

Research Article

Evaluation of sprout performance of milked yam using the minisett technique

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ABSTRACT**Article History**

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Yam (*Dioscorea rotundata*) is a critical staple and cash crop in West Africa, contributing significantly to food security and income for thousands of people. However, yam production is mostly challenged by the scarcity and high cost of quality seed yams, which can constitute a great percentage of total production. Additionally, traditional propagation methods lead to uneven sprouting and high disease risk. The minisett technique, which is developed to address these issues by using smaller tuber portions (50-65g) to increase multiplication ratios up to 1:30, also faces low adoption by farmers. This study aimed to evaluate the sprouts performance of milked yam using the minisett technique and to compare the minisett sprout ratio and response of different varieties (Urlordo, Dante, Nyameti, and Abutrei). The experiment was conducted at the University for Development Studies, Nyankpala Campus in Ghana, using healthy milked yam varieties. Minisett weighing 50-65g and treated with ash, were subjected to two soil treatments covered and uncovered soil in a nursery hut. Data recorded included key performance indicators such as sprout number, number of roots, rotten minisett, and changes in weight before and after sprouting. This data was analyzed using GenStat 18th Edition (using 2-way ANOVA). The findings demonstrated that variety had a highly significant ($p < 0.05$) effect on sprout number, number of rotten minisett, and weight parameters both before and after sprouting. The soil condition significantly ($p < 0.05$) influenced the final weight after sprouting, which showed that the soil covering was very important in moisture conservation. Nyameti demonstrated significant potential particularly under covered soil conditions. Nyameti proved promising for minisett multiplication from milked tubers due to its superior sprouting performance and robust resistance to rot. This research provides valuable insights for optimizing planting techniques, enhancing food security, improving farmer income, as well as promoting yam production in West Africa as a whole.



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INTRODUCTION

Yam (*Dioscorea spp.*) is a significant staple crop in West Africa, where it is used as by more than 60 million people (Wumbei *et al.*, 2022). It largely serves a dual purpose as food and seed. Aside from serving as food and seed, yam also has significant cultural and religious relevance (Adegboyega *et al.*, 2010). The crop has the highest value of the aggregate production compared to other crops in West Africa (Nicolay, 2024). About 74.9 million tonnes of yam tubers are produced annually in the world on about 8.9

million hectares of land with an average yield of 8.5 ton/ha (Nicolay, 2024). Africa contributes 97.8% to world production; Benin, Côte d'Ivoire, Ghana, Nigeria, and Togo account for 93.9% of world production (Nicolay, 2024). The conventional approach to yam cultivation faces several constraints, including high cost and limited availability of quality seed yams. Seed yams serve as the primary planting material in the field production of ware or table yams, which are ultimately consumed as food. The cost of acquiring seed yams accounts for approximately 50% of the total production cost (Adegboyega *et al.*, 2010). A major constraint to

increased yam production in Africa (particularly in Ghana) is the lack of quality seed yams. Notably, up to 33% of harvested yams, which could otherwise be used for food are reserved for planting in subsequent cropping seasons (Adegboyega *et al.*, 2010).

In order to alleviate the problems of scarcity and high cost of seed yam, the National Root Crop Research Institute (NRCRI), Umudike, Nigeria, and popularized by IITA in 1983 developed Yam minisett technology, which provides seed yam rapidly (Ajiehi, 2016). The technology has been adopted by farmers in Ghana through the Agriculture Development Program (ADP). The yam minisett technology involves cutting of yam tubers to produce as many minisett as possible each weighing 25g to 30g and about 2cm thick with a portion of periderm to produce ware yams. Ezidi *et al.* (2024) identified key activities in yam minisett technology to include; cutting the yam into clean cross sections without bruises, then they undergo an anti-fungi/pesticide treatment process by soaking in limewater solution, thereafter, the minisett are spread out (cured) and allowed to dry for a period of 12 to 24 hours (Aighewi *et al.*, 2020). Some variations of the technique include a pre-sprouting step to enhance the survival rate of the minisett and provide more uniform growth when transplanted to the field. The last step is the planting of minisett on the field.

Generally, the yam minisett technique is targeted at maximizing the production of healthy seed yams while minimizing the total number of planting material used as well as reducing disease transmission to increasing the multiplication ratio of seed yams. Yam minisett technology leads to increase the production of high quality, low cost and abundant planting material thereby eliminating the challenge of reserving one-quarter of the crop as seed. The minisett approach boosts the multiplication ratio to roughly 1:30, and the seed size tubers produced are planted to grow ware yam tubers (Aighewi *et al.*, 2020). Despite these obvious advantages of the minisett technology, seed yam scarcity still persists in different farming communities across the country. Therefore, this study was conducted to investigate the response of milked yam to minisett technology. Specifically, to: (i) examine the quality of minisett produced using minisett technology from milked yam; (ii) compare the response of different varieties of milked yam tuber on the sprouting rate of mini-sett technology; (iii) evaluate the sprout performance of milked yam using minisett technique.

MATERIALS AND METHOD

Study Area

The study was conducted at the Farming for the Future site (9.410501, -0.982117) at the University for Development Studies (UDS), Nyankpala Campus, in the Northern Region of Ghana. This is the designated area for field research in UDS. The plot was 2.5 m by 3 m in size. The field is characterized by sandy-loamy soil type. The study was conducted from August, 2024 to June, 2025 in the dry and early rainy season (Magna *et al.*, 2018). The average temperature was recorded as 29.63°C (Abubakar, 2015). All the yam varieties were sourced from Adjalaja-Beposo (7.999067, -1.392388) in the Pru West District of the Bono East Region of Ghana. The district has an established reputation as a major yam-producing region in the whole country.

Experimental procedure

Four yam varieties Nyameti, Abutrei, Dante, and Urlordo were sourced for the experiment on the minisett technique. All milked yam tubers selected were healthy and free of any disease. The milked yam tubers were carefully harvested from the farmers' fields and transported immediately to the experimental site in UDS. Minisett were prepared by cutting the tubers into sections weighing between 50–65 g, exceeding the typical 25–30 g benchmark harvested yam at the end of the season (Aighewi *et al.*, 2020a). This was done to ensure each minisett would have enough moisture content to support both sprouting and root development. A nursery hut was constructed using Zana-mat and neem sticks to provide necessary shade, with raised beds prepared to retain soil moisture. The minisett was treated with ash in order to minimize rot and attack by pests. With each of the four varieties, two soil treatments were used in nursing; thus covered soil treatment and uncovered soil treatment. This was done in order to compare the effect of soil cover on sprouting and weight retention against no soil cover. The experimental setup had three replicates ($n=3$).

Data collection and analysis

Growth parameters were recorded throughout the experiment. These parameters included; (i) Number of sprouted minisett: The number of sprouts was determined by counting the number of sprouts for each variety under both covered and uncovered soil treatment throughout the three replicates. (ii) Number of unsprouted minisett: This was recorded using the same trend as the number of sprouted minisett. (iii) Average number of roots per sprouted minisett: This was recorded for every variety under each soil treatment by counting the roots of five minisett in each group and then computing their average. (iv) Number of rotten minisett: This was determined by counting for each group the minisett that got rotten when it was time for transplanting. (v) Average weight before sprouting: This parameter was determined by weighing the minisett together and the diving the total weight by the total number of minisett at the beginning of the experiment. (vi) Average weight after sprouting: this followed the same trend as Average weight before sprouting but it was recorded after the minisett had sprouted.

The data recorded in MS Excel 2016 and variance was tested (two-way ANOVA) using GenStat tool (18th edition) and significant differences were determined at $p < 0.05$.

RESULTS

Number of sprouts

Variety had a highly significant effect on the number of sprouted minisett ($p < .001$). Nyameti recorded the highest mean number of sprouts with 20 sprouts, Urlordo recorded a mean sprout of 10 while Dante and Abutrei recorded mean sprouts of 6 and 4 respectively.

The interaction effects of sprouting media (soil) and variety were significantly different as shown on **Figure 3.1**. In covered soil medium, the highest mean sprouts were recorded by Nyameti (23), while Abutrei (3) variety was the least. In uncovered soil, Nyameti had 19, which was the

highest minisett sprouts while Abutrei had the lowest mean sprouts of 5.

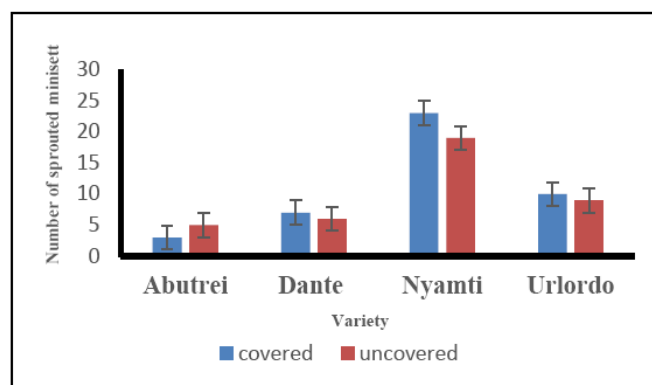


Figure 3.1: Sprouting response of yam minisett varieties in two soil media

Values are means computed from replicates ($n=3$) $\pm$ SD with LSD at 0.05.

Number of unsprouted minisett

Yam varieties and soil as factors each had no statistically significant effect ($p>0.05$) on the number of minisett that did not sprout. Abutrei recorded the highest mean number of non-sprouts (18), Urlordo recorded 17, Dante recorded 15 while Nyameti recorded 10 as indicated on **Table 3.1**. The interaction of soil and variety also had no significant effect on the number of unsprouted minisett.

Table 3.1: Number of Non-Sprouts

Variety		Means
Urlordo	Covered	17
	Uncovered	18
Dante	Covered	15
	Uncovered	14
Nyameti	Covered	9
	Uncovered	11
Abutrei	Covered	14
	Uncovered	23

Average number of roots

The results show that yam variety had no significant effect on the average number of roots per minisett ($p = 0.179$). Also, the effect of soil on this parameter was statistically not significant ($p = 1.00$). In covered soil medium, Urlordo recorded the highest mean of roots 5 while Abutrei recorded the lowest of 3 (**Table 3.2**).

Table 3.1: Average Number of Roots

Variety	Soil	Means
Urlordo	Covered	4
	Uncovered	3
Dante	Covered	3
	Uncovered	3
Nyameti	Covered	4
	Uncovered	5
Abutrei	Covered	3
	Uncovered	4

Number of rotten Minisett

The analysis of number of rotten minisett shows a high level of significance with respect to variety ($p < .001$). Abutrei had the highest mean number of rotten minisett 23, Urlordo had a mean value of 11 while Dante and Nyameti both had a mean value of 4 each. **Figure 3.2** represents the mean values of variety soil interaction.

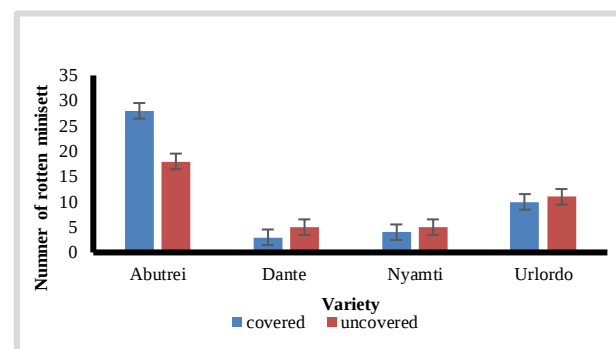


Figure 3.2: Number of rotten minisett

Values are means computed from replicates ($n=3$) $\pm$ SD with LSD at 0.05.

Average weight before sprouting

The average weight of minisett before sprouting was statistically significant ($p < .001$) with respect to variety. In covered soil medium, Nyameti had the highest average weight 62g, Abutrei had 52g, Dante had 58g and Urlordo recorded 60g. The difference in the weight among varieties could potentially be attributed to difference in size of initial cutting.

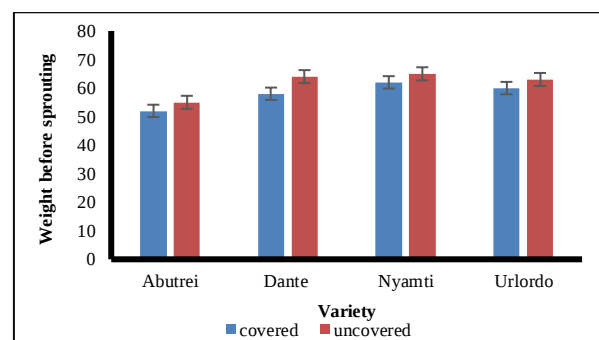


Figure 3.3: Average weight of minisett before sprouting

Values are means computed from replicates ($n=3$) $\pm$ SD with LSD at 0.05.

Average weight After Sprouting

The average weight after sprouting was statistically significant with respect to variety ($p < 0.001$). The soil condition also had a statistically significant effect on the average weight of minisett after sprouting ($p < 0.010$). Covered soil medium generally maintained significant higher weight compared to uncovered soil medium.

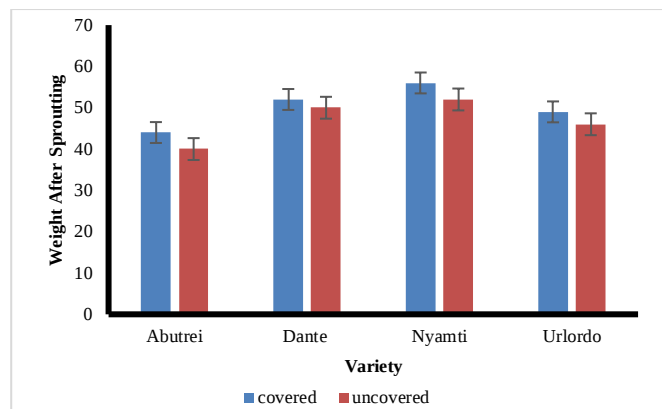


Figure 3.4: Average weight of minisett after sprouting

Values are means computed from replicates ($n=3$) $\pm$ SD with LSD at 0.05.

DISCUSSION

The number of sprouts differed significantly among the varieties studied. Nyameti recorded the highest number of sprouts, showing strong potential for minisett production. Abutrei had the lowest number of sprouts among the four varieties but still demonstrated reasonable sprouting under appropriate conditions. These findings agree with previous studies (Aighewi *et al.*, 2020), which emphasize varietal influence on sprouting performance. Soil covering played a notable role, as covered beds retained more moisture, resulting in better sprout development compared to uncovered treatments. Thus, covered medium performed significantly better than uncovered medium as seen by their mean sprouting. This finding is at variance with those of Asare *et al.*, (2007) who reported that sawdust was the best pre-sprouting medium for yam minisett. The slightly higher rates of non-sprouting in uncovered beds could be due to moisture loss and exposure to fluctuating temperatures.

The average number of roots that were obtained from the various varieties minisett were not significantly different. However, it was also observed Nyameti minisett which sprouted in covered soil medium produced vigorous and healthier sprouts with bigger roots than uncovered medium. This aligns with the report of Osei-Sarpong (2009), who stated that yam sets that sprouted under dry conditions tended to produce several more sprouting loci than those sprouted in moist media. However, the observance of significant differences in the rotten minisett from the four varieties could imply that variety has a large influence on the decay rate of minisett. This is consistent with findings by Ezidi *et al.*, (2024), who reported varietal resistance to decay as a primary determinant of spoilage. Additionally, Aighewi *et al.*, (2020a) supported this by demonstrating that some varieties of yam perform better than others in terms of rot resistance. Generally, uncovered minisett showed a higher tendency to rot, likely due to increased exposure and inconsistent moisture levels. The interaction effect of sprouting media and yam variety was highly significant, which is similar to the previous studies of Wumbei (2022) in which tuber loss of between 15 and 40 % as a result of microbial rots was reported. Overall, Nyameti showed greater resistance to rot and hence gives an early indication of a better performer and a candidate for future multiplication studies.

The weight of the minisett we used was within the ranges of 50-65g. This size was preferable to ensure that the minisett retained enough stored food and water to support sprout initiation and root development. The minisett in the uncovered medium had slightly higher weight than those in the covered medium. Aighewi *et al.*, (2020a) highlighted the influence of varietal physiological differences on pre-sprouting weight. During dormancy, tuber moisture content, carbohydrate reserves, and metabolic rate affect how much weight a minisett loses before sprouting.

Varieties with higher respiration rates or lower native water content lose more water and stored carbohydrates during the pre-sprouting period, reducing their weight, whereas varieties with slower metabolism or thicker skins retain moisture and lose less. This was seen in our study as variety had a great effect on the average weight of minisett after sprouting. Aside from these inherent factors, the minisett in uncovered soil medium lost more water than those in covered soil medium perhaps due to lack of a protective soil layer, which makes the minisett's surrounding soil dry out more quickly, leading to greater water loss. This suggests that, the covered soil medium was a more appropriate medium for the minisett technique. Largely, Nyameti and Urlordo maintained higher post-sprouting weights, aligning with their better sprout and root performance.

CONCLUSION

In conclusion, the four yam varieties Urlordo, Nyameti, Dante and Abutrei all showed remarkable sprout rates although there was a significant difference in the number of sprouts. Statistically, the number of non-sprouted minisett and the average number of roots per variety had no significant difference. Generally, the minisett in covered soil medium performed better than those in uncovered soil medium. This was due to the retention moisture content and more stable conditions in the covered soil medium. Abutrei recorded the least number of sprouted minisett in uncovered medium. The above proves the fact that varietal differences combined with appropriate media could have huge impact on the sprouting rate of milked yam under minisett technology. Moving forward, a comprehensive study could assess biological and organic pest control methods to reduce decay rate in milked yam minisett.

REFERENCES

- Abubakar G 2015: Determinants of adoption of yam minisett technology in Ghana . A case study of yam farmers in the Kintampo North District of Ghana, 3(7), 293–302.
- Adegboyega Eyitayo O, Olaniran Anthony T, Therasas I 2010: Electronic reference Oguntade Adegboyega Eyitayo, Thompson Olaniran Anthony and Ige Therasas, «Economics of Seed Yam Production Using Minisett Technique in Oyo State, 4(April 2019), 0–5.
- Aighewi BA, Maroya NG, Asiedu R 2024: *Seed yam production from minisett : A training manual*.
- Aighewi B, Maroya N, Asiedu R, Aihebhoria D, Balogun M, Mignouna D 2020: Seed yam production from whole tubers versus minisett. *Journal of Crop Improvement*, 34(6), 858–874. <https://doi.org/10.1080/15427528.2020.1779157>
- Aighewi B, Maroya N, Mignouna D, Aihebhoria D, Balogun M, Asiedu R 2020: The influence of minisett size and

- time of planting on the yield of seed yam (*Dioscorea Rotundata*). *Experimental Agriculture*, **56**(3), 469–481.
- Ajieh PC 2016: Adoption of yam (*Dioscorea* spp.) minisett technology in delta state , Nigeria Adoption of Yam (*Dioscorea* spp.) Minisett Technology in Delta State , Nigeria, (March). <https://doi.org/10.2478/v10295-012-0014-7>
- Asare-Bediako E, Opoku-Asiama Y, Showemimo FA, Tetteh JP 2007: Evaluation of different methods of sterilizing sprouting media for in the control of minisett rot of white yam (*Dioscorea rotundata* Poir).
- Ezidi CO, Nwosu EN, Ohakwe RO, Okeke CS, Austin E, Onyekaonwu OE, Ohakwe RO 2024: Seed yam production from minisett : A training manual, **11**(3), 569–575.
- Magna EK, Ofori B, Ojo S 2018: Analysis of rainfall and temperature effects on yam yield in the krachi east district of ghana Magna, E. K., Ofori, B. D., Ojo, S., 5(1).
- Nicolay GL 2024: <p>The Power of Social Capital to Address Structural Factors of Hunger</p>. *Transitioning to Zero Hunger*, (November). <https://doi.org/10.3390/books978-3-03897-863-3-3>
- Osei-Sarpong K 2009: The effect of type of mother yam and botanical extracts on the performance of the yam minisett. Citeseer.
- Wumbei A 2022: Pesticides use in yam production : implications for the quality of yam and food safety, (January 2019).
- Wumbei A, Gautier SKN, Kwodaga JK, Joseph DF, Galani YJH 2022: State of the art of yam production.