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AWARENESS OF FEEDING HYDROPONIC MAIZE FODDER TO LIVESTOCK AMONG ELITES AND ITS EFFECT AS SUPPLEMENT ON EWES' MILK

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ABSTRACT

A study was conducted to assess awareness of hydroponic maize fodder among elites and to evaluate its effect as a dietary supplement on milk production in lactating ewes. Awareness was determined using structured questionnaires administered to graduates within the university working with the university set up. For the feeding trial, twenty lactating ewes were assigned to four dietary treatments containing 0% (control), 10%, 20%, and 30% hydroponic maize fodder and fed at 3% of body weight for four weeks. Milk yield was measured by weighing lambs before and after suckling, and the chemical composition of the fodder was analyzed for crude protein, fibre, and energy content. Results showed that 85% of respondents practiced crop–livestock farming, 95% were aware of hydroponic maize fodder production, and 55% knew how to cultivate it. The hydroponic maize fodder contained 14.72% crude protein and 2593 kcal/kg metabolizable energy, meeting nutrient requirements for lactating sheep. Supplementation had a significant effect ($p<0.05$) on milk yield, with ewes fed 10%, 20%, and 30% hydroponic fodder producing 32%, 40%, and 50% more milk, respectively, than the control group. In conclusion, these findings confirm that hydroponic maize fodder is a nutritionally adequate and effective supplement that consistently boosts milk production and offers a sustainable solution to improve small ruminant productivity.

Keywords: Hydroponics, Maize, Supplement, Livestock, Milk

INTRODUCTION

Green fodder plays major role in feed of lactating animals, thereby providing required nutrients for milk production and health of the animals (Chakurkar, 2020). Hydroponics is a subset of hydro culture which involves growing plants without soil, by using water based mineral nutrients solutions in aqueous solvents. The nutrients used in hydroponic systems can come from many different organic or inorganic sources, including fish excrement, duck manure, purchased chemical fertilizers, or artificial nutrient solutions (Sanjay, 2018).

Hydroponic is a straight forward way of providing all these nutrients without the need of soil under controlled environment conditions to optimize the growth of plants in seven days of time. Fodder obtained from hydroponics consists of grass with grains, roots, stem and leaves as compared to only stem and leaves part in conventionally grown fodder (Horn, 2004). Hydroponics maize fodder is extremely high in protein and Metabolizable energy, which is highly digestible by most animals (Rabten, 2018). Therefore, the objective of this study was to determine the awareness among elites of feeding hydroponics maize fodder to lactating ewe and its effect as supplement on milk production.

MATERIALS AND METHODS

Study Area

The study was conducted at the Livestock Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Bayero University, Kano (longitude 9°30' and 12°30' and latitude 8°30' and 9°30'). The annual temperature and relative humidity range between 38 to 43°C and 40 to 51% respectively, (Olofin, 2007). The climate is characterized by four seasons from March to May is called Bazara (late dry season), June to August is Damina (early wet season), September to November is Kaka (late wet season), December to February is Rani (early dry season) (Muhammad, 2019) with annual rainfall of 800 to 1000mm (KNARDA, 2012). The environment is conducive to different livestock production (camel, cattle, sheep, goat, rabbit, horse, donkey and poultry). It is free from tse-tse fly infestation with abundant grassland for grazing animals. Crops grown in the region include sorghum, millet, corn, groundnut, cowpea, sesame and rice (Muhammad, Ashiru & Abdullahi, 2007).

Survey on Awareness on the Know-How of Hydroponic Fodder Production

A diagnostic survey was conducted to know the level of awareness on the know-how of hydroponic fodder production among the elites in Bayero University Kano. Structured questionnaire was administered to graduates working with the University set up but practice some livestock production. The questions were on awareness of the use of hydroponic maize fodder as livestock feed and knowledge of the know-how-of production.

Production of Hydroponic Fodder and Bioassay using Lactating Sheep

Maize seeds were collected and sorted out to discard broken or unhealthy seeds, chaff and dirt. A bucket of clean water was added into a container with 1kg of the seeds (Akinbobola, 2022). Seeds that floated on water were removed. Half a handful of salt was added to avoid fungus; the seeds were allowed to soak for about 12 hours (Sawant, 2021; Akinbobola, 2022). Afterwards, the water was drained; the seeds were washed with clean water and then transferred to a bag to sprout, this took about 24 hours (Jemimah *et al.,* 2018; Sawant, 2021; Akinbobola, 2022). The sprouted seeds were removed from the bag and were spread evenly over a tray. The tray was then placed on a rack. The sprouted seeds were watered every day, every 2 hours. Within a week, 1kg of maize seeds produced about 8kg of fodder (Sawant, 2021; Akinbobola, 2022). The trays were removed and the slabs of

the fodder were cut into pieces (Jemimah *et al.,* 2018; Sawant, 2021; Akinbobola, 2022).

Four treatments consisting of the hydroponic fodder at 10, 20 and 30%. Five animals in each treatment with each animal as replication and were arranged in a Completely Randomized Design (CRD). The lactating Ewes selected were fed based on 3% of their body weight. Twenty (20) ewes were used for the experiment from the Department of Animal Science Farm in small ruminants section that was managed under semi-intensive system of production. The ewes used were Yankasa breed in which all were at different stages of lactation. The sheep were balanced for parity and stage of lactation. In the first treatment which is the control, the sheep were fed only the basal diet (mix hay), while the second treatment were fed 10% green fodder and 90 basal diet, third treatment was fed 20% green fodder and 80% basal and the forth treatment was fed 30% green fodder and 70% basal diet.

Data Collection

The lambs were separated from the ewes to allow for extraction of milk synthesized overnight. The lambs were then allowed to suck the milk the following morning; their weight was taken before and after suckling. Then the milk yield was calculated using the following formula:

$$MY = FW - IW \quad (1)$$

where;

MY = Milk yield,

FW = Final weight and

IW = Initial weight.

Data was collected for four (4) weeks on each lamb.

Laboratory Analysis

Proximate and fibre analysis was done for the hydroponic maize fodder to determine Nitrogen (N) for crude protein determination (N×6.25), Crude Fibre (CF), Ether Extract (EE), Nitrogen Free Extract (NFE) and ash. Organic matter was calculated as the difference between DM and ash AOAC (2005). Neutral Detergent Fibre (NDF) and Acid detergent fibre (ADF) were analyzed according to Van Soest (1991). The nitrogen content of the urine was determined by the Kjeldahl method according to AOAC (2005) procedure.

Statistical Analysis

Data collected was subjected to Analysis of Variance (ANOVA) and RCD model was used in SAS (2003) package. The model used was:

$$Yij = U + Ti + Eijk \quad (2)$$

RESULTS AND DISCUSSION

Awareness of Hydroponic Fodder Production

The survey (Table 1.) revealed a high level of awareness of hydroponic maize fodder among the respondents. Most of them (85%) reported practicing crop–livestock farming, indicating that a large proportion of the respondents were directly involved in livestock production. Awareness of hydroponic fodder production was very high (95%), showing that the technology is well-known among the elite class in the Faculty of Agriculture. However, only 55% of respondents reported knowing how to grow hydroponic fodder for their animals, suggesting a knowledge gap in the practical aspect of production.

Table 1: Awareness of the Hydroponic Technology among the Elite class in Faculty of Agriculture, Bayero University Kano

Questions	Aware (%)	Not aware (%)
Do you practice crop-livestock farming?	85	15
Are you aware of hydroponic fodder production?	95	5
Do you know how to grow hydroponic fodder for your animals?	55	45

Chemical Composition of Hydroponic Maize Fodder and the Recommended Requirements for Lactating Sheep

Chemical composition (Table 2.) of the hydroponic maize fodder showed that its nutrient composition met or exceeded most of the recommended nutrient requirements for lactating sheep. The crude protein content (14.72%) fell within the recommended range of 13–16%, while the metabolizable energy (2593 kcal/kg) and total digestible nutrient (75.18%) levels were adequate to support milk production. However, calcium content (0.04%) was lower than the recommended range (0.2–0.5%), which may necessitate calcium supplementation in the diet.

Table 2: Chemical Composition of Hydroponic Maize Fodder and the Recommended Requirements for Lactating Sheep (%)

Parameters	HPMF Values	Recommended values
Dry matter	15.10	2.4 to 4.6% BW
Crude protein	14.72	13 to 16
Ether extract	2.65	-
Crude fibre	9.67	12
Ash	4.09	-
Nitrogen-free-extract	68.8	-
Neutral detergent fibre	51.09	33 to 38
Acid detergent fibre	18.08	
Calcium	0.04	0.2 to 0.5
Magnesium	0.96	0.18 to 0.4
Phosphorus	1.66	0.2 to 0.37
Total Digestible Nutrient	75.18	65 to 72
Metabolizable energy (kcal/kg)	2593	2400 to 3250

HPMF = Hydroponic Maize Fodder

Effect of Hydroponic Maize Fodder on Milk Yield

Feeding hydroponic maize fodder (Figure 1.) had a significant ($p<0.05$) positive effect on milk production. Milk yield increased progressively with the level of fodder inclusion. Compared with the control group (0% inclusion), ewes fed 10% hydroponic fodder produced 32% more milk, those fed 20% produced 40% more milk, and those fed 30% produced 50% more milk. This indicates a clear dose–response relationship where higher inclusion levels resulted in proportionally higher milk yields.

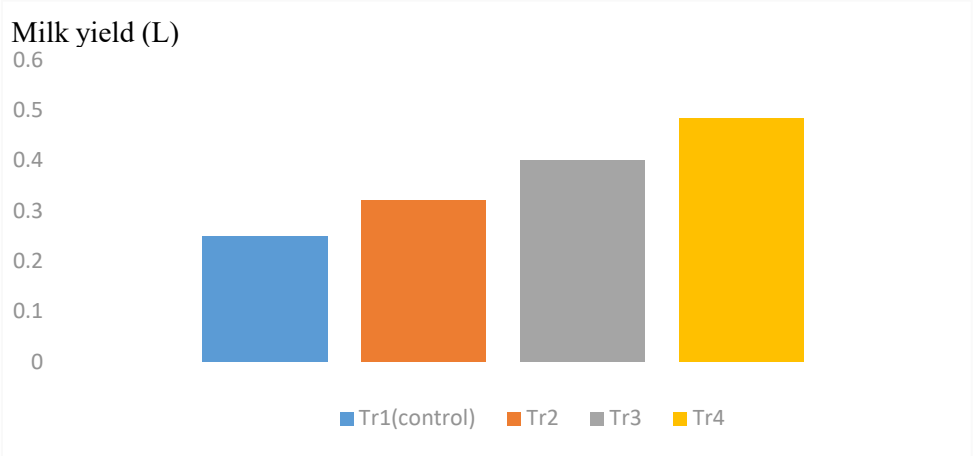

Figure 1: Effect of hydroponic maize fodder on milk yield of Yankasa sheep at Bayero University Farm, Kano

Discussion

The present study revealed a high level of awareness and partial adoption of hydroponic maize fodder technology among the elite class in the Faculty of Agriculture, Bayero University, Kano. A total of 85% of respondents practiced crop–livestock farming, which is higher than the 78% reported by Vyshavi *et al.* (2023), indicating that crop–livestock integration is more common in this study population. Furthermore, 95% were aware of hydroponic fodder production, suggesting that the concept is well-known within this academic community, although only 55% had the practical knowledge to grow it. This highlights the need for capacity-building programs to bridge the knowledge–practice gap and encourage wider adoption of the technology.

The proximate composition of the hydroponic maize fodder obtained in this study revealed a crude protein (CP) value of 14.72%, which is within the recommended range (13–16%) for lactating ewes and comparable to values reported by Kide *et al.,* (2015), Adebiyi *et al.,* (2018), and Bari *et al.,* (2020). Similar results have also been reported by Telgote *et al.,* (2022), confirming that hydroponic maize fodder is a good source of digestible protein. Although the CP values reported by Bhalerao *et al.,* (2019) and Salo (2019) were slightly higher (15.05–15.60%), the differences may be attributed to variations in seed type, growing conditions, and nutrient solution used. Conversely, the CP values reported by Naik *et al.,* (2014), Vijayakumar *et al.,* (2019), and Bhalerao *et al.,* (2022) (9.33–13.3%) were lower, possibly due to environmental and methodological differences.

The feeding trial clearly demonstrated that hydroponic maize fodder significantly improved milk yield in lactating ewes ($p<0.05$). Ewes supplemented with 10%, 20%, and 30% hydroponic maize fodder produced 32%, 40%, and 50% more milk, respectively, compared to the control group. The percentage differences are 21.8, 37.5, 48.34% between the control and treatments 2, 3, 4.These findings are consistent with Naik *et al*., (2014), who reported increased milk yield after feeding hydroponic barley (3.9%) and maize fodder (13.7%) and with Adjlane *et al*., (2016), who found that dairy cows supplemented with hydroponic barley produced 19% more milk. The higher percentage increase observed in the present study may be due to the improved digestibility and high nutrient density of the hydroponic maize fodder used, as well as the genetic potential of the Yankasa ewes employed in the trial.

CONCLUSION

This study demonstrated that awareness of hydroponic maize fodder production among elites, particularly within the Faculty of Agriculture at Bayero University Kano, is remarkably high, with the majority also practicing crop-livestock farming. The results showed that hydroponically grown maize fodder is nutritionally adequate for lactating ewes, meeting recommended protein and energy requirements. Supplementation with hydroponic maize fodder significantly improved milk yield, with the highest inclusion level (30%) increasing production by nearly 48% compared to the control group. These findings confirm that integrating hydroponic fodder into ewe diets is a practical and effective strategy to enhance milk production, optimize nutrient intake, and support small ruminant productivity. Adoption of this technology could play an important role in improving livestock performance and addressing feed scarcity challenges in semi-arid regions.

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