



SHORT COMMUNICATION

Comparative evaluation of agrochemical treatments on *in vivo* macro-propagation of three *Musa* spp. Cultivars

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ABSTRACT

Musa spp. are globally important crops, serving as staple foods in many regions, particularly southern Nigeria. However, production often falls short of market demand due to challenges such as low-quality suckers and limited sucker availability. This study evaluated the response of three *Musa* spp. cultivars (Hex Agbagba, FHIA 20, and FHIA 23) to two agrochemical treatments (Digro and Supergro) under *in vivo* macro-propagation. A 3 × 3 factorial experiment was arranged in a completely randomized design with three replications. Corms were cross-cut to suppress apical dominance, sterilized with neem leaf extract, air-dried for 72 hours, and planted in propagators containing river sand and sawdust under shade. Results indicated that Supergro produced the highest shoot collar girth (12.18 cm), followed by Digro (10.46 cm) and control (10.40 cm). The interaction between cultivar and agrochemical treatment was highly significant, demonstrating the potential of Supergro in enhancing vegetative growth and survival.

Keywords: detached corm techniques; digro; macro-propagation; *Musa* spp.; supergro

INTRODUCTION

Musa paradisiaca (plantain) and *Musa sapientum* (banana) are triploid species ($2n = 3x = 33$) belonging to the AAB genomic group (Elayabalan et al., 2017; Adi, 2024). Globally, bananas represent one of the most important fruit crops, with annual production exceeding 130 million tons (Athanasopoullou et al., 2025). Beyond their role as a staple food, banana by-products such as peels have been recognized as nutrient-rich soil amendments that enhance soil fertility and sustainability (Mishra et al., 2023; Athanasopoullou et al., 2025). Both bananas and plantains are herbaceous perennial monocots characterized by underground corms with adventitious roots (Boris et al., 2023). They serve as essential caloric staples in many developing regions, particularly for low-income populations (Brown et al., 2017). In addition to their nutritional value, *Musa* spp. are associated with medicinal benefits, including relief from headaches, gastric disorders, and constipation, while also

providing vitamins (B6, C, folate), Carotenoids (β -carotene, α -carotene, lutein, & zeaxanthin) and minerals such as P, K, Ca, Mg, Na, Fe, Mn, Zn, Cu, & B (Ashokkumar et al., 2018; Boris et al., 2023). Plantain flour has further gained relevance as a substitute for cereal-based flours in diverse culinary applications, including pasta, biscuits, and pancakes (Ngoh et al., 2020).

Despite their nutritional and economic importance, banana and plantain production in Nigeria remains constrained by low-quality planting materials and pest and disease pressures. Export data from the World Bank indicate that Nigeria exported 9,660 kg of bananas and plantains valued at \$18.78 thousand in 2022, which increased to 75,146 kg valued at \$115.72 thousand in 2023 (World Integrated Trade Solution [WITS], 2022). However, these figures remain low compared to global export standards, reflecting challenges in production and market competitiveness. Key constraints include nematodes, banana weevils, and foliar diseases such as black leaf streak caused by *Mycosphaerella fijiensis* and other *Sigatoka* diseases. These biotic stresses reduce sucker quality and limit productivity, thereby affecting both local consumption and international trade. Addressing these challenges requires innovative propagation techniques and agronomic interventions to ensure the availability of healthy, disease-free planting materials.

Macro-propagation has emerged as a practical alternative to conventional propagation methods, offering rapid multiplication of pest-free and genetically uniform plantlets. In vitro macro-propagation exploits the regenerative potential of corms by repressing apical meristem activity and stimulating lateral bud development, often using substrates such as sawdust (Kindimba & Msogoya, 2014; Sajith et al., 2016). Techniques such as bud manipulation combined with benzylaminopurine (BAP) at 40.0 mg L⁻¹ have been shown to enhance propagation efficiency (Thiemele et al., 2015). In addition, agrochemicals such as Digro and Supergro are marketed as growth stimulants that supply macro- and micronutrients, improve plant vigor, and enhance resistance to disease outbreaks. Against this background, the present study aimed to evaluate the response of *Musa* spp. cultivars to Digro and Supergro during in vivo macro-propagation, with particular emphasis on plantlet survival, growth performance, and the potential of these agrochemicals to improve propagation efficiency.

MATERIALS AND METHODS

The study was conducted at a farmer's site in Erho-Abraka, Delta State, Nigeria (6°00'–6°15' E; 5°45'–5°50' N), from August 2 to November 5, 2025. The experimental site was manually cleared of vegetation, and a nursery shade (2.7 m high) was constructed using bamboo wood and palm fronds to reduce solar radiation by approximately 50%. Perforated plastic bowls (35 cm deep × 120 cm wide) served as propagators, each lined with a basal layer of 10 cm river sand and topped with 20 cm sawdust derived from light-colored wood. The nursery floor was covered with dark polythene sheets to prevent direct soil contact. Corms of two plantain cultivars (Hex Agbagba, FHIA 20) and one banana cultivar (FHIA 23) were obtained from the Agricultural Development Programme (ADP), Oko-ogba, Benin City, Edo State. Roots and leaf sheaths were removed, buds exposed, and apical dominance suppressed by cross-cutting. The corms were sterilized in a neem leaf extract-fungicide solution for 20 minutes, air-dried under shade for 72 hours, and subsequently buried in pairs within propagators, covered with 5 cm sawdust. Watering (2 L per propagator) was performed 24 hours after planting, followed by weekly applications of Supergro (1 ml/L), Digro (50 ml/15 L), or water (control). Weeding was conducted at three-week intervals, and plantlets reaching the three-leaf stage were transplanted into compost-filled polythene bags under shade.

The experiment was arranged in a 3 × 3 factorial design and laid out as a Completely Randomized Design (CRD) with three replications. Morphological data collected included days to sprouting, number of sprouted buds, shoots per corm, leaves per shoot, shoot height, sucker collar girth, leaves per sucker, roots per plantlet, and total plantlets per corm. Measurements were taken at defined intervals (e.g., leaf counts at the 5th and 7th weeks) using direct observation and measuring tape where applicable. Data were subjected to analysis of variance (ANOVA) using Genstat statistical package version 12, and treatment means were separated with Fisher's Least Significant Difference (LSD) test at the appropriate level of significance.

RESULTS AND DISCUSSION

The response of the three *Musa* spp. cultivars (Hex Agbagba, FHIA 20, and FHIA 23) to Digro, Supergro, and control treatments revealed significant differences across several growth parameters (Table 1).

Table 1. The Response of the three cultivars *Musa spp.* to Digrow , Supergrow and Control

Treatment	Average weight of sucker (kg)	Days of first sprout	Number of sprouted buds	Shoot height (cm)	Shoot collar girth (cm)	Number of leaves	Number of root	Number of shoot per corm	Number of plantlet	Number of plantlet per corm	Survived plantlet	Survival percentage (%)
Agro chemicals (A)												
Digro	0.56	9.4	2.89	30.2	10.46	3.89	2.44	2.89	2.89	1.67	2.44	94.0
Supergro	0.39	19.7	3.16	41.2	12.18	5.61	4.44	3.16	2.84	1.33	2.84	100.0
Control	0.47	16.9	4.78	28.7	10.40	4.17	2.39	4.78	4.78	2.33	4.50	96.7
Significant	*	n.s	n.s	n.s	n.s	*	n.s	n.s	n.s	n.s	n.s	n.s
LSD	0.12					1.25						
Cultivars (Cv)												
FHIA20	0.20	16.3	3.00	24.8	7.79	4.83	2.83	3.00	2.67	1.33	2.50	97.6
FHIA 23	0.93	17.1	5.11	47.8	15.82	4.89	4.11	5.11	5.11	2.44	4.67	94.0
HEX	0.29	12.6	2.72	27.5	9.43	3.94	2.33	2.72	2.72	1.56	2.61	99.1
AGBAGBA												
Significant	**	n.s	n.s	*	**	n.s	n.s	n.s	n.s	n.s	n.s	n.s
LSD	0.12			18.85	4.80							
AxCv												
Significant	**	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s
LSD	0.21											

*, ** significant 0.05 and 0.01 level probability, respectively

Agrochemical treatments significantly influenced average weight, number of leaves, and shoot collar girth, while other parameters showed no significant differences. Cultivars differed significantly only in average weight, with Hex Agbagba recording the highest survival percentage (99.1%), followed by FHIA 20 (97.6%) and FHIA 23 (94.0%). Among agrochemical treatments, Supergro produced the highest survival percentage (100%), followed by the control (96.7%) and Digro (94.0%). FHIA 23 exhibited greater collar girth under Supergro treatment, a trend consistent across cultivars though with varying magnitudes.

Interaction effects between agrochemicals and cultivars were highly significant for average weight (LSD = 0.21), days to first sprout, number of sprouted buds, number of leaves, and survival percentage. Control and FHIA 23 produced the highest number of plantlets (4.78 and 5.11, respectively), while Digro (2.89) and Supergro (2.84) yielded fewer. Root production varied across treatments, with Supergro (4.44) outperforming Digro (2.44) and control (2.39). Similarly, FHIA 20 produced the highest number of roots (4.11), followed by Hex Agbagba (2.83) and FHIA 23 (2.33).

Table 2. Correlation data for three *Musa spp* cultivars

	Average weight (1)	Days of first sprout (2)	Number of sprouted buds per corm (3)	Number of leaves (4)	Number of plantlet (5)	Number of plantlet per corm (6)	Number of root (7)	Number of shoot per corm (8)	Shoot collar girth (9)	Shoot height (10)	Survival percentage (11)	Survived plant (12)
1	-											
2	-0.05											
3	0.37	0.05										
4	0.05	0.70**	-0.18									
5	0.38	0.03	0.10**	-0.20								
6	0.34	-0.07	0.97**	-0.29	0.98**							
7	0.39	0.02	0.01	0.13	0.00	-0.07						
8	0.37	0.05	1.00**	-0.18	0.10**	0.97**	0.01					
9	0.60**	0.44	0.25	0.54*	0.27	0.24	0.36	0.25				
10	0.52*	0.33	0.17	0.59**	0.18	0.13	0.44	0.17	0.88**			
11	-0.33	-0.09	-0.57**	-0.02	-0.58**	-0.60**	0.24	-0.57**	-0.35	-0.17		
12	0.35	0.01	0.97**	-0.22	0.97**	0.93**	0.08	0.97**	0.20	0.16	-0.37	-

*, ** significant 0.05 and 0.01 level probability, respectively

Correlation analysis revealed highly significant associations between average weight and shoot collar girth, sprouted buds and plantlet production, number of leaves with shoot collar girth and height, and plantlet number with survival percentage. However, shoot height and survival percentage showed no significant relationship, nor did average corm weight with parameters such as sprouting time, bud number, or root count (Table 2).

These findings demonstrate that cultivars responded differently to agrochemical treatments, with Supergro enhancing vegetative traits such as leaf number, shoot height, collar girth, and survival percentage. Digro, however, promoted higher plantlet production, likely due to its hormonal composition (auxins, cytokinins, and gibberellins) that synergistically stimulate cell division and differentiation (O'Dell, 2003). The superior performance of Supergro in vegetative parameters aligns with earlier report by Emede et al. (2018), who observed enhanced leaf number and girth in cucumber under Supergro application. Supergro's surfactant properties facilitate nutrient absorption, reduce water loss, and improve soil penetration, thereby promoting vigorous growth and higher survival rates (Vinuj Kumar et al., 2013; Emede et al., 2018).

Overall, while Digro enhanced plantlet multiplication, Supergro provided superior vegetative growth and survival advantages. The significant differences in average weight among cultivars and their interaction with agrochemicals highlight the importance of cultivar-specific responses in optimizing propagation strategies. These results suggest that integrating Supergro for survival and vigor with Digro for multiplication could provide a balanced approach to improving *Musa* spp. propagation efficiency.

CONCLUSION

The response of the various cultivars with or without agrochemicals varied during the experiment, using cultivars under control to compare with those of Supergro and Digro. This could have also influenced plantlet performance when agrochemicals were applied. However, the effect of these agrochemicals was highly significant when interacting with cultivars. This implies that the application of these agrochemicals can boost plantlet production with respect to the types of cultivars used. Although the result from each cultivar will vary due to individual cultivar attributes and genetic makeup, the effect of agrochemicals will still be highly significant when used on plantlet production. This implies that the use of these agrochemicals should be encouraged among farmers.

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AUTHOR CONTRIBUTIONS

T.G. Ajiboye: Investigation, Conceptualization, Writing original draft, Review and editing.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Not Applicable

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Not Applicable

AVAILABILITY OF DATA AND MATERIALS

There is no data used for this review study.

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