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Cocowater as a growth promoter of Banana in macropropagation technique

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Key words: Banana, Cocowater, Drenching, Macropropagation, Soaking

Abstract

The study was conducted to evaluate the effects of different application methods of cocowater solution on banana corms using the macropropagation technique. Using a Complete Randomized Design (CRD), four treatments (T_0-control or no application, T_1-corm soaking, T_2-drenching, and T_3-corm soaking+drenching) were tested and analyzed. Results showed that banana corms applied with different methods of cocowater application significantly shortened the number of days to shoot after planting ($p<0.01$), increased the number of shoots produced per corm ($p<0.01$) and increased the size of shoot collar diameter ($p<0.01$). Furthermore, results also showed that the banana macropropagation technique combined with cocowater solution is effective to produce inexpensive but quality and healthy banana planting materials for banana production.

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Introduction

The main production constraint for bananas is the availability of disease-free and affordable banana seedlings. The traditional production of suckers in the field is inadequate to meet the demand, especially of large scale plantations. While tissue culture techniques are relatively expensive and not readily accessible by small hold farmers. In response to these constraints, an affordable and streamlined process for seedling production was considered.

Macropropagation is an alternative technique to in-vitro propagation. Banana macropropagation is the process of propagating bananas from a single corm to generate more clean and healthy planting materials rapidly and in a short period of time. A single banana corm could produce many new shoots in a short period of time, especially when corms are induced chemically by pouring or soaking them in synthetic plant growth hormone such as Benzylaminopurine (BAP) or GA3 solution. These synthetic plant growth hormones are synthetic cytokinins that are commonly used in tissue culture techniques for stimulating the growth of auxiliary and adventitious buds and foliar development of shoots.

As a result, chemical induction promotes the sprouting of lateral buds by breaking apical dominances. However, using commercial synthetic plant growth hormone is expensive. Therefore, substituting expensive chemical nutrients with low-cost natural extracts is important. One of the effective alternatives to these commercially available synthetic hormones that can be used in the macropropagation of banana is coconut water or coconut juice, which can be extracted from the coconut fruit. This is possible because coconut water is naturally rich in cytokinins, auxins, and gibberellins, which are key elements in shoot and root proliferation in plants.

Materials and methods

Location of the Study

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

Selection and Preparation of Banana Corms

Corms of the dwarf Saba banana cultivar were used in this study. Healthy sword suckers or maiden suckers were selected and extracted from the mother plants for macropropagation. Corms of recently harvested banana plants that have good yielding characteristics were also selected. Furthermore, banana suckers with uniform weight and size were used in the study.

Preparation and Application of Cocowater Solution (CWS)

The cocowater solution was prepared in an appropriate container. Fresh cocowater from the fresh or young coconut fruit was used as the source of natural plant growth hormone. The cocowater was mixed with water at a ratio of 25:1000, or 25 ml of cocowater per liter of water. The derived solution was applied to the corms through the soaking method, the drenching method, and a combination of both methods. In the soaking method, banana corms were soaked in the cocowater solution for 24 hours. After soaking, the corms were planted into the prepared propagators. In the drenching method, the cocowater solution was added directly to the base of the corm. After planting, continuous application of cocowater solution at a rate of 350 ml per corm was also done weekly through the drenching method.

Culture and Management

Watering was done immediately after planting the corms. Subsequent watering was conducted intermittently to maintain the moist or high humidity. Moreover, application of recommended fertilizer was applied once a month to enhance the growth of plantlets. Spraying of insecticides, including manual weeding, was also done as often as necessary to prevent insect pests and maintain the sanitation of the experimental area.

Growth Measurements

Plants from each treatment were randomly selected and tagged for identification. Plant responses to treatments were measured by means of the number of days to produce shoots after planting, the number of healthy and quality banana shoots produced, shoot height (cm), shoot stem diameter (cm) and leaf area (cm^2).

Experimental Layout and Design

All data gathered was recorded, tabulated, and analyzed following the Complete Randomized Design (CRD). The gathered data was also subjected to Analysis of Variance (ANOVA) using the software Statistical Tool for Agricultural Research (STAR). Treatments with significant results were compared using the Tukey's Honestly Significant Difference (Tukey's HSD) to test differences among sample means.

Results and discussions

All banana plantlets derived from the experiment were all normal in terms of the leaf shape, leaf color, leaf habit and pseudostem color based on physical observation. Additionally, a total of 1,350 healthy and disease-free banana plantlets were obtained from the study. No occurrence of insect pests or diseases was recorded throughout the duration of the study.

Number of Days to Produce Shoots

The effect of CWS on bananas in terms of the number of days to emerge is presented in Fig. 1. Results showed that the different application methods of CWS had a very high significant influence (P≤0.01) on the number of days from banana corm sowing to shoot emergence. Corms applied with CWS through the soaking+drenching method recorded the shortest days to emergence, with mean values of 31.34 days.

This was followed by corms soaked in CWS and the drenching method with 31.92 days and 33.07 days, respectively. Moreover, corms on control or no CWS application take more days to produce banana shoots. Furthermore, results also showed that CWS application has a notable influence on banana corms, especially in various plant activities that help to shorten the number of days to produce shoots after planting. This is because of the large amount of CWS or natural plant growth solution uptake, particularly on corms subjected to the soaking+drenching method of CWS application that provides sufficient nutrients for cell growth that leads to early shoot emergence.

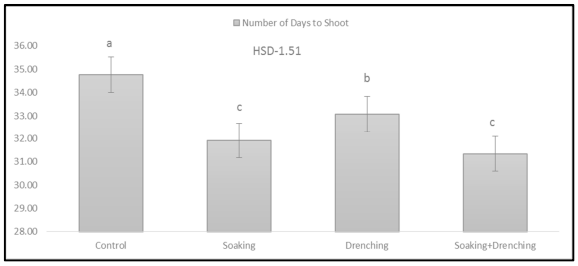

Fig. 1. Number of days to emerge as influenced by CWS application.

Number of Shoots Produced per Corm

Fig. 2 shows the number of shoots produced per corm as affected by different CWS applications. The number of healthy and quality banana shoots produced per corm was significantly increased (P≤0.01) when CWS was applied. The result showed that corms applied with CWS through the soaking+drenching method produced a higher number of healthy shoots, 14.37 counts.

This was followed by corms applied with CWS through soaking and drenching menthod with mean values of 13.61 and 12.30, respectively. Moreover, control or no CWS application produced the least number of banana shoots with 10.23 counts. As expected, corms applied with a combination of soaking and drenching method produced the largest number of shoots compared with other treatments.

This is due to the amount or concentration of CWS that is greatly absorbed by the banana corms. The corms subjected to the soaking+drenching method of CWS application obviously absorbed more cocowater solution, which helps the corms to induce proliferation and production of shoots.

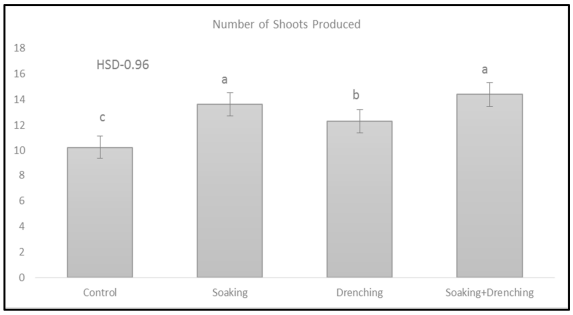

Fig. 2. Number of shoots produced per corm as influenced by CWS application.

Shoots Height

Fig. 3 depicts the effect of CWS application on banana shoot height. Results showed that corms applied with CWS significantly influenced (P≤0.01) the height of banana shoot. However, treatments under control produced the highest shoot height with 36.31 cm. This was followed by the soaking method with 34.42 cm and the drenching method with 32.51 cm. The shortest banana shoot height was found on the soaking+drenching method at 31.86 cm. The increase or decrease in the size of shoot height corresponds well with the number of shoots produced. The lower the number of shoots produced, the larger the size of the shoot produced. This result is due to the reduction in competition among the shoots for resources such as water, light, and nutrients coming from the natural plant growth solution applied that induces growth and development of banana plantlets. Moreover, the results also showed that corm shoots grow laterally instead of vertically, producing a greater number of shoots.

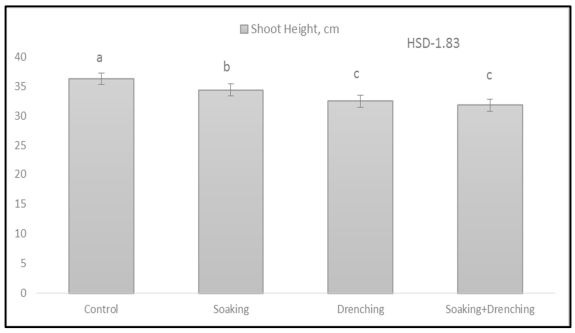

Fig. 3. Shoot height per corm as influenced by CWS application.

Shoot Stem Girth

The effect of CWS on the shoot stem girth was presented in Fig. 4. The shoot stem girth of the corm was significantly increased (P≤0.01) by CWS application. Banana corms applied with CWS through the soaking+drenching method recorded the largest size of stem girth diameter, with a mean value of 2.87 cm. This was followed by banana corms applied with CWS through the drenching method and the soaking method with 2.56 cm and 2.33 cm, respectively. The smallest size of stem girth diameter was found on the banana corms applied with no CWS application. Banana corms applied with CWS, particularly through the soaking+drenching method, produced a large size of stem girth due to the higher concentration of CWS absorbed by the corms that helps the corm to induce growth and development of banana plantlets.

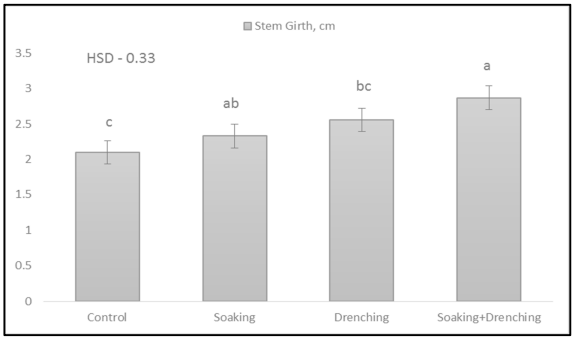

Fig. 4. Stem girth of shoots produced per corm as influenced by CWS application.

Leaf Area

The effect of CWS application on the leaf area of banana corm is shown in Fig. 5. Different methods of CWS application on banana corm insignificantly affect the leaf area of the banana plantlets produced, with mean values ranging from 312.19 cm2 to 521.60 cm2. However, it was observed that leaf area followed the trend observed in the size of stem girth diameter of banana shoots produced. Banana corms that obtain a greater size of stem girth diameter produce the largest size of leaf area. This was due to the more vigorous corm shoots generated from the banana corm applied with a different method of CWS application.

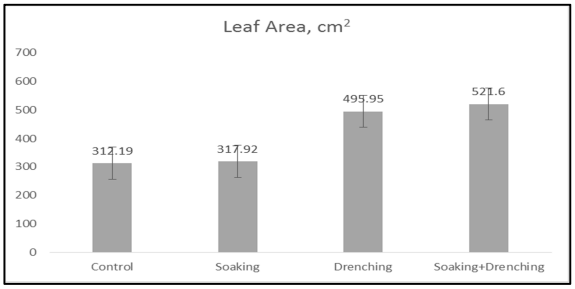

Fig. 5. Leaf area of shoots produced per corm as influenced by CWS application.

Conclusion

The overall results obtained in the study showed that banana corms applied with different methods of CWS application generally enhance and improve the production of quality and quantity of banana plantlets

in a short period of time. In general, the treatment soaking+drenching method of CWS application proved to be more effective than other treatments used. Therefore, it is the most recommended protocol for the macropropagation of bananas, particularly the dwarf Saba banana cultivar, in producing quality and healthy banana planting materials.

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