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# Growth Performance of Feeding Hydroponic Maize Fodder to Weaner Rabbit

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## Abstract

This study was conducted to investigate proximate composition of hydroponic maize fodder (HMF) and the growth performance of weaner rabbits by replacing the concentrate mixture with HMF at 0, 25, 50, 75 and 100 % level in their diet. Forty (40) weaner rabbits were used; the experiment lasted for six (6) weeks. The experiment had five (5) treatments and four (4) replications with two (2) weaner rabbits per replication in a Completely Randomized Design (CRD). Data collected were subjected to analysis of variance with the aid of SPSS package. Result of the proximate composition of HMF showed that dry matter, crude protein, ether extract, crude fibre, ash and NFE had 28.31, 8.75, 4.52, 14.14, 5.23 and 67.36% respectively. Production parameters such as, daily weight gain, daily feed intake/head/42 day (g) (DM basis), feed conversion ratio were studied. T1, T2, and T3 significantly ($p < 0.05$) improved the final weight of the weaner rabbits (1052.50, 988.33, and 965.00g) respectively, T1 and T2 were significantly ($p < 0.05$) higher in daily weight gain (9.86 and 9.24g), daily feed intake on DM basis significantly decreases down the treatment. It was concluded that HMF can be incorporated up to 50% in the basal diet of rabbits.

**Keywords:** Rabbit, Feed Intake, Weight Gain, Maize, Hydroponic Fodder.

## Introduction

Feeding livestock according to their requirement and avoiding wastage is very important in exploiting the production potential for economic growth and sustainability since feed costs are the dominant cost and accounts for more than 70% of the cost of production. Therefore, new technology for production of forages i.e., hydroponics fodder production system is now a hope for sustainable livestock production. Hydroponic fodder is a viable way to ensure the long-term availability of high-quality fodder for livestock. Hydroponics have been produced from several cereal crops such as barley (Naik *et al.*, 2015), oats, wheat (Snow *et al.*, 2008); sorghum, alfalfa, cowpea (AI-Karaki and AI-Hashimi 2012) and maize (Naik *et al.*, 2011; Naik *et al.*, 2012). The fodder can be produced in a short duration (6-10 days) and all year around. The hydroponics fodder present various benefits for animal health. It is rich in protein, vitamins, fiber, and minerals (Girma and Gebremariam 2018). Feeding hydroponically produced fodder enhance the digestibility of the ration's nutrients

(Hassen and Dawid 2022). Hydroponic fodder production is an economic solution particularly where the conventional production of green fodder is limited or unavailable. This technology put forward a solution to address the shortage of forage production caused by the scarcity of green feed in dry seasons and urban areas (Ndaru *et al.*, 2020). It is one of the important agricultural techniques used nowadays in different countries.

The rabbit production is adaptable to wide range of production systems from backyard to commercial multi-tier cage rearing systems. Rabbit production would boost the income of the farmer and could improve human nutrition. Rabbit production with appropriate technologies can play an important role in scaling up the production traits and thereby economic benefits to the farmers. Quality green fodder is an important input for rabbit production. It is inevitable to produce green fodder by alternative method for feeding livestock including rabbits.

This study aims to investigate the proximate composition of hydroponic maize fodder (HMF) and the growth performance of weaner rabbits by replacing the concentrate mixture thereby addressing critical gaps in knowledge and contributing to sustainable livestock production. Through innovative approaches, the study aims to provide cost-effective and resource-efficient feeding strategies to support rabbit farming and meet the growing demand for animal protein.

## Materials and Methods

### Experimental site

The experiment was conducted at the Rabbit Unit of the Teaching and Research Farm of Abubakar Tafawa Balewa University, Bauchi. Bauchi State is located between latitudes $9^{O}$ $30^{1}$ and $12^{O}$ $30^{1}$ N and longitudes $8^{O}$ $50^{1}$ and $11^{O}$ $00^{1}$ E of the Greenwich meridian with total land of 49,259.01 square kilometres. The State records annual rainfall of around 1300mm in the Sudan savannah zone and 700mm in the Sahel savannah.

### Establishment of hydroponic system

The hydroponic system composed of wooden frame and shelves with the rectangular shaped aluminum trays put on the shelved wooden frames. In addition, each shelf of the system unit carried 4 planting trays. Aluminum trays with a length of 3m, a width of 2m, and a depth of 3cm were used for growing seeds to produce green fodder. These trays were obtained from the local aluminum artisan.

### Sourcing of plant materials for the experiment

Maize grains were purchased from Muda Lawal Market in Bauchi Metropolis.

### Treatment of Seeds and Planting

Maize seeds were cleaned of debris and other foreign materials. The cleaned seeds were washed well. The seeds were soaked in tap water for 20 hours. Later water was drained, and the seeds were kept in gunny bags for 24 hours for germination as described by Jemimah *et*

*al.* (2018). After germination, seeds were placed onto different trays. The seeds were irrigated manually twice daily (early in the morning and late in the afternoon) with enough tap water to keep the seeds/ seedlings moist. The maize seeds were grown under hydroponic system and used as experimental materials during the study. The maize plants were allowed to sprout for 8 days, after which the fodder was harvested, weighed and then fed to rabbits.

**Experimental Diets, Animals and Management**

Forty (40) weaner rabbits were used for the experiment which lasted for six (6) weeks. The weaner rabbits were subjected to one-week acclimation whereby they were treated against internal and external parasites by subcutaneous injection of Ivermectin and broad-spectrum antibiotic. The experiment had five (5) treatments and four (4) replications with two (2) weaner rabbits per replication arranged in a Completely Randomized Design (CRD). The rabbits were placed on concentrate feed (grower's mash and groundnut haulms mixed together) for one week before assigning them to the experimental diets. Feed and water were provided *ad libitum*. Subsequently feed offered and left over was weighed and recorded on a daily basis.

**Table 1: Composition of concentrate**

| Ingredient | Inclusion |
|---|---|
| Maize | 36.50 |
| Soybean meal | 10.80 |
| Wheat offal | 30.00 |
| Bone meal | 2.00 |
| Groundnut haulms | 20.00 |
| Premix | 0.25 |
| Salt | 0.25 |
| Lysine | 0.10 |
| Methionine | 0.10 |
| **TOTAL** | **100** |
| **Calculated analysis** | |
| Crude Protein (%) | 16.00 |
| Crude Fibre (%) | 9.46 |
| Ether Extract (%) | 3.49 |
| Ash (%) | 4.39 |
| ME (Kcal/kg) | 2209.95 |

**Feeding trail**

Maize hydroponic fodder replaced the concentrate ratio to weight diets of weaner rabbits. The trial had five treatment groups namely, treatment 1 (100% Concentrate mixture), treatment 2 (75% concentrate + 25% maize hydroponic fodder), treatment 3 (50%

concentrate + 50% maize hydroponic fodder), treatment 4 (25% concentrate + 75% maize hydroponic fodder) and treatment 5 (100% maize hydroponic fodder).

**Table 2: Feeding schedule of maize hydroponic fodder**

| Type of fed | T1 Control | T2 25% Replacement of concentrate | T3 50% Replacement of concentrate | T4 75% Replacement of concentrate | T5 100% Replacement of concentrate |
|---|---|---|---|---|---|
| Concentrate | 125.00g | 31.25.00g | 62.50g | 93.75g | 0 |
| Maize hydroponic fodder | 0 | 93.75g | 62.50g | 31.25g | 125.00g |

**Proximate analysis**

The Proximate composition of hydroponic cereals fodder will be determined using AOAC (2012) procedure (dry matter, crude protein, crude fibre, ether extract and nitrogen free extract).

**Data collection**

The following data was collected for each experiment:

**Performance parameters**

**Feed intake**

A known weight of feed for each replicate was given and recorded daily. The left over after each day's meal, was kept separately, measured and recorded for each replicate on a daily basis. Feed consumption for each day was obtained from the differences between the feed given per day and the left over.

$$\text{Total feed intake (g)} = \text{total feed given (g)} - \text{total feed left over (g)}$$

$$\text{Average daily feed intake (g)} = \frac{\text{Total feed intake (g)}}{\text{Total number of days of the experiment}}$$

**Body weight gain**

Rabbits in each replicate were weighed at the start of experiment and then weighed at the end of each week for 6 weeks of the experiment. Body weight gain was calculated from the difference between the body weight for the given week and that of the previous week. Final weight was taken and recorded at the end of the experiment.

$$\text{Total body weight gain (g)} = \text{Final body weight (g)} - \text{Initial body weight (g)}$$

$$\text{Daily body weight gain (g)} = \frac{\text{Final body weight (g)} - \text{Initial body weight (g)}}{\text{Total number of days of the experiment}}$$

**Feed conversion ratio**

This was calculated as feed intake per body weight gain.

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total feed consumed (g)}}{\text{Total body weight gain (g)}}$$

**Data analysis**

Data collected was subjected to analysis of variance in completely randomised design using SPSS package, differences between means was separated using Duncan's Multiple Range Test.

## Result and Discussion

**Proximate composition of hydroponic maize fodder**

Proximate composition of hydroponics maize fodder (HMF) used in this experiment is shown in Table 3. The dry matter (DM) content of HMF was 28.31%, low % DM of HMF is caused by the high water uptake, which increased the metabolic activity of dormant seeds and resulted in total dry weight (starch) loss throughout hydroponic fodder's germination cycles (Naik *et al.*, 2014). Adebiyi *et al.* (2018) and Thadchanamoorthy *et al.* (2012) with HMF of 25.00 and 26.07% DM respectively observed similar result. The crude protein content observed in HMF was 8.75% similar as compared to 8.7-10% 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). In this research, ether extract of HMF was 4.52%, which was slightly higher than the result obtained by Naik *et al.* (2013) which ranged from 3.27-3.49% but was lower than the observed value (6.42%) by Thadchanamoorthy (2012), and Jemimah *et al.* (2018) reported similar result (4.62%). Nitrogen free extract value (67.36%) was similar to the Singh (2011) who observed the ranged from 66.7-75.3%. The crude fibre content (14.14%) was however comparable to the value (14.10%) obtained Naik *et al.* (2013). Cuddeford (1989) noted that the increase in the crude fibre of hydroponics maize fodder is due to the buildup of cellulose, varied proportions of hemicelluloses and lignin.

**Table 3: Proximate composition of hydroponic maize fodder**

| Parameter | |
|---|---|
| Dry matter | 28.31 |
| Crude protein | 8.75 |
| Ether extract | 4.52 |
| Crude fibre | 14.14 |
| Ash | 5.23 |
| Nitrogen free extract | 67.36 |

**Growth performance of weaner rabbits fed hydroponic maize fodder**

The growth performance of the studied was given in Table 4. The study revealed that the weaner rabbits fed on T1 and T2 diets recorded the highest final weight and daily weight gain ($P < 0.05$) compared to T3, T4 and T5. The final weight and daily weight gain particulars indicated that significant and highest final weight was recorded in T1 (1052 g) followed by T2 (988.33g), T3 (965.00g), T4 (943.33g) and T5 (926.67g). Significant and highest daily weight gain was observed in T1 (9.86g) followed by T2 (9.24g), T3 (7.84g), T4 (5.91g) and T5 (5.79g). Lowest weight gain was observed in 100 per cent feeding of hydroponic maize fodder in weaner rabbits. The results are in accordance with Rajkumar *et al.* (2016), Chakravarthi *et al.* (2020) and Mohsen *et al.* (2015) in their studies on rabbits. The results indicated that significantly higher daily feed intake was recorded T1 (109.82g) followed by T2 (87.51g), T3 (81.24), T4 (58.39) and T5 (29.84g). Due to high moisture content in hydroponic maize fodder, low dry matter intake was observed on 100% feeding of hydroponic maize fodder. Rajkumar *et al.* (2016) and Chakravarthi *et al.* (2020) who stated that lower dry matter intake was observed on feeding of hydroponic maize fodder in rabbits reported similar result. Besides, helping in the elimination of the anti-nutritional factors such as phytic acid of the grains, hydroponics fodders are good source of chlorophyll and contain a grass juice factor that improves the performance of the livestock (Sneath and Mclntosh 2003; Shipard 2005).

**Table 4: Performance of weaner rabbits fed maize hydroponic fodder**

| Diets | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **1(0%)** | **2(25%)** | **3(50%)** | **4(75%)** | **5(100%)** | **SEM** |
| Initial weight (g) | 638.33 | 600.33 | 635.67 | 695.00 | 683.50 | 42.32 |
| Final weight (g) | $1052.50^{a}$ | $988.33^{ab}$ | $965.00^{ab}$ | $943.33^{b}$ | $926.67^{b}$ | 42.42 |
| Daily feed intake (%) | $109.82^{a}$ | $87.51^{b}$ | $81.24^{c}$ | $58.39^{d}$ | $29.84^{e}$ | 2.69 |
| Daily weight gain (g) | $9.86^{a}$ | $9.24^{ab}$ | $7.84^{b}$ | $5.91^{c}$ | $5.79^{c}$ | 0.63 |
| Feed conversion ratio | $11.17^{a}$ | $9.57^{a}$ | $10.42^{a}$ | $9.98^{a}$ | $5.25^{b}$ | 0.83 |

$^{abcde}$ - Means bearing different superscripts within a row are significantly different ($p<0.05$)

SEM - Standard error of means

## Conclusion and Recommendation

From the experiment, it was observed that supplementation of 100 per cent hydroponic maize fodder decreased the dry matter intake and body weight gain in weaner rabbits when compared with hydroponic maize incorporated with concentrate diets. Hence, keeping in view of the body weights and weight gain it can be concluded that hydroponic maize fodder can be incorporated up to 50% in the concentrate diet of rabbits.

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