ESTABLISHMENT AND PRODUCTION OF TREATED AND UNTREATED HYDROPONICS MAIZE FODDER USING LOW COST GREENHOUSE TYPE CULTIVATION UNIT

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ABSTRACT

A study was conducted to assess treated and untreated hydroponic maize fodder. Clean water was measured using total dissolve solid and pocket pH meter. Four kilogram of maize grain seeds were weighed using weighing scale, submerged in water for a period of 4-8 hours. After 8 hours, the water was drained and collected to measure the total dissolved solid using TDS meter and pH. The wet seeds were transferred directly in to a clean dry fumigated jute bag for a period of 24 hours (incubation). The bag was kept away from direct sunlight to avoid sun drying of the seeds, a quantity of 2 to 3 liters of clean water was sprinkled after every 2 to 3 hours. From day 5 to 9 N.P.K. liquid fertilizer was applied to improve the protein content of the foliage. A whole plant was harvested on the 9th day after planting. Treated and untreated hydroponic maize fodder; samples of the green fodder were taken on day 9th; nutrients composition was determined. The quantity of hydroponic maize fodder and biomass production was recorded daily by weighing the seeds before planting and after harvest. Parameters measured includes; plant height (cm), leaves length (cm), stems height (cm), root length (cm) and biomass yield (kg/d/tray) on day 9th. One of the agro-technology which could be developed locally with low cost materials and is more nutritious, palatable and digestible fodder for livestock is hydroponics. The technology is less competitive than traditional fodder production on per kg dry matter basis. Hydroponic is an alternative technology against scarcity of land and impeding climate changes in different agro-climatic regions in Nigeria.

Keywords: Hydroponic Maize fodder, Calcium nitrate ($CaNO_3$), N.P.K. mineral solution

INTRODUCTION

Livestock production represents approximately ten percent of agricultural activity and less than five percent of the gross domestic product in Nigeria as reported by (1). The low cost greenhouses or shade net structures can be prepared from thatch, wood, mosquito net. The cost of the shade net structures depends upon the type of fabricating material but is significantly lower than the hi-tech greenhouses. Thatch can use on side wall of the house which reduces the cost of fabrication. This production rate of livestock needs to be increased due to the high geometric progression of present human population and quest for animal protein consumption by humans in Nigeria. (2) Reported that green fodder is the natural diet for livestock and Its production will meet the current demand among livestock farmers. Livestock production in the tropics suffers major setback due to inadequate quantity and quality of feeds for the animals especially during dry season. The major problem facing small ruminant animal producer is how to feed the animals adequately all year round using new technology as revealed by (3).

Justification of the study

With the very limited land allocation (about 5% of the gross cropped area) for fodder cultivation, water scarcity and frequent drought make it very difficult for the production of sufficient fodder to meet the requirement of the huge livestock population is a big challenge, in this situation hydroponic technology is emerging as an alternative to grow fodder for farm animals, hydroponics fodder can be grown in low cost green house with locally available or home grown grain. Production of hydroponic fodder in low cost greenhouses is an effective solution for fodder scarcity and is a very promising technology for sustainable livestock production in Nigeria

Objectives of the study

To supply quick digestible nutrients to the animals with required energy and minerals.

MATERIALS AND METHODS

Research was conducted at Duware Street within Yola South Metropolis Adamawa State to produce fodder (H.M.F) using modern techniques.

Materials and equipment used for the construction of hydroponic unit (house) were; 2 by 3 hard woods, Batting (wood), Nails (1 inch, 1 ½ inch), Thatch (Zanah), Ultra-violent resistant polythene (plastic), mosquito net, sand, Cement (to floor the Hydroponics house) (4). Hydroponic chamber was established or frame with wood 2 by 3 and cover with translucent material which allowed partial-controlled environment for a better fodder growth/germination like mosquito net as described by (5). Thatch was applied to prevent direct sunlight which slightly increased the humidity within the hydroponic house ranged between 40 to 80% as described by (6).

White maize (*Zea mays L*) seeds were procured from Local Market of Ngurore Yola South of Adamawa State. The grains were subjected to seed selection and treatment to check their viability before use as described by (7). Seeds were sun dried a day prior to seeds washing; broken seeds and foreign materials were removed and kept in a dry and safe place (8). 4kg was washed properly with 10 liters of water, the seeds settled down after 5 minutes. The water was then drained completely and the process was repeated till broken and dead seeds were removed completely as described by (9).The seed were treated by diluting 20% (15ml) of sodium hypochlorite solution (house hold bleach) in 4 liters of clean water, which provided the concentration needed for sanitizing the seeds as revealed by (10).The seed were washed thoroughly after treatments for 30 minutes using 4 liters of clean water to remove the residue concentrated of hypochlorite solution. Planting trays were washed with diluted hypochlorite solution and disinfected before and after harvest as reported by (11). Seed were submerged completely in clean water of 4 to 5 litres using 10 liters calibrated rubber bucket; for a period of 4-8 hours. After 8 hours, the water was drained and collected to measure the total dissolved solid using (TDS) meter and pH as reported by (12). The seeds were transferred directly inside clean dry fumigated jute bag for a period of 24 hours (incubation), during incubation period, the jute bags were kept away from direct sunlight to avoid sun drying of the seeds, a quantity of 2 to 3 liters of clean water were sprinkled after every 2 to 3 hours. After 24 hours of incubation period, the seed was transferred immediately to clean perforated improvised aluminum trays of 3cm/tray high for proper sprouting / germination of hydroponic. Solution form of solid calcium nitrates was prepared by adding 100g of $Ca(NO_3)_2$ in 1 liter of water and the substance were dissolved for 2 minutes by stirring the solution. 1 to 3ml of $Ca(NO_3)_2$ liquid was collected and added to in 2 liters of water at graded levels and was applied 2 times using knapsack sprayer to growing biomass hydroponic maize fodder. T_1= (Unthread hydroponic maize fodder), T_2= (Treated hydroponic maize fodder), T_3 = (Treated hydroponic maize fodder) and T_4 (Treated hydroponic maize fodder). Procedure: T_1 = no application of fertilizer (control), T_2 = 1ml of liquid $Ca(NO_3)_2$ were collected and added in 2 liters of water plus 0.6ml N.P.K, T_3 = 2ml of liquid $Ca(NO_3)_2$ were collected and added in 2 liters of water plus 0.4ml N.P.K and T_4 = 3ml of liquid $Ca(NO_3)_2$ were collected and added in 2 liters of water plus 0.2ml N.P.K.

The equipment and materials used were; rubber tray, clean water from the tap, calibrated bucket (10 liters), Knapsack sprayer for irrigation of water, commercial liquid fertilizer (N.P.K) and solid calcium nitrates $Ca(N0_3)_2$. After the sprouted seeds was planted, only fresh water was sprayed for the first treatment and second to 4th days while liquid solution of N.P.K and calcium nitrates $Ca(NO_3)_2$ was sprayed on day 5th with T_2 0.6ml of N.P.K +1ml of Ca $(NO_3)_2$, T_3 0.4ml of N.P.K + 2ml Ca $(NO_3)_2$ and T_4 0.2ml of N.P.K+ 3ml $Ca(NO_3)_2$ and this solution were withdrawn on day 8th prior to harvest on day 9th using knapsack sprayer to spread evenly on each surface of sprouted maize, and it was kept moist, not dried or flooded as reported by (13).

Table1: Chemical Composition of Treated and Untreated hydroponic maize seeds

Chemical Composition (%)	Dry Maize Seed	T_1 Un- treated H.M.F	T_2 Treated H.M.F	T_3 Treated H.M.F	T_4 Treated H.M.F
Moisture	4.93	81.80	81.60	81.44	81.27
Dry matter	95.07	18.20	18.40	18.56	18.73
Crude protein	8.56	13.32	13.66	13.73	14.53
Crude fiber	6.65	12.93	13.02	13.01	13.12
Ether Extracts	2.86	3.22	3.27	3.29	3.37
Nitrogen free Extracts	78.76	66.96	65.77	64.95	63.43
Total Ash	3.17	3.57	4.28	5.02	5.55
Neutral detergent fibre	18.73	35.02	35.21	35.77	36.13
Acid detergent fibre	9.09	16.63	16.81	16.99	17.08
ME (Kcal/kg)	3344.36	3130.74	3105.125	3080.225	3062.345

*Metabolisable Energy (ME) = 37 x % CP + 81.0 x % EE + 35.5 x % NFE, (22). Key: H.M.F = Hydroponic c Maize Fodder,

The following parameters were determined; plant height (cm), leaves length (cm), stems height (cm), root length (cm) and biomass yield (kg/d/tray) on day 9th as described by (14). (15) Methods as reported by (16) were used to determined Acid Detergent Fiber (ADF) and Neutral Detergent Fibre (NDF).

Table 2: Herbage Yield of Untreated and Treated Hydroponic Maize Fodder

Parameters	T_1 Un-treated H.M.F	T_2 Treated H.M.F	T_3 Treated H.M.F	T_4 Treated H.M.F	SME
Leave Length (cm)	21.57^{c}	21.80^{b}	22.80^{a}	22.85^{ab}	0.02*
Stem Height (cm)	8.65^{d}	8.93^{c}	8.96^{b}	9.84^{a}	0.02*
Root Length (cm)	12.98^{c}	13.78^{b}	13.94^{b}	13.98^{a}	0.02*
Biomass Yield (kg)	5.81^{a}	6.20^{a}	6.64^{a}	6.92^{a}	0.02^{ns}
Plant Height (cm)	30.22^{d}	30.73^{c}	31.77^{b}	31.69^{a}	0.02*

Means with different superscripts in the same row differ significantly.

DISCUSSION:

Table 1 showed the dry matter content (18.20 and 18.73%) tallies with the results reported by (17) (18.30%). The crude protein, crude fibre, ether extracts, total ash and Nitrogen free extracts values (13.32%) CP, (12.93%) CF, (3.22%) EE and (66.96%) NFE agreed with the results (13.32%) CP, (6.37%) CF, (1.75%) EE and (75.32%) NFE reported by (18). Table 2 showed Biomass yield were significantly (P>0.05) different among the treatment for the 9th days period. The results were lower than (7.5kg) per 1 kg reported by (19) who produced hydroponic fodder using barley seeds. The result of stem height in the current study were significance (P<0.05) different among the treatment means. The values (8.65 to 9.84 cm) were higher than the figure (8.42 to 9.04 cm) as reported by (20). The value for that the leave length were significantly (P<0.05) different among the treatment means. The results (21.57 to 21.85cm) of this study agreed with the findings of (21). The results for the root length ranged from (12.98 to (13.98cm) showed significant (P<0.05) difference among the treatment means.

CONCLUSION:

The used of calcium nitrate ($CaNO_3$) Nitrogen (N), Phosphorus (P) and Potassium (K) fertilizer help to improve the protein contents in the seed and prevent the presence of yellowish color on tips of the leaves between 5 to 7 days' growth period. However, the use of fertilizer give strength to the plant because they were not expose to light and the fodder maintain the greenish color (Carotene) content as reported by.

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