

## Use of banana seedlings from tissue culture and vegetative propagation in orchard cultivation.

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### ABSTRACT

Banana seedlings in general are highly perishable in nurseries due to the cultivating time. Seedlings that stay for a long period of time in nurseries are considered inappropriate for planting. However such seedlings could be used for family farming. With that in mind, the production of bananas from rhizomes of banana trees grown from seedlings and micro propagated seedlings within 210 days of cultivation was studied. The varieties used in this study were Grand Nain and Thap Maeo both in their first production cycle. In 2010 the subject plants were planted with 3 x 3 meters of space between them, equivalent to 1,111 ha<sup>-1</sup> plants randomly planted in six repetitions in each group of five plants. The harvest began 510 days post-planting. It was observed that the production was significantly higher for the rhizomes seedlings for the two varieties (30.1 kg for Thap Maeo and 34.5 kg for Grand Nain) which was verified by weighing the bunches. Nevertheless, taking advantage of micro propagated seedlings that are classified as disposable is still a possibility. Overall it was noticed that the Grand Nain variety exceeded Tap Maeo within the analyzed parameters.

**Keywords:** fruit growing; management; disposal.

## Uso de mudas de bananeiras provenientes da cultura de tecido e propagação vegetativa na instalação de pomar.

### RESUMO

Mudas de bananeiras são insumos de alta perecibilidade em viveiros devido ao tempo de cultivo. Se as mudas passam por longo período no viveiro são consideradas descarte. No entanto poderiam ser aproveitadas em projetos de agricultura familiar. Diante disso estudou-se a produção de bananas provenientes de plantas de mudas de rizomas obtidas de touceiras e micropropagadas com 210 dias de viveiro caracterizadas como descarte. Foram usadas também as variedades, Grand Naine e Thap Maeo, ambas em seu primeiro ciclo produtivo. As mudas foram plantadas em 2010 com espaçamento de 3 x 3 metros, equivalente a 1.111 plantas ha<sup>-1</sup>, em blocos ao acaso com seis repetições de cinco plantas. A colheita iniciou-se aos 510 dias pós-plantio. A produção foi significativamente superior para mudas de rizomas das duas variedades (30,1 Kg para Thap Maeo e 34,5 Kg para Grand Naine) explicada pelo peso dos cachos, ainda assim na implantação da cultura considera-se possível o aproveitamento das mudas micropropagadas de descarte. De modo geral a variedade Grand Naine foi superior a variedade Thap Maeo para os parâmetros analisados.

**Palavras-chave:** fruticultura; manejo; descarte.

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**Recebido em:** 14 abr. 2015

**Aceito em:** 20 jun. 2015

**Editor responsável:** Prof. Dr. Guilherme Malafaia

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## INTRODUCTION

Banana (*Musa* spp.) is one of the most cultivated fruits in the tropical regions of the world. India is the world's largest banana producer followed by Brazil, Ecuador, the Philippines and China (FAO, 2014). Brazil has a highlighted presence in the world market, however in order to achieve a better position exporting bananas, Brazil needs to improve management of its banana plantations, which in many places seems to be a challenge due to low investments in technology and inadequate pest control.

The changes should begin with new plantations and greater care regarding banana seedlings in order to grow plants of proven quality. Banana seedlings are traditionally produced by multiplying rhizomes (Alves, 1997, Alvares & Caldas, 2002). This system of seedling production has its weaknesses, which delay the production. One related issue is the spread of diseases such as *Fusarium oxysporum* (also known as Panama disease), *Haustonia solanacearum*, *Mycosphaerella fijiensis* var. *difformis*, nematodes and the *Cosmopolites sordidus*.

Thus since 1980 several farmers have adopted the use of seedlings cultivated by tissue cultures taken from new plantations. The tissue culture allows the production of a higher quantity, uniformity and quality of plants. Hence, the number of micro propagated banana seedlings rises up to 150-300 seedlings per explant, within 6 to 8 months (Borges et al. 1997), which makes it possible to better use the space and produce higher quality plants, simplifying transport, and yields greater uniformity in treatment culture and cultural booth (Borges et al. 1997). This is a highly perishable seedling however, because of the time frame for cultivation. Micro propagated seedlings take approximately 120 days to mature from the initial planting of the apical bud until the point of transplanting (Borges et al. 1997, Souza et al. 1999).

In the properties of the called family farming, the micro propagated seedling is very useful, since the farmer may have greater return on their banana production and superior quality of the seedlings obtained.

However, this kind of seedling requires additional care, especially during acclimatization (Pereira et al. 2005), due to high temperatures, sunlight intensity and air humidity. The fluctuation in production costs is another problem faced by banana farmers, since the seedling represents around 20% of the total cost when considering varieties of medium to large sized fruit (apple, Tropical, Silver and Mao Thap) and 23% of the

cost for small sized species (Nanica, Nanicão and Grand Naine) (CEASA/MS, 2008).

Faced with these problems to produce healthy bananas and high productivity, this study compares the development of bananas produced by micro propagated banana tree seedlings and by the traditional system.

## MATERIAL AND METHODS

The experiment was conducted at the Agricultural Development and Rural Extension Agency (CEPAER/AGRAER), located in Campo Grande, the capital of the state of Mato Grosso do Sul in Brazil, at 1.706 feet of altitude, coordinates S 20°25'12.6 and W 054°40'09. The experiment was performed in Oxisol soil.

The weather in this area, according to the Köppen climate classification system, is classified as a transition between Cfa (humid subtropical climate) and Aw (wet and dry tropical climate or savanna), tropical humid, with rainfall's annual average of 1500 mm. The dry period goes from May to September (Moreira, 1985).

The seedlings used for the study were of Grand Nain varieties (AAA, Cavendish subgroup) and Thap Mao (AAB), with two types of seedlings, traditional ones obtained from rhizome clumps from the trees in the AGRAER/CEPAER campus and, the micro propagated banana seedlings purchased from a seed company called Campo Biotecnologia Vegetal Ltda. (Campo Plant Biotechnology LLC) from the city Cruz das Almas, in Bahia state, Brazil.

The experiment was established by first spacing the plants 3 m x 3 m, totaling 1111 plants per hectare. The experimental design consisted of randomized groups of plants (2 x 2) with four treatments and six repetitions of each group of five plants. Two types of banana seedlings (produced by micro propagated rhizomes) combined with seedlings of two other varieties (Grand Nain-AAA and CAA-Thap Mao) were used for this study.

The fertilization was performed according to recommendations for production according to the local area. Herbicides, fungicides and insecticide application on the crop performed weed and pest control were conducted. Maintenance of shoots, removal of old leaves, shoring plants and harvesting heart shape were held at the appropriate time and proper seasons. For the assessment phase of the experiment, only the first cycle of production from the banana trees was considered. One bundle from each repetition group was collected summing up a total of 24 bundles. Each bundle was measured to obtain a total mass and total number of bananas in the bundle. Each bunch in the bundle was analyzed

regarding total number of bananas, total mass, and fruit dimension. As for the production index the criteria analyzed was the amount of bunches per bundle, the amount of bananas per bunch, and each banana was measured to verify its length, average diameter and mass.

The results were submitted to analysis of variance and the methods were compared by using the Tukey's range test with 5% probability using SAEG 9.1 software (SAEG, 2007).

## RESULTS AND DISCUSSIONS

The production obtained from micro propagated seedlings compared to production from rhizomes seedlings, for both varieties Grand Nain and Thap Maeo were significantly different, 14 % for Grand Nain and 9,5 % for Thap Maeo (See Table 1)

**Table 1.** Classification of production for the varieties Grand Nain and Thap Maeo.

Variables	Grand Nain (AAA)		Thap Maeo (AAB)	
	Micro propagated	Rhizome	Micro propagated	Rhizome
<b>Mass (g)</b>				
<b>Bundle</b>	31522.62 a	34491.45 a	26 408,43 b	30 123,62 a
<b>CV (%)</b>	11.8			
<b>Fruit</b>	193.5 a	194.0 a	120,0 b	132,2 b
<b>CV (%)</b>	22.00			
<b>Length (cm)</b>				
<b>Fruit</b>	21.22 a	22.89 a	16.27 b	16.98 b
<b>CV (%)</b>	14.6			
<b>Diameter (mm)</b>				
<b>Fruit</b>	40.82 a	40.68 a	38.58 b	40.63 a
<b>CV (%)</b>	3.6			
<b>Number</b>				
<b>Bunches</b>	9.7 a	10.2 a	12.0 a	11.7 a
<b>CV (%)</b>	16.5			
<b>Fruit Bundle<sup>-1</sup></b>	16.91 b	17.62 b	18.36 ab	19.65 a
<b>CV (%)</b>	9.4			
<b>Fruit Bunch<sup>-1</sup></b>	163.0 b	178.8 b	219.7 a	228.8 a
<b>CV (%)</b>	16.1			

CV: Variation Coefficient \*averages in lines in a row with the same letter do not differ among each other.

Scarpere Filho et al. (1998) observed similar results, when compared the performance of different types of plants in the first production cycle of the species Nanicão array (AAA). The authors observed that the propagation material influences the planting of banana trees and a high rate of somaclonal variations in seedlings. This variation may increase depending on the number of subcultures (Santos & Rodrigues, 2004).

The fruit from the variety Grand Nain (AAA) from both rhizomes and from micro propagated seedlings were those displaying the highest average weight with 193.5g and 194g respectively. This species also presents the highest average length per independent fruit (20 - 10 cm). Nomura et al. (2013) found similar results in fruit length when using micro propagated seedlings.

The average diameter of the fruit produced by Grand Nain banana (AAA) species from both micro propagation seedlings and from rhizomes, and the fruit produced from Thap Maeo from both sources also do not differ statistically. The same is observed for the number of cycles for each type of plant. The variety Thap Maeo presents 5% lower diameter than the fruit from micro propagated seedling, while for the variety Grand Nain the difference is not significant.

Regarding the number of fruit per bunch the variety Thap Maeo both from micro propagated and from rhizome presents better performance when compared to Grand Nain. However, when comparing the varieties, the Grand Naine showed a better harvest in most aspects when compared to Thap Maeo.

The variety Thap Maeo presents the greatest number of bananas per bunch and plants from rhizomes. The number of bananas from in vitro plants is an average between the Grand Nain and Thap Maeo seedling rhizomes (See Table 1).

The use of micro propagated seedlings for cultivation of bananas is already a reality in Brazil. However somaclonal variation (Alvares & Caldas, 2002, Santos & Rodrigues, 2004) and seedling acclimatization (Martins et al. 2011) are aspects that still need major adjustments.

## CONCLUSIONS

Seedlings from rhizomes show higher values of bunch mass and fruit diameter in Grand Nain in comparison to Thap Maeo. Generally the Grand Nain variety exceeded Tap Maeo in all the analyzed parameters.

## ACKNOWLEDGEMENTS

To The National Council for Scientific and Technological Development (CNPq). To Marcela Martins for their support in laboratory for analysis. To agriculture expert Luis and their team of AGRAER/CEPAER for offering the space and the support for this study.

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