GROWTH PATTERN OF HYDROPONIC FODDER PRODUCED FROM SORGHUM SEEDS AS INFLUENCED BY SPROUTING MEDIA

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ABSTRACT
This study determined the effect of sprouting media on the growth pattern of hydroponic fodder produced from Sorghum (Sorghum bicolor) seeds. Two hundred and fifty grammes (250 g) of sorghum seeds were grown for 7 days in two media; borehole water (SW) and banana pseudo-stem/borehole water (SBW), respectively. Leaf height of the sorghum seed fodder was recorded daily for seven days. The completely randomised design was employed in this study. Data obtained from the study were subjected to student's t-test. Results obtained indicated that the fodder height were similar (p>0.05) among the growth media within the growth period except day 5 (8.93 cm versus 7.23cm) and 7 (16.63 versus 12.40 cm). The average daily fodder growth rate (height) was, significantly higher in the SBW (2.37 cm) than SW (1.76 cm) The percentage daily increase in fodder height (growth rate) were however, similar (p>0.05) across media (14.18% versus 14.26%). Banana pseudo-stem meal is recommended as a medium for hydroponic production of fodder from sorghum seeds.
Keywords: Growth patterns, hydroponic fodder, sorghum seeds, sprouting media

INTRODUCTION

The availability of quality fodder is a major challenge that is facing the ruminant production industry in the African continent, especially under the traditional pastoral production system (Kubkomawa, 2016). Pastoralists exploit several types of fodder in ruminant feeding particularly, grasses and leguminous species. However, due to seasonal availability and low quality of fodder, optimal maintenance and productivity of the animals are not achieved (Lamidi and Ologbose, 2014). The production of quality fodder is therefore critical to the sustenance of the ruminant industry and supply of animal products and proteins to the populace. Innovative approaches such as hydroponic fodder production which is the technique of growing plants without soil is being used as an alternative to natural production of fodder for farm animals (Sneath and Mclntosh, 2013).

Maize, barley, oats, sorghum, rye, alfalfa, and triticale seeds have been used to produce hydroponic fodder (Singh, 2020). In addition to increased biomass yield, desirable nutritional changes occur during sprouting, due to the breakdown of the complex compounds in the seed into more simple forms, transformation into essential constituents and breakdown of nutritionally undesirable constituents (Devi *et al.*, 2015). The quality of the sprouting media is therefore critical to ensuring successful hydroponic fodder production (Bakshi *et al.,* 2017). There are however, several locally available materials in addition to the popular aqua media of various kinds which could potentially serve as growth media with possible high nutrient impact which have not been investigated. For example, the banana pseudo-stem, which consists of an aggregation of leaf stalk bases in cylindrical form constitutes a major waste from banana production. It has been shown to be a good medium and fertilizers for plant growth when properly processed (Subagyo and Chafide, 2018).

The objective of the study was to compare borehole water (SW) and banana pseudo stem with borehole water (SBW) as media for hydroponic fodder growth pattern of sorghum *(Sorghum bicolor)* grains.

MATERIALS AND METHODS

Study location: The study was conducted in the Laboratories of the Department of Animal Science and Technology and the Livestock Unit of the Teaching and Research Farm, Federal University of Technology Owerri (FUTO), Nigeria between January, and February 2023.

Hydroponic seeds: The sorghum (*Sorghum bicolor*) grains were purchased from retailers who obtained them from northern Nigeria. The grains were sorted to remove impurities such as chaffs, stones, and foreign grains.

Experimental sprouting media: The media used were borehole water and banana pseudo-stem meal. Borehole water was collected from a borehole at the FUTO Farm. Water from such a borehole has been analysed (Okoli *et al*., 2005) and found to be potable, slightly acidic with normal total dissolved solids and total suspended solids, although the total coliform and total viable bacteria counts were high. Banana pseudo-stem meal (BPM) was obtained from partially decayed mature banana trunk or pseudo-stem from a fruited banana tree harvested about two months earlier and left in the field under hot humid tropical conditions. The pseudo stem was chopped into small pieces, sundried for 4 – 5 days and thereafter milled into coarse powder with a motorised grinder to form BPM.

Experiment Design: The set-up of the sorghum grain sprouting experiment is shown in table 1. From the sorted seeds, 1.75kg was weighed out with a digital weighing balance (Model ISF-400). From these, 250g was measured out and kept in plastic cups as control (raw seeds). The remaining 1.5kg was transferred to a plastic bucket and soaked with clean borehole water for 4 hours to prime or activate them (DFID, 2020). Thereafter, the water was drained, and the seeds were divided into 6 equal parts representing 250 g of raw dry seeds in triplicates as shown in table 1. They were transferred directly to plastic trays of known weight, measuring 12x 16 inches and depth of 1 inch (FW) and to similar trays containing 250 g of BPM (FBW) as sprouting medium in a completely randomised design (CRD) experiment as shown in table 1. The trays were perforated at one end to allow for draining of excess water. The seeds were spread evenly on the plastic trays with one end left uncovered to allow excess water to drain through the perforation on the end of the tray.

The treatments were set-up on an improvised sprouting rack in ventilated, naturally lit room and irrigated twice daily at 8 am and 4 pm by gentle sprinkling with known volume of borehole water to avoid floating of the seeds. The experiment lasted seven days. Upon sprouting, the daily foliage height was measured in centimetre at 3 spots per tray with the aid of a thread and ruler.

Statistical Analysis of Data: Data generated were analysed using the students t- test using SPSS version 20 (SPSS, 2010).

Table 1: Experimental seed sprouting layout

Seeds	Sprouting Media	
	Bore hole water	Banana pseudo stem meal/Water
Sorghum	SW1	SBW1
	SW2	SBW2
	SW3	SBW3

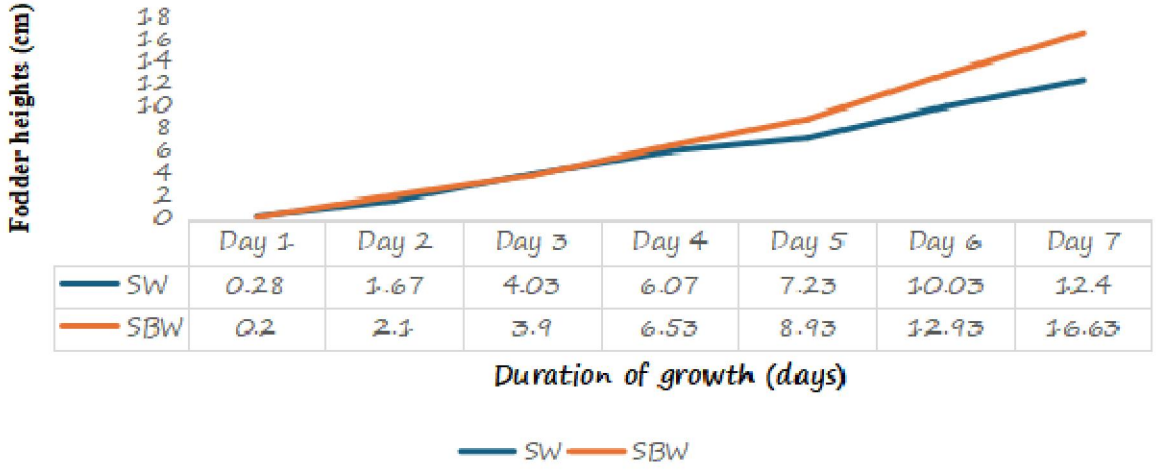
SW = Sorghum sprouting in borehole water
SBW = Sorghum sprouting in banana pseudo-stem +borehole water

RESULTS AND DISCUSSION

The fodder heights of sprouted sorghum were similar ($p>0.05$) between the sorghum fodder grown with the two media throughout the growth period except on days 5 and 7 (Figure 1).

The daily fodder heights of sprouted sorghum were generally higher in SBW medium than SW medium resulting in significantly higher ($p<0.05$) total fodder height (16.63 cm vs 12.40 cm) (Table 2). The SW fodder height was within the height range of 12.33 to 15.67 cm reported by Chana *et al.* (2021) for different sorghum cultivars grown for 8 days. Murthy *et al*. (2017) however, reported a height of 10.80 cm for the 5th day of hydroponic sorghum fodder under low-cost greenhouse production system.

Figure 1: Daily growth pattern of hydroponic fodder from sorghum seeds



The percentage daily increase in foliage length (growth rate) were similar ($p<0.05$) for both media (14.18% versus 14.26%), though numerically higher in SBW medium (Table 1). It has been reported that changes in water, light, nutrients, and temperature affects growth of plants especially under hydroponic production system (Gent, 2017), the nutrient density in BPM therefore, might have resulted in the higher daily rate of foliage increase recorded daily (ECOgardener, 2018).

Table 2: Hydroponic fodder yield characteristics of sorghum seeds from different media

Parameters	Sprouting Media		p-value
	Bore hole water (SW)	Banana pseudo-stem medium + Water (SBW)	
Initial dry weight of seeds (g)	250.00	250.00	1.00
Initial weight of seeds + media (g)	340.33[a]	587.33[b]	0.001
Total fodder height of spouted seeds (cm)	12.40[a]	16.63[b]	0.02
Daily fodder height of spouted seeds (cm)	1.76[a]	2.37[b]	0.02
Percentage daily increase in fodder height (%)	14.18	14.26	0.28

[ab] Means within a row with different superscripts are significantly different ($p<0.05$)

CONCLUSION AND RECOMMENDATION

This study showed that growth medium has significant impact on the growth patterns of fodder produced hydroponically from sorghum seeds. Banana pseudo-stem meal used as a growth medium in this study was shown to significantly and positively enhance the fodder height of hydroponic fodders produced from sorghum seeds. There is therefore a great potential for hydroponic fodder production using sorghum seeds with banana pseudo-stem meal in water as part of the medium.

Banana pseudo-stem meal is recommended as a medium for hydroponic production of fodder from sorghum seeds. Hydroponic technology is recommended for intensive production of fodder from readily available local seeds, particularly sorghum to overcome problem of forage scarcity and pastoral conflicts in Nigeria.

REFERENCES

Bakshi, M. P. S., Wadhwa, M. and Makkar, H., P. S. 2017. Hydroponic fodder production: A critical assessment. Broadening Horizons No. 48, December 2017, Feedipedia www.feedipedia.org.

Chana, Z. M., Abubakar, M., Kalla, D. J. U. & Bello, K. M. (2021a). Effect of cultivator and harvesting time on growth components and chemical composition of hydroponic sorghum fodder.

Nigerian Journal of Animal Science and Technology, 4(4), 35 - 45Devi, C. B., Kushwaha, A. and Kumar, A. 2015. Sprouting characteristics and associated changes in nutritional composition of cowpea (*Vigna unguiculata*). *Journal of Food Science and Technology* 52 (10), 6821 - 6827.

ECOgardener (2018). 4 factors that affect plant growth. Retrieved on Monday June 4, 2023. 4 Factors That Affect Plant Growth and How To Deal With Them – ECOgardener

DFID 2020. Soaking seeds (seed priming) to improve crop yields. Technologies and practices for small agricultural procedure. Food and Agricultural Organisation, Rome. https://www.fao.org/teca/en/technologies/6649.

Gent, M. P. (2017). Factors affecting relative growth rate of lettuce and spinach in hydroponics in a green house. *HortScience Hort.,* 52(12), 1742 – 1747

Kubkomawa, I. H. 2016. Studies on the characteristics of pastoral cattle production in

Adamawa state, guinea Savanna zone of Nigeria. PhD Thesis, Federal University of Technology, Owerri, Imo state, Nigeria Pp. 2-5.

Lamidi, A. A. and Ologbose, F. I. 2014. Dry season feeds and feeding: A threat to sustainable ruminant animal production in Nigeria. *Journal of Agriculture and Social Research*, 14 (1), 17 – 30.

Murthy, A. K., Dhanalakshmi, G. & Chakravarthy, K. (2017). Study on performance of different fodder crops under low-cost greenhouse hydroponic fodder production System. *International Journal of Environment, Agriculture and Biotechnology*, 2 (2), http://dx.doi.org/10.22161/ijeab/2.2.50.

Okoli, C. G., Njoku, I. V., Ac-Chukwuocha, N. and Njoku, P. C. 2005. Quality characteristics of groundwater utilised by resident students of a Nigerian University. *Journal of Applied Sciences,* 5(6), 1088 - 1091.

Subagyo, A. and Chafide, A. 2018. Banana pseudo-stem fibre: Preparation, characterisation, and application. IntechOpen. DOI: https://dx.doi.org/10.5772/intechopen.82204.

Singh, R. 2020. Step by step procedure for hydroponic fodder production. https://www.pashudhanpraharee.com/step-by-step-procedure-for-hydroponic-fodder-production/.

Sneath, R. and McIntosh, T. 2003. Review of hydroponic fodder production for beef cattle. Project Report NBP 332. Oct. 2003. Meat and Livestock, Queensland Government Department of Primary Industries, Dalby Queensland, Australia. Pp. 1 – 55.

SPSS 2010. Statistical Package for Social Sciences. Version 20, Armonk, NY: IBM Corporation.