



**IMPROVING THE PRODUCTION OF PLANTING MATERIALS
OF UBE (*Dioscorea alata*) CULTIVARS THROUGH
MINISETTS TECHNOLOGY**

Roderick C. Paturay & Mirasol L. Agpuldo

paturayroderick@gmail.com/mirasol782019@gmail.com

Apayao State College

San Isidro, Luna, Apayao, Philippines

ABSTRACT

This study aimed to improve the production of high-quality planting materials for ube (*Dioscorea alata*) through miniset technology. Specifically, it sought to determine the best miniset size for seedling production, evaluate the growth and survival performance of different ube cultivars under varied miniset technologies, determine the interaction between cultivar and miniset size, and assess the Return on Cash Expense (ROCE). The study is significant to farmers, nurseries, agribusinesses, and researchers because it provides an efficient and sustainable propagation technique that can increase the availability of quality planting materials, improve productivity, and enhance profitability in ube production. A two-factor factorial experiment arranged in a strip-plot design was conducted using five miniset treatments: 25 g, 50 g, 75 g, 100 g, and farmers' practice (150 g), and three ube cultivars namely Ulang, Sampero, and Pingingan. The experiment was carried out under controlled conditions using a 1:1 mixture of river sand and carbonized rice hull as planting medium. Data gathered included days of emergence, plant height, stem diameter, survival rate, internode length, root characteristics, vigor index, and ROCE. Data were analyzed using Analysis of Variance (ANOVA). Results revealed that miniset technology significantly affected emergence, plant height, root development, root-shoot ratio, and vigor index. Treatments M_0 (150 g) and M_4 (100 g) consistently produced superior growth and vigor, while M_1 (25 g) showed the weakest performance. Among cultivars, Ulang and Pingingan demonstrated better survival, vigor, and profitability compared to Sampero. Economically, Ulang and Pingingan obtained the highest ROCE of 233.01%. The study concluded that appropriate miniset technology and cultivar selection are essential in improving the growth, survival, and profitability of ube seedling production in Apayao.

Keywords: *Introduction, Methodology, Results, Discussion, Summary, Conclusions, Acknowledgement; References, Tables, Figure legends and Figures.*



INTRODUCTION

Purple yam (*Dioscorea alata*), locally known as ube, is an important root crop in the Philippines due to its high nutritional value, unique flavor, and increasing demand in both local and international markets. Despite its economic potential, ube production remains constrained by the limited availability of high-quality, disease-free planting materials. Traditional propagation practices depend on the use of whole tubers or large setts, which consume a significant portion of the harvest and increase production costs. In addition, planting materials are often affected by pests and diseases, resulting in poor seedling establishment and reduced productivity. These challenges are more evident in upland areas such as Apayao, where access to certified planting materials is limited and organized seed systems remain underdeveloped. Consequently, there is a need to improve propagation techniques that can efficiently produce vigorous and healthy ube seedlings while reducing production costs and maximizing profitability.

Minisett technology has been recognized as an effective rapid multiplication technique for yam production because it allows a single tuber to produce multiple planting materials while maintaining varietal purity and reducing the use of edible tubers for planting. According to Otoo et al. (2015), minisett technology significantly improves seed yam multiplication efficiency and contributes to sustainable yam production systems. Similarly, Bhagsari and Harmon (1982) emphasized that proper sett size and handling practices strongly influence sprouting and seedling vigor in yams. In the Philippine context, the Bureau of Agricultural Research (BAR, 2020) and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD, 2021) promoted the adoption of minisett technology to address the shortage of clean planting materials for ube production. Studies further revealed that cultivar response to minisett propagation varies depending on genetic characteristics and environmental conditions, highlighting the need for localized evaluation of suitable minisett technologies and cultivars under specific production areas such as Apayao.

This study was conducted to improve the production of high-quality planting materials for ube through minisett technology. Specifically, it aimed to determine the best minisett technology for producing vigorous planting materials, evaluate the growth and survival performance of different ube cultivars under varied minisett treatments, determine the interaction between minisett technology and cultivars, and assess the Return on Cash Expense (ROCE) of minisett production. The findings of the study are expected to contribute to the development of efficient and sustainable propagation practices that will benefit farmers, nurseries, researchers, and the ube industry in general.

METHODOLOGY

This study employed an experimental research design to evaluate the effectiveness of different minisett technologies on the growth, survival, and vigor performance of selected ube (*Dioscorea alata*) cultivars. The experiment was conducted under controlled conditions from February 11, 2026 to May 2, 2026 using a two-factor factorial arrangement in a Strip-Plot Design. The vertical factor consisted of five minisett treatments: MS₀ (Farmers' Practice – 150 g), MS₁ (25

Corresponding author: paturayroderick@gmail.com/mirasol782019@gmail.com

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g), MS₂ (50 g), MS₃ (75 g), and MS₄ (100 g). The horizontal factor included three ube cultivars commonly grown in Apayao: C₁ – Ulang, C₂ – Sampero, and C₃ – Pigingan. The design allowed the evaluation of the individual and combined effects of minisett size and cultivar on seedling performance.

Planting materials were obtained from local ube growers in Apayao to ensure the use of locally adapted cultivars. Concrete plots measuring 1 m × 7 m × 0.80 m were constructed and covered with 50% shade nets to provide a uniform growing environment. A soil medium composed of river sand and carbonized rice hull in a 1:1 ratio was prepared and used as the planting medium to promote proper aeration and drainage. Prior to planting, ube tubers were pre-sprouted for 14 days under shaded conditions and covered with moist cloth to stimulate bud emergence. The tubers were then carefully cut into designated minisett sizes ranging from 25 g to 150 g. To minimize contamination and rotting, cutting tools were sterilized using a 1% Clorox solution after every cut, and the minisett were treated with wood ash and fungicide before planting.

The prepared minisett were planted immediately in the concrete plots with the skin side facing upward and covered lightly with the prepared soil medium. Watering was conducted three times weekly during the establishment phase to maintain sufficient moisture for sprouting and rooting. Manual weeding was regularly performed to reduce competition, while observed cutworms were manually collected and destroyed to minimize pest damage. Staking and vine training using fiberglass rods were applied once seedlings reached approximately two feet in height to support proper vine growth and canopy development.

Data collection was conducted systematically at 80–85 days after planting. Parameters measured included days of emergence, plant height, stem diameter, survival rate, internode length, number of roots, root length, root–shoot ratio, vigor index, and Return on Cash Expense (ROCE). Plant height and root measurements were obtained using a ruler or measuring tape, while stem diameter was measured using a digital caliper. Survival rate was computed based on the percentage of living propagules, while vigor index was calculated by multiplying germination percentage and seedling length. Economic analysis was carried out by comparing total production costs and net returns to determine ROCE.

All data gathered were tabulated and subjected to Analysis of Variance (ANOVA) using the Statistical Tool for Agricultural Research to determine significant differences among treatments. Mean comparisons were interpreted to identify the best-performing minisett technology and ube cultivar combinations for high-quality planting material production.



RESULTS AND DISCUSSION

Table 1. Average Plant Height, Stem Diameter, and Length of Internodes of Ube Seedlings at 80 DAP

Treatment	Plant Height (cm)	Stem Diameter	Length of Internodes (cm)
Factor A: Minisett			
M ₀	71.67 ^a	45.00	11.67 ^a
M ₁	14.96 ^c	16.50	7.33 ^b
M ₂	33.80 ^{bc}	17.60	6.89
M ₃	31.49 ^c	34.90	8.00
M ₄	57.49 ^{ab}	14.20	10.78 ^a
ANOVA	**	ns	**
Factor B: Cultivars			
C ₁	65.63 ^a	47.20 ^a	7.93 ^b
C ₂	17.58 ^c	3.49 ^b	7.53 ^b
C ₃	42.43 ^b	26.51 ^a	11.33 ^a
ANOVA	**	**	**

The results showed that minisett technology significantly influenced plant height and internode length, but not stem diameter. M₀ (150 g) produced the tallest plants and longest internodes, followed by M₄ (100 g), while M₁ (25 g) produced the shortest plants and smallest internodes. Larger minisett likely contained greater food reserves that enhanced vegetative growth during early establishment.

Among cultivars, C₁ (Ulang) produced the tallest plants and thickest stems, while C₃ (Pigingan) recorded the longest internodes. C₂ (Sampero) consistently showed lower growth performance. These findings suggest that varietal characteristics significantly influence seedling vigor and vegetative development. The superior growth of Ulang and Pigingan supports the objective of identifying suitable cultivars for high-quality planting material production.



Table 2. Average Days of Emergence and Survival Rate of Ube Seedlings

Treatment	Days of Emergence	Survival Rate (%)
Factor A: Minisett		
M ₀	41	96.7
M ₁	53	95.6
M ₂	46	92.2
M ₃	55	97.8
M ₄	51	97.8
ANOVA	*	ns
Factor B: Cultivars		
C ₁	50	98.00 ^a
C ₂	46	91.33 ^b
C ₃	52	98.67 ^a
ANOVA	Ns	*

Minisett technology significantly affected the average days of emergence. M₀ produced the earliest emergence, while M₃ had the slowest sprouting. Earlier emergence in larger minisett may be attributed to greater carbohydrate reserves that supported rapid bud development.

Survival rate was not significantly affected by minisett treatments, although all treatments showed high survival percentages above 90%, indicating that minisett propagation is a reliable technique for ube seedling production. However, significant differences were observed among cultivars. C₁ and C₃ exhibited higher survival rates than C₂, suggesting better adaptability and tolerance during the seedling stage. This result supports the importance of cultivar selection in improving seedling establishment and propagation success.

Table 3. Average Number and Length of Roots of Ube Seedlings

Treatment	Number of Roots	Length of Roots (cm)
Factor A: Minisett		
M ₀	6.11 ^{ab}	46.59 ^a
M ₁	5.00 ^b	31.19 ^c
M ₂	6.22 ^a	40.43 ^{ab}
M ₃	6.00 ^{ab}	37.49 ^{bc}
M ₄	6.89 ^a	37.89

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ANOVA	*	*
Factor B: Cultivars		
C ₁	8.33 ^a	43.45
C ₂	4.20 ^c	36.77
C ₃	5.60 ^b	35.93
ANOVA	**	*

Root development was significantly affected by minisett treatments and cultivars. M₂ and M₄ produced the highest number of roots, while M₀ generated the longest roots. In contrast, M₁ produced the fewest and shortest roots. Better root development among larger minisett may be associated with higher nutrient availability that supported root initiation and elongation. Strong root systems are essential for efficient nutrient absorption and seedling establishment.

Among cultivars, C₁ produced the highest number and longest roots, indicating superior rooting ability. C₂ consistently recorded the poorest root performance. These results align with PCAARRD (2021), which emphasized that cultivar response strongly influences rooting capacity and seedling vigor in ube propagation. The findings highlight the importance of selecting vigorous cultivars and suitable minisett sizes to improve planting material quality.

Table 4. Root–Shoot Ratio and Vigor Index of Ube Seedlings

Treatment	Root–Shoot Ratio	Vigor Index
Factor A: Minisett		
M ₀	1.56 ^a	11633 ^a
M ₁	0.48 ^b	4387 ^c
M ₂	0.87 ^b	6927 ^{bc}
M ₃	0.76 ^b	6813 ^{bc}
M ₄	1.54 ^a	9439 ^{ab}
ANOVA	**	**
Factor B: Cultivars		
C ₁	1.52 ^a	10781 ^a
C ₂	0.47 ^b	4983 ^c
C ₃	1.14 ^a	7756 ^b
ANOVA	**	**

The root–shoot ratio and vigor index were significantly affected by minisett technology and cultivar type. M₀ and M₄ recorded the highest root–shoot ratios and vigor indices, indicating more balanced growth and stronger seedlings. M₁ showed the weakest vigor performance. Higher vigor index values indicate healthier seedlings with better growth potential and adaptability under field conditions.

Among cultivars, C₁ exhibited the highest vigor index, followed by C₃, while C₂ consistently showed lower values. These findings confirm that cultivar selection is a critical factor in producing



vigorous and high-quality ube seedlings. Similar results were reported by Otoo et al. (2015), who emphasized the importance of selecting appropriate propagation materials and cultivars for successful yam seed production.

Table 5. Return on Cash Expense (ROCE) of Ube Cultivars

Particulars	Ulang	Sampero	Pigingan
Total Production Cost	₱5,150.00	₱5,150.00	₱5,150.00
Gross Income	₱17,150.00	₱15,925.00	₱17,150.00
Net Income	₱12,000.00	₱10,775.00	₱12,000.00
ROCE (%)	233.01	209.22	233.01

The economic analysis revealed that production costs were similar across cultivars; however, profitability varied depending on survival rate and seedling output. Ulang and Pigingan obtained the highest net income and ROCE values due to better survival and higher seedling production. Sampero generated lower returns because of reduced seedling output and lower survival rate.

The results demonstrate that minisett technology can be economically viable for ube propagation when combined with suitable cultivars. The high ROCE values indicate that investment in minisett technology can provide profitable returns to farmers and nursery operators. This supports the goal of improving sustainable and cost-efficient planting material production for the expanding ube industry in the Philippines.

SUMMARY

This study was conducted to improve the production of high-quality planting materials for ube (*Dioscorea alata*) through minisett technology. Specifically, the study aimed to: (1) determine the best minisett technology for producing high-quality planting materials; (2) evaluate the growth and survival performance of different ube cultivars under varied minisett technologies; (3) determine the interaction between minisett technology and ube cultivars in producing quality planting materials; and (4) assess the Return on Cash Expense (ROCE) of minisett production.

The experiment employed a two-factor factorial arrangement using a Strip-Plot Design. The vertical factor consisted of five minisett treatments: M₀ (150 g or farmers' practice), M₁ (25 g), M₂ (50 g), M₃ (75 g), and M₄ (100 g). The horizontal factor consisted of three ube cultivars commonly grown in Apayao: Ulang (C₁), Sampero (C₂), and Pigingan (C₃). The study was conducted under controlled conditions using a planting medium composed of river sand and

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carbonized rice hull at a 1:1 ratio. Prior to planting, tubers were pre-sprouted and cut into designated minisett sizes, treated with fungicide and wood ash, and planted in concrete plots under tunnel-type protective structures. Standard cultural management practices such as watering, weeding, pest management, and staking were regularly performed.

Data gathered included average days of emergence, plant height, stem diameter, survival rate, internode length, number of roots, root length, root–shoot ratio, vigor index, and Return on Cash Expense (ROCE). Data were analyzed using Analysis of Variance (ANOVA) through the Statistical Tool for Agricultural Research.

Results showed that minisett technology significantly influenced emergence, plant height, internode length, root development, root–shoot ratio, and vigor index. Treatments M_0 and M_4 consistently produced superior growth and vigor performance, while M_1 generally showed the weakest results. Cultivars also differed significantly, with Ulang (C_1) and Pigingang (C_3) exhibiting better survival, growth, root development, and vigor compared to Sampero (C_2). Although the interaction between minisett technology and cultivars was mostly non-significant, combinations such as M_0C_1 , M_4C_1 , and M_0C_3 numerically produced superior seedling performance. Economic analysis revealed that Ulang and Pigingang generated the highest net income and ROCE of 233.01%, while Sampero had lower profitability.

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REFERENCES

Aighewi, B. A., Asiedu, R., Maroya, N., & Balogun, M. (2021). Yield and quality of seed yams (*Dioscorea rotundata* Poir.) from minisetts established with different sprout lengths. *Journal of Crop Improvement*, 35(4), 542–553. <https://doi.org/10.1080/15427528.2020.1848710>

Baquiran, P. B., et al. (2018). *Purple yam (ube) production guide*. Cagayan Valley Department of Agriculture.

Balunan, T. R., et al. (2021). Assessment of ube cultivars in the Cordillera highlands. *BSU Research Journal*, 85, 12–22.

Bureau of Agricultural Research. (2021). *Ube production guide*. Department of Agriculture, Philippines. <https://www.bar.gov.ph/index.php/digest-home/digest-archives/123-2001-3rd-quarter/468-ube-production>

Bureau of Plant Industry–Plant Materials Research Division. (n.d.). *Ubi (Dioscorea alata L.) production guide*. Department of Agriculture. Retrieved January 12, 2026, from <https://library.buplant.da.gov.ph/images/1641957628UBE.pdf>

Chujoy, E., & Ocampo, A. (2019). Rapid multiplication techniques for root and tuber crops in the Philippines. *Philippine Journal of Crop Science*, 44(1), 25–34.

Darkwa, K., Olasanmi, B., Asiedu, R., & Asfaw, A. (2020). Review of progress and gaps in providing an economic lifeline for African smallholder yam farmers. *Heliyon*, 6(6), e04341. <https://doi.org/10.1016/j.heliyon.2020.e04341>

Department of Agriculture–Cordillera Administrative Region. (2023). *Regional highland root crop development plan 2023–2028*. <https://car.da.gov.ph/>

Food and Agriculture Organization of the United Nations. (1998). *Storage and processing of roots and tubers in the tropics*. FAO.



Lebot, V. (2020). *Tropical root and tuber crops: Cassava, sweet potato, yams and aroids* (2nd ed.). CABI. <https://doi.org/10.1079/9781789243369.0000>
Northern Philippines Root Crops Research and Training Center. (n.d.). *Minisett technology protocol*. Benguet State University.

Ogaraku, A. O., & Ugwuoke, K. I. (2012). Postharvest handling and storage of yam (*Dioscorea* spp.). *Journal of Agriculture and Social Research*, 12(2), 1–7.

Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. (2022). *The Philippines recommends for ube production*. DOST-PCAARRD. <https://www.pcaarrd.dost.gov.ph/>

Provincial Agriculture Office–Apayao. (2024). *Annual crop production report: Root crops sector*. <https://apayao.gov.ph/>

Sánchez-López, D. B., Luna-Castellano, L. L., Regino-Hernández, S. M., & Cadena-Torres, J. (2023). Sprouting induction in yam tubers (*Dioscorea rotundata* Poir.) with the application of growth regulators. *Revista Terra Latinoamericana*, 41(2), 1–10.