DOI: https://doi.org/10.57233/ihcfs.008

ISBN: 978-978-68-07775

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IHCFS – 2025 WEBSITE: fos.fugusau.edu.ng

1ST INTERNATIONAL HYBRID CONFERENCE OF FACULTY OF SCIENCE

(A PUBLICATION OF FACULTY OF SCIENCE, FEDERAL UNIVERSITY GUSAU, NIGERIA)

EFFECT OF PLANTING DEPTH AND SPACING ON THE YIELD OF TWO SWEET POTATO (*Ipomoea batatas* (L.) Lam.) VARIETIES

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ABSTRACT

Yield and quality of potato varieties has been attributed to variety and agronomic practices such as spacing and planting depth. The effect of planting depth and spacing was carried out on the yield of sweet potato (Ipomoea batatas (L.) Lam) under the agro-ecological conditions of Gusau, Zamfara State, Nigeria. Two varieties (White Skin and Purple Skin), were planted in four spacing intervals (20 cm, 40 cm, 60 cm, and 80 cm), and two planting depths (1 node and 2 node) using a randomized complete block design with three replications. Results showed that planting depth had no statistically significant effect on yield (p = 0.227). Plant spacing and variety had significant effects on yield 150gram (p = 0.005), with 40 cm spacing and the White Skin variety producing the highest mean yields. These findings suggest that optimizing planting depth may be adjusted based on convenience without major impact on yield, while spacing and selecting high-performing varieties can significantly enhance sweet potato productivity. The study provides practical recommendations to improve sweet potato production for smallholder farmers in similar environments.

Key words: Planting depth, Spacing, Sweet Potato, *Ipomoea batatas*

1.0 INRODUCTION

Sweet potato (*Ipomoea batatas*) is a dicotyledonous plant that belongs to the family Convolvulaceae. It is the world's most important versatile and underutilized food crop grown generally for its storage roots (Tortoe, 2010). In addition to its rich carbohydrate content, sweet potato is also a significant source of beta-carotene, calcium, and dietary fiber (Laurie *et al.,* 2012). Despite its potential, yield performance remains inconsistent due to suboptimal agricultural practices. Optimizing agronomic practices such as spacing, nutrient management, and variety selection has been emphasized in multiple studies to maximize both yield and quality (Otoo *et al.,* 2014).

The effects of in-row spacing have been studied for several sweet potato varieties (Shaw *et al.,* 2008; Rubatzky & Yamaguchi, 1997; Swiader *et al.,* 1992). Improved spacing strategies can enhance canopy development, reduce inter-plant competition, and support the formation of larger and market-preferred tubers (Alam *et al.,* 2013).

Despite the significant nutritional and economic potential of sweet potato (*Ipomoea batatas*), its productivity in many regions remains suboptimal due to improper agronomic practices. A major challenge lies in the inadequate understanding of the effects of planting depth and spacing on yield, which leads to inefficient use of available land and substandard tuber formation. Farmers often rely on traditional planting methods that do not optimize spacing or depth, resulting in overcrowded plants and shallow tuber development, both of which reduce yield and marketability (Otoo *et al.,* 2017).

Research has shown that adjusting planting depth and spacing can enhance root growth and yield, but studies specific to local conditions are lacking (Bolarinwa *et al.,*

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2020). If these issues are not addressed through scientific intervention, farmers may continue to suffer poor yields, limiting their income and undermining the full potential of sweet potato as a sustainable crop for food security (Chowdhury *et al.,* 2021). This research thus aimed to identify the most suitable plant spacing and depth of sweet potato that maximizes yield under local field conditions, thereby contributing directly to increased food production and better resource utilization.

2.0 METHODOLOGY

2.1 Study Area

This study was conducted at the Biological Sciences Garden of Federal University Gusau, located in Zamfara State, Northwestern Nigeria with geographical coordinates of latitude 12°10′0″N and longitude 6°40′0″E, situated at an elevation of approximately 420 meters above sea level (National Space Research and Development Agency [NASRDA], 2022). With predominantly sandy-loamy soil, the study area experienced average daily temperatures ranging from 30°C to 35°C, and moderate rainfall conditions. Land preparation involved manual clearing, tilling, and ridging.

2.2 Sample Collection and Preparation

The potato vines collected were de-leafed and cut into 25–30cm each containing 4–6 nodes using sterilized tools to minimize contamination and immediately transported to the field site for planting. Care was taken to ensure uniformity in the size, health, and node count of collected samples for consistency across treatments.

2.3 Treatment and Experimental Design

The experiment utilized the two sweet potato varieties (White Skin and Purple Skin) in combination with four plant spacings (20 cm, 40 cm, 60 cm, and 80 cm) and two planting depths based on the number of buried nodes (1 node and 2 nodes). This produced a factorial treatment arrangement laid out in a Randomized Complete Block Design (RCBD) with three replications. Each plot had a fixed inter-row spacing of 75 cm and varying intra-row spacing as per treatment. Agronomic practices such as weeding, irrigation, and pest control were uniformly applied to maintain treatment integrity. The planting was done manually by inserting each cutting at an angle into the ridges according to the experimental design, ensuring proper depth and firm soil contact for each cutting to promote rooting and establishment. Harvesting was carried out at full crop maturity, approximately 4 months after planting.

2.4 Data Collection

Data were collected on fresh tuber yield per plant across all treatment combinations. Tuber yield was weighed using a digital scale, and recorded in grams. Yield data were expressed as mean ± standard error, and additional metrics such as minimum and maximum values per treatment were also documented to evaluate performance consistency.

2.5 Data Analysis

The collected data were analyzed using descriptive statistics and Analysis of Variance (ANOVA) using R-software. The significance of treatment effects was evaluated at the 5% probability level ($p \leq 0.05$). Where significant differences were found, mean separation was done using the Least Significant Difference (LSD) test. Emphasis was placed on identifying the optimal spacing, variety, and planting depth combinations for yield maximization.

3.0 RESULTS

Table 1: Effect of Planting Depth (Node Number) on Yield of sweet potato

Planting Depth	Mean Yield (g) ± SE	Range (Min – Max, g)	*p*-value

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1 Node	116.29 ± 6.45	70.12 – 197.07	0.227
2 Nodes	127.40 ± 6.45	57.42 – 404.86	

Table 1. showed no significant effect of planting depth on yield (p = 0.227). Although planting with 2 nodes yielded slightly more (127.40 ± 6.45 g) than planting with 1 node (116.29 ± 6.45 g), the difference was not statistically meaningful. This indicates that either planting depth can be used without considerable variation in yield, although 2 nodes may offer a marginal benefit.

Table 2: Effect of Spacing on Yield of Sweet Potato

Spacing (cm)	Mean Yield (g) ± SE	Range (Min – Max, g)	*p*-value
20	117.85 ± 9.12	76.44 – 197.07	0.005
40	150.47 ± 9.12	88.91 – 404.86	
60	104.37 ± 9.12	57.42 – 188.84	
80	114.70 ± 9.12	87.00 – 145.00	

The result (Table 2.) revealed that spacing significantly influenced yield (p = 0.005). The highest mean yield (150.47 ± 9.12 g) was recorded at 40 cm spacing, suggesting that this spacing provided optimal plant density for resource utilization. In contrast, wider (60 cm and 80 cm) and narrower (20 cm) spacing resulted in lower yields, possibly due to suboptimal light interception and intra-plant competition.

Table 3: Effect of Variety on Yield of sweet potato

Variety	Mean Yield (g) ± SE	Range (Min – Max, g)	*p*-value
Purple Skin	113.09 ± 6.45	70.12 – 166.28	0.005
White Skin	130.60 ± 6.45	57.42 – 404.86	

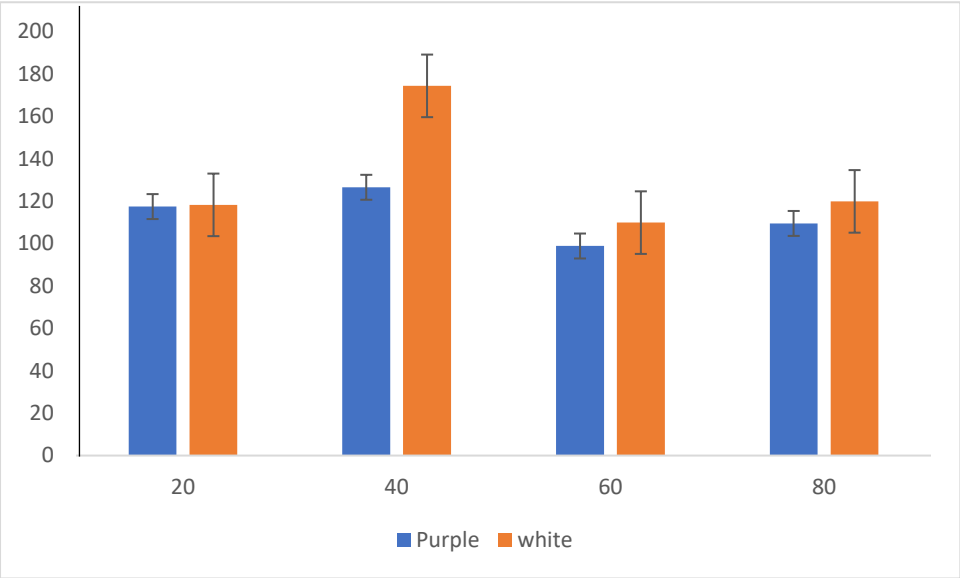
The findings (Table 3.) indicate a significant variation between the two varieties (p = 0.005). The White Skin variety exhibited a higher mean yield (130.60 ± 6.45 g) compared to the Purple Skin variety (113.09 ± 6.45 g), implying a varietal influence on productivity under the given growing conditions. This suggests that the White Skin variety may be more suitable for achieving higher yields in this environment.

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ple and white skin sweet elds than purple ones at very narrow (20 cm) and cm is the most effective spacing for maximizing growth and productivity, especially for the white variety.

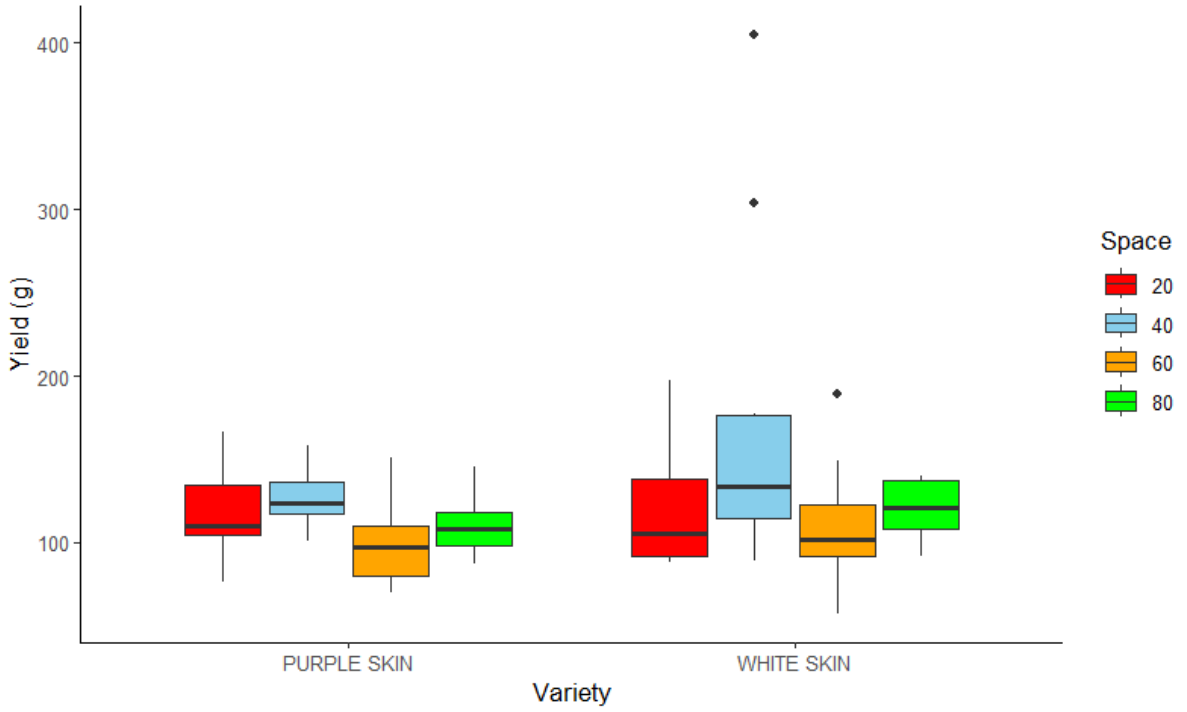


Figure 1: Box Plot Showing Yield Across Variety and Space

Discussion

The findings of this study provide meaningful insights into the agronomic factors influencing crop yield, specifically the effects of spacing, variety, and planting depth (node number). A significant effect of plant spacing on yield ($p = 0.005$), with the highest mean yield recorded at 40 cm spacing (150.47 ± 9.12 g). This finding aligns with the work of Ahmed *et al.* (2021), who observed that moderate spacing in sweet potato and related root crops enhances tuber expansion and resource use efficiency. Wider spacings such as 60 cm and 80 cm may reduce plant competition but result in underutilization of available land area, while very narrow

spacing (20 cm) can induce intra-specific competition, leading to reduced tuber size and overall yield (Ibrahim *et al.,* 2022).

According to the Food and Agriculture Organization (FAO, 2021), optimum spacing for most root and tuber crops ranges between 30–45 cm, depending on soil fertility and climatic conditions. Therefore, the results of this study support these recommendations, suggesting that 40 cm spacing achieves a balance between plant density and resource availability.

Varietal differences had a statistically significant impact on yield ($p = 0.005$), with the Purple Skin variety outperforming the White Skin variety. This could be attributed to the genetic makeup of the purple-skinned variety, which may possess superior traits such as better nutrient uptake efficiency, disease resistance, and adaptability to environmental stress. Olowe *et al.* (2023) similarly reported that purple-fleshed varieties of yam and sweet potato yielded significantly more than their white-fleshed counterparts under identical field conditions in southwestern Nigeria.

In addition, the Purple Skin variety may have a higher dry matter content, which has been linked to higher yield and better consumer acceptability (Chukwu *et al.,* 2021). The findings from this study emphasize the importance of variety selection in maximizing crop yield and are consistent with varietal performance trials recommended by the National Agricultural Seeds Council (NASC, 2021), which promote cultivar evaluation under local agro-ecological conditions before large-scale cultivation.

Although yield appeared slightly higher with planting at 2 nodes compared to 1 node, the difference was not statistically significant ($p = 0.227$). This suggests that the number of nodes used at planting does not have a pronounced effect on yield under the conditions of this study. This outcome contradicts the findings of Ndukwu *et al.* (2022), who reported significantly higher yields when stem cuttings of sweet potato were planted with two or more nodes, attributing the increase to improved root establishment and shoot emergence.

However, Okafor and Umeh (2021) found no significant yield difference when varying planting depths in cassava and yam under controlled irrigation. Their results, similar to the present study, suggest that while deeper planting (more nodes) may confer initial establishment advantages, other factors such as soil moisture and nutrient availability play a more dominant role in determining final yield.

CONCLUSION

The research has established that among the agronomic factors studied, plant spacing and variety significantly influence the yield of sweet potato. The 40 cm intra-row spacing emerged as the most effective, producing significantly higher yields than the other spacing treatments. The study also showed that planting depth, though slightly favoring 2-node cuttings, had no significant statistical effect on yield, implying that farmers can adopt either method without risking yield losses.

REFERENCES

Ahmed, M. A., Bello, U. A., & Lawal, H. Y. (2021). Influence of spacing and fertilizer on growth and yield of sweet potato in semi-arid zones. *African Journal of Agricultural Science*, *17*(3), 112–119.

Alam, M. M., Hossain, M. S., & Hasan, M. K. (2013). Effect of spacing and fertilizer on the growth and yield of sweet potato (*Ipomoea batatas* L.). *Journal of Root Crops*, 39(2), 45–52.

Bolarinwa, O. I., Gana, B. M., & Oyeleke, A. A. (2020). Influence of planting depth and spacing on the growth and yield of sweet potato in tropical environments. *Agricultural Science Journal*, 28(4), 234–241.

Chowdhury, R. I., Rahman, S. M., & Sultana, T. (2021). Agronomic management practices for increasing the yield of sweet potato in Bangladesh: A review.

Bangladesh Journal of Agriculture, 45(2), 123–130.

Chukwu, O., Ogbonna, P. E., & Nwosu, D. J. (2021). Evaluation of yield and consumer preference of sweet potato varieties in Nigeria. *Journal of Root Crops Research*, *19*(2), 87–95.

FAO. (2021). Good agricultural practices for root and tuber crops: A field guide. *Food and Agriculture Organization of the United Nations*.

Ibrahim, D., Musa, J. J., & Salihu, T. (2022). Effect of plant density on the productivity of root crops in sandy soils. *Nigerian Journal of Soil and Environmental Management*, *25*(1), 43–50.

Laurie, S. L., Ayres, D., & Wilson, J. D. (2012). Enhancing the nutritional value of sweet potato through agronomic improvements and breeding. *Crop Science*, 52(3), 1046-1054.

Laurie, S. M., Faber, M., Claasen, N., & Slabbert, R. (2012). The use of sweet potato for human nutrition and development in South Africa: A food-based approach. *South African Journal of Clinical Nutrition*, 25(3), 127–135.

NASC. (2021). Seed varietal release report for major crops in Nigeria. *National Agricultural Seeds Council*.

Okafor, G. I., & Umeh, C. C. (2021). Effects of planting depth on yield parameters of yam and cassava in Southeastern Nigeria. *International Journal of Agriculture and Forestry*, *11*(2), 58–65.

Olowe, V. I., Adedeji, T. O., & Akinyemi, B. E. (2023). Comparative yield performance of white and purple-fleshed sweet potato varieties in Nigeria. *West African Journal of Agronomy*, *45*(1), 29–37.

Otoo, E., Agyeman, A., & Bonsu, M. (2014). Enhancing sweet potato production through improved agronomic practices in Ghana. *African Journal of Agricultural Research*, 9(3), 306–313.

Otoo, J. A., et al. (2017). Growth and yield of sweet potato (Ipomoea batatas L.) as influenced by vine cutting length and planting depth in the coastal savanna zone of Ghana. Journal of experimental Agriculture International, 1-10.

Rubatzky, V. E., & Yamaguchi, M. (1997). *World vegetables: Principles, production, and nutritive values* (2nd ed.). Chapman and Hall, New York.

Shaw, S., Westelaken, T., Sorrenson, I., Searle, B., & Hederley, D. (2008). Effects of plant population and planting date on growth and development of kumara cultivar Owairaka Red. *New Zealand Institute for Crop and Food Research*, 38, 61-68.

Tortoe, C. (2010). Microbial deterioration of white variety sweet potato (Ipomoea batatas) under different storage structures. *Intl. J. Plant Biol.* 1(1): 10-15.

Swiader, J. M., et al. (1992). Producing vegetable crops. Interstate Publishers.