, 2019). Nutrient levels in hydroponic fodder vary during the stages of growth and are reduced as crops mature. Dry matter decreases as the seeds germinate, increasing the levels of fibre, ash, protein and fat. (Zahera *et al.*, 2015). When hydroponic maize fodder was fed to goats, increased body growth rate and total body weight were observed compared to those fed regular feed with grains (Gebremedhin, 2015). Reduced feed intake and increased feed conversion was observed in milch cows fed hydroponically cultivated maize with no significant differences in digestibility of nutrients or milk production (Naik *et al.*, 2017). As a part of research works

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on evaluating the possibilities of improving green fodder production in southern region of Tamilnadu, a study was conducted in Veterinary College and Research Institute, Tirunelveli to analyse the proximate composition of hydroponically grown maize green fodder to investigate its nutritional constituents for feeding ruminant livestock.

Materials and Methods

Hydroponic maize was cultivated in the Department of Animal Nutrition, Veterinary College and Research Institute, Tirunelveli, in an eight-layer TANUVAS Hydroponic Green Fodder machine capable of producing 40 kg of maize fodder per day. Selected maize seeds soaked in water were placed in plastic trays uniformly, maintained at ambient temperature and water was sprayed by means of sprayer mounted on the machine for two minutes for every threehours. After eight days, the plastic trays were taken out and the green fodder was fully harvested. Three categories of samples were collected i) Hydroponic maize whole crop, ii) leaf and stem portion and iii) root portion. Dry matter and proximate constituents were estimated in all the three following the methods outlined in AOAC (1990). Samples were dried in a hot air oven at 105° Cfor 8 hours for moisture estimation. In the dried samples, the level of proximate constituents such as crude protein, crude fibre, crude fat, total ash, and acid insoluble ash were analysed. Nitrogen-free extract content was calculated.

Results and Discussion

Proximate composition of whole crop and components of Hydroponic Maize fodder is given in the following table.

Table: Proximate composition of whole crop, components of Hydroponic Maize

Proximate Constituents	Level (on % Dry Matter Basis)		
	Leaf and stem	**Root**	**whole crop**
Dry Matter	$7.69^{a} \pm 0.54$	$21.04^{c} \pm 1.23$	$16.34^{b} \pm 1.04$
Crude protein	$19.35^{c} \pm 1.56$	$7.90^{a} \pm 0.82$	$9.33^{b} \pm 0.75$
Crude fat	$1.13^{a} \pm 0.17$	$3.69^{c} \pm 0.65$	$1.93^{b} \pm 0.48$
Crude fibre	$24.59^{c} \pm 1.36$	$7.06^{a} \pm 0.69$	$10.67^{b} \pm 0.88$
Total Ash	$5.96^{c} \pm 0.42$	$1.93^{a} \pm 0.49$	$4.25^{b} \pm 0.90$
Acid insoluble ash	0.20 ± 0.02	0.06 ± 0.01	0.11 ± 0.01
Nitrogen free Extract	$48.97^{a} \pm 2.14$	$79.42^{b} \pm 3.11$	$73.87^{ab} \pm 2.89$

Values with different superscripts (a, b, c) vary significantly ($P \leq 0.05$)

Dry matter, crude protein, crude fibre, crude fat, total ash, acid insoluble ash and nitrogen-free extract contents in whole crop of hydroponic maize fodder were found to be 16.34%,

9.33%, 10.67%, 1.93%, 4.25%, 0.11% and 73.87% respectively. Similarly, the proximate constituents found in leaf and stem portion were 7.69%, 19.35%, 24.59%, 1.13%, 5.96%, 0.2% and 48.97%. Proximate constituents of the root were found to be in the range of 21.04%, 7.9%, 7.06%, 3.69%, 1.93%, 0.06% and 79.42%. Though the dry matter content of the whole crop was consistent with the research findings of Naik *et al.* (2016), the crude protein level (9.33%) was considerably lower. Crude protein content varied significantly ($P \leq 0.05$) between whole crop, leaf and stem portion and root region. It was observed to be the highest in leaf and stem portion (19.35%) and lowest in the root region (7.90%). Similar to crude protein, crude fibre content was also considerably higher ($P \leq 0.05$) in leaf and stem portion (24.59%) than the root region (7.06%). Maturity of the crop is considered to be the major factor that influences the protein and fibre contents of cereal crops. However, in this study, variation in the levels of crude protein and crude fibre in hydroponic maize green fodder was not only due to crop maturity but was also observed between different parts of the same crop. Similar differences in proximate constituents of roots with germinated seeds, leaves and plants of hydroponic maize fodder was observed by Naik *et al.* (2017). The levels of crude fat and nitrogen free extract (soluble carbohydrates) were observed to be significantly higher ($P \leq 0.05$) in the root region than in the leaf and stem portion. This may be attributed to the general increase in fat content in germination parts of the cereal crop and the high soluble carbohydrate content of non-germinated grains. Compared to field cultivated maize fodder, the values of proximate constituents mainly crude protein, crude fat and NFE were higher; crude fibre was lower in the whole crop of hydroponic maize fodder (Naik *et al.*, 2017). Hence, hydroponically grown maize fodder could be used as a valuable substitute to conventional maize fodder along with a good quality fibre source to meet the nutrient requirements of ruminant livestock.

Conclusion

The results of this study showed that the quantity of all the nutrients with the exception of fibre available from whole hydroponic maize fodder crop harvested in eight days was better than the traditionally cultivated maize fodder, although the levels of nutrients in various parts like leaf and stem portion and root region varied significantly. Therefore, in areas where crops cannot be cultivated in the traditional way and in drought-prone conditions, a low-cost soil less hydroponic maize crop can be used as a nutritious green fodder for feeding ruminants along with a dry fodder source rich in good quality fibre.

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