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Productivity and economic performance of different sources of dwarf Saba banana planting materials under field condition

Jimson S. Ramirez*

Isabela State University, Echague, Isabela

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Key words: Dwarf saba, Macropropagated bananas, Planting materials, Suckers, Tissue-cultured bananas

Abstract

The study evaluates the productivity and economic performance of different sources of dwarf Saba banana planting materials under field conditions. Three different sources of planting materials were used in the study: banana suckers, tissue-cultured bananas, and macropropagated banana plantlets. Growth and yield parameters of dwarf Saba banana were observed and analyzed using a Randomized Complete Block Design (RCBD) design. Results show that different sources of planting materials significantly shortened the number of days from planting to shoots ($p<0.01$) and harvest ($p<0.01$), increased the number of hands per bunch ($p<0.05$), produced the heaviest hand weight per bunch ($p<0.01$), and total bunch weight ($p<0.01$). Moreover, in terms of economic performance, the macropropagated dwarf Saba banana plantlets recorded the highest ROI among the different sources of dwarf Saba banana planting materials used. The findings also suggest that macropropagated dwarf Saba banana performs as well as tissue cultured banana under field conditions and prove the possibility of using macropropagated plantlets as an alternative to tissue cultured planting materials for enhancing yield in dwarf Saba banana cultivars.

***Corresponding Author:** Jimson S. Ramirez ✉ j622.ramirez@gmail.com

Introduction

Banana is the most important fruit crop in the Philippines, constituting a significant portion of the country's export revenue. It is one of the important sources of food in the rural areas where Saba banana, in particular, is frequently used to extend, supplement, or substitute staple foods such as rice and corn. In the Philippines, the current cultivars used are Saba and Cardaba. These cultivars are tall, bear fruit for almost two years, and are susceptible to bugtok and Moko diseases. Today, the ISU tissue culture laboratory is now propagating a dwarf version of the Saba banana. This Saba Banana cultivar with short stature is typhoon resistant compared to the other local cultivars because of its height and has a much shorter growing period. It also bears its fruit earlier, increasing yields and resistance to major pests and diseases. This would increase the productivity of the farms to be planted with varieties of dwarf Saba banana.

Banana plantlets can now be propagated using a macropropagation technique. Macropropagation is a cost-effective seedling production technology that addresses the gap in the availability of affordable healthy planting bananas. This leads to high-quality and affordable banana seedlings. The technique is inexpensive, and materials for this method can be sourced locally. Macropropagation relies on a simple and cost-effective methodology that can be easily implemented with good training and few resources. Moreover, macropropagation methods of banana seedling propagation has the potential to increase access to affordable, high-quality planting materials to enhance the banana production of smallholder banana farmers.

A large number of quality planting materials can be made available by the tissue culture technique. However, it is too expensive and not affordable for small and marginal farmers. Under the above circumstances, macropropagated banana planting materials have been advocated as an effective alternative planting material for tissue culture in enhancing banana production. Therefore, this study was conducted to assess the productivity and economic performance of these macropropagated banana plantlets in the field as compared to tissue culture, conventional planting materials, or banana suckers.

Materials and methods

Location of the Study

This study was conducted at the Research Experimental Area, Research Department, Isabela State University, Echague, Isabela.

Land preparation

Ploughing and harrowing were done in double passing using a tractor. Lay outing and staking of the plantation were done following the recommended planting distance (4m by 4m) between hills and rows.

Source of Planting Materials

A Dwarf Saba banana cultivar was used in this study. Banana seedlings or plantlets derived from different propagation methods such as suckers, tissue-culture, and macropropagation were used as planting materials in this study. Healthy sword suckers were collected in the field while macropropagated banana seedlings were taken from the banana nursery of the Research Department. Moreover, the tissue-culture banana seedlings used in this study were taken from the ISU Banana Tissue Culture Laboratory.

Field Planting

Banana seedlings of the dwarf Saba banana cultivar derived from different propagation methods were planted in the research experimental area. Banana seedlings (suckers, macropropagated, and tissue-culture) with an average height of 0.5 meters were planted in the field at 4 m by 4 m spacing. Vermicast and urea were applied per plant during planting.

Cultural Requirements and Management of Bananas

This study followed the recommended good agricultural practices (GAP) and integrated crop management (ICM) on banana production from the ISU Package of Technology (POT) on Banana.

Growth and Yield Measurements

Banana plants from each treatment were randomly selected and tagged for identification. The number of days between planting and the first shooting was recorded. The number of leaves at the time of shooting and at the time of harvest was determined. Lastly, the yield characteristics of different sources of planting materials of dwarf saba banana were examined at the time of harvest.

Experimental Layout and Design

All data gathered was recorded, tabulated, and analyzed following the Randomized Complete Block Design (RCBD) with three replications. The gathered data was also subjected to an Analysis of Variance (ANOVA) using the software Statistical Tool for Agricultural Research (STAR). Treatments with significant results were compared using the Least Significant Difference (LSD).

Results and discussions

Common diseases of bananas were slightly observed, particularly during the vegetative stage of the banana. However, these diseases did not cause any significant damage because they were immediately controlled following the protocol for disease management on banana package of technology (POT).

Growth Characteristics of Banana

The growth characteristics of bananas were assessed by measuring the following parameters: pseudostem height, pseudostem girth, number of leaves at shooting and number of leaves at harvest. The result showed that different sources of planting materials did not significantly affect all the parameters tested, as shown in Figure 1. However, tissue cultured and macropropagated bananas grew taller and their pseudostem girth circumference increased faster than the sucker derived plants.

In terms of the number of leaves, a greater number of leaves present at the shooting stage were observed in tissue-cultured banana, followed by macropropagated bananas, and banana suckers, with a mean of 9.83, 9.76, and 8.61, respectively. Moreover, at harvest stage, macropropagated bananas produced more leaves with a mean of 9.10, while banana suckers produced the lowest number of leaves with 8.33. Overall, bananas planted using tissue-cultured and macropropagated banana plantlets performed better compared to bananas planted using banana suckers. This is because tissue cultured and macropropagated banana plantlets develop their rhizome faster as compared to the banana suckers.

Banana suckers slowly develop or heal their injured rhizome that they obtained during the process of desuckering.

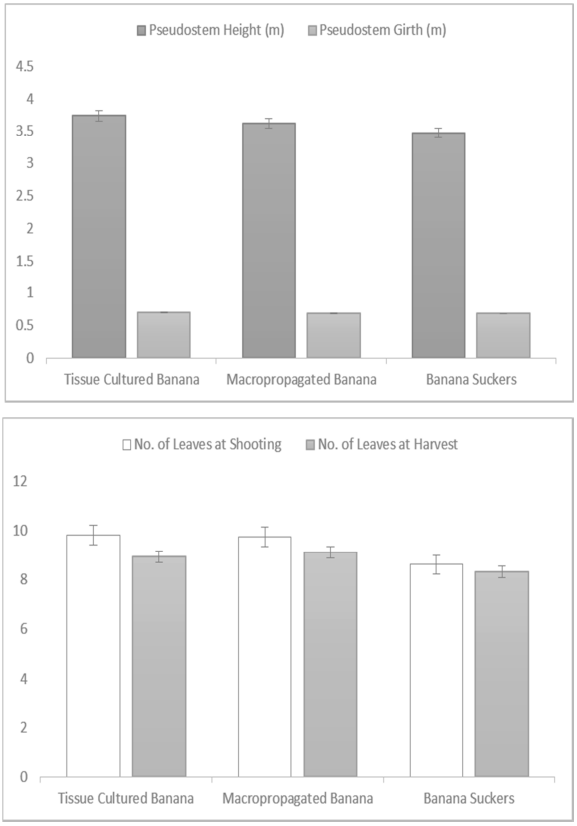

Fig. 1. Growth components of dwarf Saba banana planting materials.

Yield Characteristics of Banana

The yield characteristics of dwarf saba bananas planted using different sources of planting materials are presented in Figure 2. In terms of yield produced, results showed that different sources of planting materials significantly affect the different yield parameters of dwarf saba banana, such as the number of days to shooting ($p<0.01$), the number of days to harvest ($p<0.01$), the number of hands per bunch ($p<0.05$), hand weight ($p<0.05$) and bunch weight ($p<0.01$). As expected, bananas planted using tissue culture as planting materials shoot earlier as compared to the other sources of planting materials. Tissue cultured banana shoots are earlier at 283.90 days, followed by the macropropagated banana and banana suckers at 292.60 days and 297.03 days, respectively.

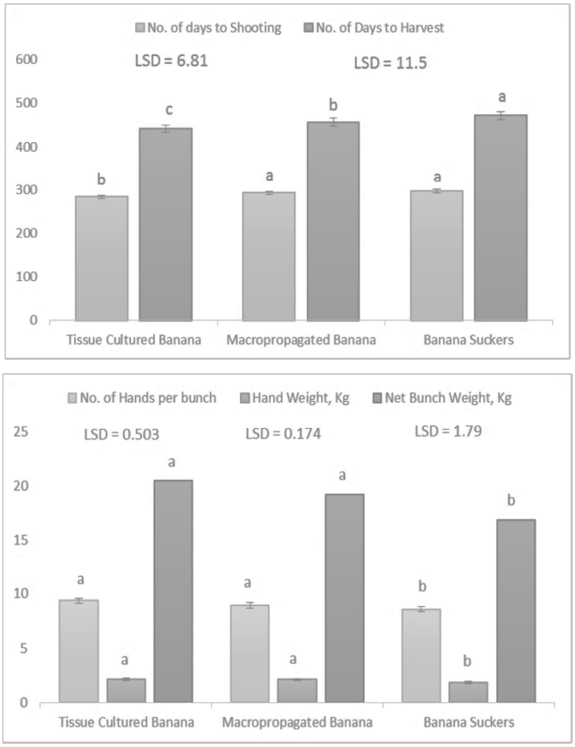

Fig. 2. Yield components of dwarf saba banana.

Tissue cultured bananas performed significantly better among the different sources of planting materials used. Tissue cultured bananas gave the shortest days to harvest with 441.56 days, followed by the macropropagated banana with 456.73 days and banana suckers with 471.90 days. Furthermore, tissue cultured bananas also gave a higher yield as compared to other sources of planting materials. Results showed that tissue cultured bananas recorded the heaviest bunch weight of 20.49 kg, followed by the macropropagated banana and banana suckers with 19.20 kg and 16.85 kg, respectively.

Cost and Return Analysis

Table 1 shows the simple cost and return analysis of the different sources of planting materials used in 1-hectare dwarf saba banana production.

The simple cost and return analysis of the study showed that after deducting the total cost of production from the gross income, the production of dwarf saba banana using macropropagated banana plantlets got the highest ROI of 135.18%, followed by tissue cultured plantlets with 82.01%, and banana suckers with 69.78%.

Table 1. Simple Cost and Return Analysis of One (1) Hectare Dwarf Saba Banana Production.

Activities	Tissue cultured plantlets	Macro propagated plantlets	Banana suckers
Labor Cost (Land prep., fertilizer, planting, harvesting, Others expenses)	44,275.00	44,275.00	44,275.00
Material Inputs (Plantlets cost, fertilizer, etc.)	166,803.00	108,803.00	141,803.00
Total Cost of Production	211,078.00	153,078.00	186,078.00
Gross Income (Harvest)	384,187.50	360,000.00	315,937.50
Net Income	173,109.50	206,922.00	129,859.50
ROI	82.01	135.18	69.78

Conclusion

The growth and yield advantages of the tissue cultured banana over the other sources of planting materials are very impressive. However, aside from the tissue cultured banana, the macropropagated banana also performed well under the field conditions as illustrated in this study. Moreover, this study also proves that macropropagated plantlets can be used as a low-cost alternative to tissue-cultured planting materials in banana production. Lastly, the study also revealed that the macropropagated dwarf saba banana is more profitable to farmers than other sources of planting materials. Therefore, banana farmers should be encouraged to adopt macropropagated banana plantlets as a source of planting materials to get a higher yields and profits.

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