

## GROWTH, FLOWERING AND YIELD POTENTIAL OF TISSUE CULTURE BANANA (*MUSA* AAB CV. NENDRAN)

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**Abstract:** The present experiment in split-split plot technique was laid out at the College of Agriculture, Vellayani during 1991-1993 to evaluate the growth, flowering and yield potential of tissue culture plants of Nendran banana *Musa* (AAB group) compared to plants from suckers. The initial establishment and early growth phase of tissue culture plants were comparable with that of the suckers. But their growth rate became faster during the later stages and ultimately they recorded an increase of 6.7 per cent in height, 11.92 per cent in girth and 3.35 leaves more than the plants from suckers. They showed less variability in time taken for flowering and recorded an increase in yield of 25.63 per cent compared to plants from suckers. The attributes responsible for the increase in yield were length of bunch, number of fingers and length and girth of finger.

**Key words:** Banana, flowering, growth, tissue culture, yield

### INTRODUCTION

In banana, the difficulty to obtain large number of uniform disease free plants with high yield potential by the conventional propagation of techniques is one of the major limiting factors in increasing productivity. Another important problem faced by the growers is the staggered flowering (variability in time of flowering). Tissue culture technology enabling the rapid production of a large quantity of uniform disease free plants from a single plant showing good genetic potential is gaining importance in recent days. There is difference in growth and physiology of tissue culture plants compared to plants from suckers especially at different developmental stages. It was thus essential to make a critical evaluation of such plants, especially of a leading commercial variety like Nendran under field conditions.

### MATERIAL AND METHODS

An experiment was laid out in split-split plot design with three replications at the College of Agriculture, Vellayani, Trivandrum, Kerala with the objective of comparing the growth, flowering and yield potential of tissue culture plants with that of plants raised from suckers. Two sets of tissue culture plants (2.5 and 3.5 month old) and suckers of same age group were used for the study. Besides type and age of planting material, the treatments also included three levels of split application of fertilizers and two modes of sucker retention. There were thus 24 treatments consisting of all possible combinations of the above four factors at different levels.

Data were collected on the important morphological characters such as girth and height of pseudostem, number of leaves produced and retained, total leaf area, number of functional leaves at shooting, duration of the crop, flowering pattern and bunch characters.

### RESULTS AND DISCUSSION

The study revealed that tissue culture plants were superior in performance over the conventional suckers exhibiting vigorous vegetative growth, increased yields and significant uniformity in flowering, compared to plants produced from suckers. Tissue culture plants of 2.5 and 3.5 month old were on par with respect to yield.

The initial establishment and early growth phase of tissue culture plants were comparable with that of conventional suckers. During the initial stages up to fourth week after planting the height of tissue culture plants and suckers did not show any significant difference. But from the fifth week, the tissue culture plants had greater height (Table 1) than plants from suckers. At planting, suckers had a higher girth and maintained superiority in the initial stages of growth (Table 1). Uniformity in pseudostem thickness of tissue culture plants and suckers was attained five weeks after planting. From sixth week onwards, tissue culture plants recorded higher pseudostem girth. At shooting, the tissue culture plants and suckers recorded an average height of 295.5 cm and 278.42 cm and girth of 66.75 cm and 59.67 cm, respectively. Up to three months after planting, average increase in height and girth per week was 11.26 cm and

Table 1. Height and girth of pseudostem of tissue culture plants and suckers of Nendran banana in the initial stages (cm)

Planting material	Weeks after planting									
	3	4	5	6	7	8	9	10	11	12
Tissue culture plants										
Height, cm	22.40	30.45 (8.05)	37.93 (7.48)	45.75 (7.82)	53.20 (7.45)	66.85 (13.65)	87.44 (20.59)	103.34 (15.90)	109.91 (6.57)	122.72 (12.81)
Girth, cm	6.44	8.96 (2.52)	11.00 (2.04)	12.86 (1.86)	15.01 (2.15)	18.18 (3.17)	20.40 (2.22)	24.24 (3.84)	26.89 (2.65)	29.54 (2.65)
Suckers										
Height, cm	22.19	30.17 (7.98)	36.29 (6.12)	42.54 (6.25)	50.78 (8.24)	61.71 (10.93)	84.24 (22.53)	99.78 (15.54)	104.75 (4.97)	114.74 (9.09)
Girth, cm	7.93	9.51 (2.68)	11.11 (1.60)	12.29 (1.18)	13.86 (1.57)	15.59 (1.73)	18.13 (2.54)	21.33 (3.20)	24.20 (2.57)	28.56 (4.36)
CD (0.05)										
Height, cm			0.583	0.761	0.713	0.834	1.421	1.411	0.723	5.091
Girth, cm	0.165	0.121		0.157	0.168	0.164	0.223	0.308	0.288	0.885

Average increase in height/week (cm) T/C plants = 11.55; Suckers = 11.26; Average increase in girth/week (cm) T/C plants = 2.51; Suckers = 2.29; Figures in parentheses indicate increase in values corresponding to previous observations

Table 2. Height and girth of pseudostem of tissue culture plants and suckers of Nendran banana from four months after planting to shooting

Planting material	Height of pseudostem (cm)					Girth of pseudostem (cm)				
	Months after planting					Months after planting				
	4	5	6	7	At shooting	4	5	6	7	At shooting
T/C	140.68	193.36 (52.68)	216.00 (22.64)	244.36 (28.36)	295.86 (51.50)	41.02	51.98 (10.96)	57.23 (5.25)	62.28 (5.05)	66.78 (4.50)
Suckers	135.65	187.37 (51.72)	205.00 (17.63)	233.58 (28.58)	278.42 (44.84)	36.09	46.62 (10.53)	50.15 (3.53)	54.48 (4.33)	59.67 (5.19)
CD (0.05)	0.572	--	2.134	2.765	2.673	0.771	0.881	0.820	0.857	1.032

Figures in parentheses indicate increase in values corresponding to previous observations

Table 3. Number of leaves produced in tissue culture plants and suckers of Nendran banana

Planting material	Months after planting							
	1	2	3	4	5	6	7	At shooting
T/C	7.40	10.71 (3.31)	14.91 (4.20)	20.27 (5.36)	25.76 (5.49)	33.35 (7.59)	36.78 (3.43)	40.33 (3.55)
Suckers	3.00	6.06 (3.06)	9.23 (3.17)	13.29 (4.06)	17.81 (4.52)	21.93 (4.12)	25.74 (3.81)	29.23 (3.49)
CD (0.05)	0.116	0.223	0.284	0.303	0.352	0.384	0.413	1.074

Figures in parentheses indicate increase in values corresponding to previous observations

2.29 cm for suckers and 11.55 and 2.51 cm for tissue culture plants (Table 2). The average monthly increment in girth from three months after planting to shooting was 6.22 cm for

suckers and 7.44 cm for tissue culture plants. The tissue culture plants ultimately recorded an increase of 6.7 per cent in height and 11.92 per cent in girth over the plants from suckers.

Table 4. Phase of flowering in tissue culture plants and suckers of Nendran banana under different treatments

Sl. No.	Treatments	Number of days	Sl.No.	Treatments	Number of days
1	T/C plants	8.00	13	T/C plants	7.00
2	Suckers	18.00	14	Suckers	18.67
3	T/C plants	9.00	15	T/C plants	10.00
4	Suckers	17.60	16	Suckers	15.67
5	T/C plants	8.33	17	T/C plants	10.33
6	Suckers	16.00	18	Suckers	18.67
7	T/C plants	18.00	19	T/C plants	6.33
8	Suckers	19.33	20	Suckers	16.00
9	T/C plants	7.67	21	T/C plants	8.00
10	Suckers	16.33	22	Suckers	18.00
11	T/C plants	8.67	23	T/C plants	12.67
12	Suckers	18.67	24	Suckers	20.00

Table 5. Bunch characters of tissue culture plants and suckers of Nendran banana

Planting material	Weight of bunch, kg	Length of bunch, cm	Number of hands	Number of fingers	Length of fingers, cm	Girth of fingers, cm	Weight of fingers, g
T/C	12.01	37.28	5.02	49.78	30.05	16.91	268.19
Suckers	9.56	32.69	4.57	39.36	26.38	14.94	226.58
CD (0.05)	0.259	0.427	0.176	0.819	0.557	0.340	4.460

Increase in height and girth of tissue culture plants over the suckers was reported previously by Daniells (1988), Drew and Smith (1990) and Robinson *et al.* (1993).

The tissue culture plants produced higher number of leaves compared to plants from suckers throughout the growing period. The average leaf production in tissue culture plants was 4.57 and in suckers, it was 3.72 per month. The maximum difference in leaf production was observed at seven months after planting. At all stages of growth, tissue culture plants had significantly higher number of leaves than plants propagated from suckers (Table 3) and the total number of leaves produced was also higher (40.33 and 29.33 for tissue culture plants and suckers respectively). Leaf production in banana is related to increased rate of plant growth (Barker and Steward 1962; Sathyanarayana, 1985). The maximum difference in leaf production was observed just before shooting (5.53 and 3.85 leaves/month). The maximum increase in pseudostem height was also observed in this stage. The tissue culture plants produced 3.35 leaves more than the plants from suckers during their growth in the field. Robinson *et al.*

(1993) and Daniells (1988) also reported that the tissue culture plants produced more number of leaves compared to suckers. In banana, number of leaves produced by a plant and its functional leaf area are the critical factors in determining the yield potential.

There was no significant difference in the time taken for flowering and harvest between tissue culture plants and suckers. The enhanced growth rate exhibited by tissue culture plants however did not delay flowering. Tissue culture plants showed less variability in the time taken for flowering under the same treatment. They were able to complete flowering in 9.8 days earlier compared to plants from suckers (Table 4).

Tissue culture plants recorded significantly higher values for all the bunch characters than the plants from suckers (Table 5). An increase in yield of 25.63 per cent was obtained in tissue culture plants over the plants from suckers. The yield increase may be attributed to genetic uniformity of the plants, due to selection of superior types for micropropagation and the increased number of leaves of tissue culture plants. Yield increase in tissue culture

plants was reported to 7.0 per cent (Daniells, 1988), 24.6 per cent (Robinson and Anderson, 1990) and 39.0 per cent (Pradeep *et al.*, 1992). Among the yield attributes, the number of fingers and length of bunch had the greatest correlation with yield (correlation co-efficient of 0.93 each). Heavier bunches have thicker and longer peduncles. Peduncle thickness and diameter is decided by length and girth of pseudostem. Production of more leaves, greater height and circumference of pseudostem increase the potential for production of heavier bunches.

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