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STUDIES ON HARDENING OFF METHODS AND STARTER CONTAINERS FOR GIANT CAVENDISH BANANA EXPLANTS SHIPPED INTO ST. CROIX, U.S.V.I.

C. Ramcharan [1/]

SUMMARY

Transplanting Giant Cavendish banana explants directly or indirectly at 3, 6 and 9 days into speeding and forestry planter trays were studied. A survival rate of 79 per cent and 83 per cent for direct transplants as compared with 89 - 96 per cent for delayed transplants were recorded. Although indirect transplanting overall produced better plantlets after 6 weeks, delayed transplanting for 3 and 6 days using forestry planter trays gave biggest and most vigorous plants. The relatively smaller exposed soil surface of the forestry trays reduced the chances of leaf/soil contact and so minimized the incidence of leaf rot. The vertically extended root space (1 1/3" x 4 3/4") of these trays also allowed for good drainage and plantlets developed elongated but extensive roots with sturdy stems.

INTRODUCTION

The importance of tissue culture as a method of rapid propagation of pest-free plants has been widely accepted (3, 5, 7). Although most of the application to this relatively new technique has been to major temperate and subtropical fruits (7), recently some major tropical fruits (1) have been propagated In Vitro, with good potential.

Although banana and plantains reproduce by vegetative suckers quite readily, the mass production of pest-free plantlets by cloning make In Vitro propagation important for large scale field production. In island situations like St. Croix,

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1/ Associate Horticulturist, V. I. Agricultural Experiment Station, Kingshill, St. Croix USVI.

USVI where strict quarantine regulations exist but with good air transportation connections, plantlets can be shipped in rapidly and started in shade houses for later distribution or for research purposes.

One critical stage in all tissue-culture operations is the hardening off and establishment of plantlets once they have left the laboratory. This is even more critical, when the establishment area is situated far away from center of clone production. Methods of acclimatization of propagules to new soil media and climatic condition (2, 4, 6) are essential for their subsequent survival. This study was undertaken to select a suitable method of transplanting and container for use in hardening off Giant Cavendish banana propagules shipped into St. Croix USVI.

MATERIALS AND METHODS

A 2 x 4 factorial experiment utilizing two types of commonly used greenhouse starter trays and four transplant intervals was initiated on August 6th, 1982. Giant Cavendish (Musa AAA) banana Stage 3 plantlets were shipped from Florida via U.S. mail and took approximately four days to arrive in St. Croix. Plantlets were immediately removed from shipping cartons but not from plastic containers with stock medium. One hundred (100) propagules were transplanted in each of the following methods:

1. Separated in luke-warm water and immediately transplanted to 5-cm dram cell speedling trays (SO).

2. Transplanted in bulk without separation to a 30 cm. square plastic flat containing terralite mix (a mixture of peat, perlite, vermiculite and micronutrients) and separated and retransplanted three days later to 5 cm diam cell speedling trays (S3).

3. Transplanted in bulk and retransplanted as in (2) six days later (S6).

4. Transplanted in bulk and retransplanted nine days later (S9).

5. Separated in luke-warm water and immediately transplanted to 3.3 cm x 11.9 cm cell forestry trays (FO).

6. Transplanted in bulk and retransplanted as in (2) three days later to forestry trays (F3).

7. Transplanted in bulk and retransplanted six days later (F6).

8. Transplanted in bulk and retransplanted nine days later (F9).

All containers were placed under 80 per cent shade and misted with an automatic intermittent mist system at approximately 6 seconds/10 mins. After two weeks plantlets were removed from mist and kept under 50 per cent shade. They were given a bi-weekly 20.20.20 liquid fertilizer treatment at 9.3 g/3.6L and sprayed as needed with Benlate and Ridomil. Six weeks later on September 20th 10 plants from each treatment were randomly selected and following data were recorded: plant height, leaf length and width, number of healthy leaves, stem fresh weight, root fresh weight, root volume and a visual grade on a 1 to 10 basis. Survival percentage was calculated on the basis of 100 plants in each combined treatment.

Data was analyzed by ANOVA and treatment means separated by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Survival percentage was quite high for all treatments except where propagules were transplanted directly into speedling (79%) or forestry trays (83%) (Table 2). Plants grew better in forestry trays, particularly after delayed separation of propagules for three to six days. (Table 1 and Fig. 1). Direct transplanting with immediate separation of propagules (SO) and (FO) did produce inferior plantlets. These treatments apparently did not allow enough time for acclimatization of plantlets to a new medium. Immediate separation of plants also caused breakage of tender roots and consequent loss of plants. If, however delayed separation was up to nine days, roots became too extensive, were difficult to separate and in the case of forestry trays (F9), were difficult to transplant so reducing overall growth performance of plantlets.

Direct transplanting also reduced the number of green healthy leaves per plant particularly with speedling trays (Table 2). Using forestry trays with delayed transplanting produced plantlets with most green leaves after six weeks. Delayed transplanting of nine days however reversed this trend

(Table 2, Fig. 1). Similar effects of container and transplant time were recorded on stem, root weight and root volume. Direct transplanting did not appear to reduce plant size and quality when forestry trays were used as compared with speedling containers. After six weeks growth, the overall appearance of plants in forestry trays was superior except for those with the nine day delayed transplant treatment. Plants growing in forestry trays with 3-6 days delayed transplant time were almost twice as high and wide as those immediately transplanted into speedling flats.

Although forestry trays permitted less root space the extended vertical structure of individual cells seemed to give better soil drainage and aeration. This reduced rhizosphere also allowed for better acclimatization of roots in initial stages; good drainage and aeration produced a better and more extensive root system of six week old plantlets. In the forestry trays plant roots developed a more elongated shape but root weights and volumes were larger than those of plants started in speedling flats. The smaller soil surface of forestry trays cells (3.3 cm vs 5 cm for speedling), effectively reduced chances of soil/leaf contact and consequent leaf rot so giving more plants with healthy green leaves. Smaller cells also meant a smaller quantity of synthetic mix required for transplanting. Overall smaller size of forestry container has added advantage of occupying less greenhouse space and producing more transplants per unit space.

Results of this investigation indicate that Giant Cavendish banana propagules, shipped from an overseas laboratory for a period of up to four days in transit, can be transplanted to a growing mix at a 80-96 per cent survival rate. Upon arrival packing cartons should be opened immediately but individual banana plantlets should not be separated and transplanted until three to six days later. During this time plantlets should be allowed to acclimatize to new growing medium. Immediate separation can also reduce survival percentage due to breakage of tender roots. Starter containers with reduced cell diameter but extended root area produce bigger plants with less diseased leaves. Forestry trays not only meet these cell requirements but are also more compact, convenient and require less synthetic soil mix for transplanting.

LITERATURE CITED

1. Berg, A. L; and Bustamante, M. 1974. Heat Treatment and Meristem Culture for the Production of Virus-Free Bananas. Phytopathology Vol. 64 (3) 320-22.

2. Brainerd, K. E.; and Fuchigami, L. H. 1981. Acclimatization of aseptically cultured apple plants to low relative humidity. J. Amer. Soc. Hort-Sci. 106: 515-18.

3. Gamborg, O. L., and Shyluk, J. P. 1981. Plant Tissue Culture Methods and Applications in Agriculture. Academic Press, N. Y.

4. Kyte, L., and Briggs, B. 1979. A simplified entry into tissue culture production. Proc. Int. Plant Prop. Soc. 29.

5. Langhans, R. W., Horst, K. R., and Earle, E. D. 1977. Disease-free Plants via Tissue Culture Propagation. Hort. Science, 12 (2) 149-150.

6. Poole, R. T., and Conover, C. A. 1983. Establishment and Growth of In Vitro-cultured Dieffenbachia. Hort. Science 18 (2): 185-187.

7. Proceedings of the conference on Nursery Production of Fruit Plants Through Tissue Culture - Applications and Feasibility, April 21-22, 1980 Beltsville, Maryland. USDA ARR-NE-11.

Table 1. Effects of Container and Transplant Time on Leaf Size and Plant Height of Giant Cavendish Banana Plantlets after 6 Weeks[z]

Treatments	Leaf Length	Leaf Width	Plant Height
		cms	
S 0	8.2 a	3.8a[y]	11.2 a
S 3	9.8 a	5.2 ab	14.3 ab
S 6	8.9 a	4.4 a	12.0 a
S 9	9.9 a	5.1 ab	14.5 ab
F 0	11.9 ab	5.4 ab	18.7 b
F 3	14.5 b	7.4 b	24.6 c
F 6	14.9 b	7.5 b	24.3 c
F 9	11.8 ab	5.8 ab	19.5 bc

[z] Each mean based on 10 plantlets randomly selected.

[y] Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. Effects of Container and Transplant Time on Percentage Survival, Appearance, Root and Stem Size of Giant Cavendish Plantlets after 6 Weeks[z]

Treatments	Survival %	No. Healthy Leaves	Root Volume (cc)	Stem Weight (gms)	Root Weight (gms)	Visual Grade (1-10)
S O	79[x]	3.1 a	4.5 a	3.4 a[y]	3.4 a	4.8 a
S 3	96	4.5 b	5.5 a	5.0 ab	4.0 a	5.7 ab
S 6	92	4.4 b	5.9 ab	4.4 a	3.8 a	5.6 ab
S 9	90	5.3 bc	7.4 b	6.4 b	5.0 b	6.6 b
F O	83	4.7 b	8.3 bc	5.0 ab	4.4 ab	6.2 b
F 3	92	5.4 bc	8.2 bc	8.4 c	5.1 b	6.2 b
F 6	92	5.6 c	9.5 c	9.0 c	6.8 c	6.8 b
F 9	89	4.1 ab	6.0 ab	6.2 b	5.5 b	4.9 a

z Each mean based on 10 plantlets randomly selected.

y Mean separation within columns by Duncan's multiple range test, 5% level.

x Based on 100 transplants.

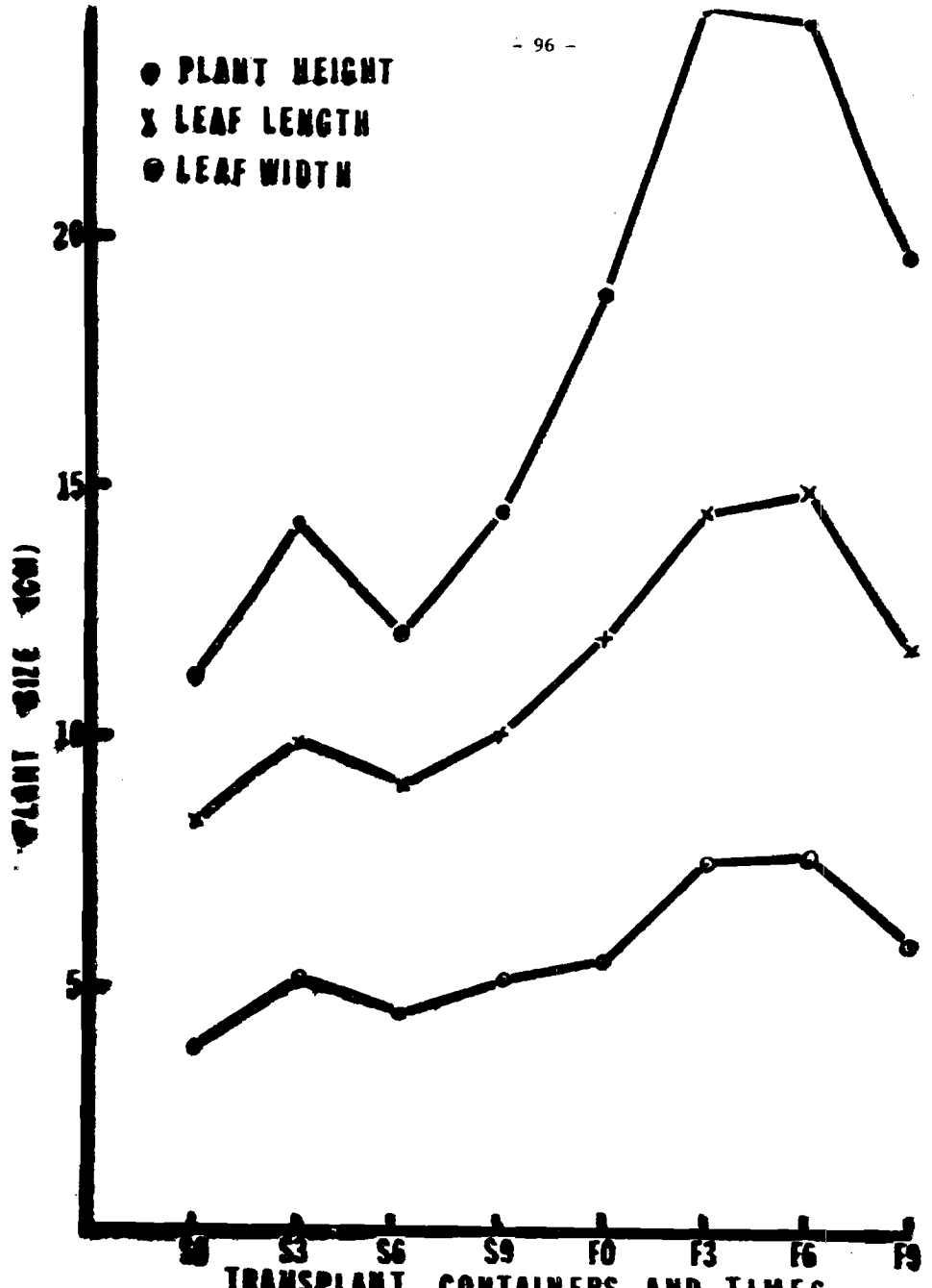

Fig. 1 Comparative growth of Giant Cavendish Banana plantlets using varying transplant time and containers.