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Performance of different tissue culture raised banana varieties on yield and cost benefit ratio of main and ratoon crop under southern dry zone of Karnataka (Bengaluru condition)

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Abstract

A field experiment was carried out on “Evaluation of elite tissue culture raised banana varieties for growth, yield and quality under southern dry zone of Karnataka (Bengaluru condition)” during 2018 to 2020 with twelve tissue culture raised Banana varieties at Department of Horticulture, University of Agricultural Sciences, Gandhi Krishi Vigyan Kendra, Bengaluru. Among these twelve varieties, the highest yield per hectare (81.2 t/ha) was recorded in Grand Naine followed by Williams. However, the lowest yield per hectare (22.90 t/ha) was observed in Nendran. The highest cost benefit ratio was recorded in Grand Naine (1: 3.45), which was followed by Williams (1: 3.05). Whereas, the lowest cost benefit ratio was registered in Monthan (1: 0.74).

Keywords: Banana, tissue culture, cost benefit and yield

Introduction

Banana (*Musa* spp.) is one of the most important tropical fruits cultivated by man from pre-historic time in India with great socio-economic significance. The edible banana is indigenous to Asia, probably originated in the mountainous region of Assam, Burma and Thailand. Banana is the world's largest monococious perennial herb and one of the major commercial fruit crop grown in tropics, subtropics and considered as the most economical sources of food also known for its antiquity that is interwoven with Indian heritage and culture. It is one of the most important fruit grown and consumed worldwide. It is also known as the Apple of paradise, Tree of wisdom, Adam's fig and poor man's apple. It is the fourth most important global food commodity in terms of gross value after paddy, wheat and maize products and forms an important crop for subsistence farmers. India is the largest producer of banana in the world and grown in an area of 0.89 million ha with an annual production of 31.75 million tons (Anon., 2019)^[1].

Banana is a heavy feeder of nutrients and requires continual supply of nutrients and water in large quantities for its growth, development and yield. In banana, regardless of cultivars, soils and climate, the total amount of nitrogen uptake by the plant is closely related to total dry matter production (Lahav., 1995)^[2], other than by using the nutrient for growth, the banana plant cannot store nitrogen. Potassium and nitrogen is the most used nutrient in plant growth, development and fruit production. It is a monocotyledonous herbaceous perennial with underground, horizontal rhizome from which roots develop pseudostem. Banana has a primary and adventitious root system. Primary roots originate from the surface of the central cylinder in the rhizome. Secondary and tertiary roots originate from the primary roots. The true stem is at underground and commonly referred to as a corm, but botanically the rhizome. The pseudostem is formed by the tightly packed overlapping leaf sheaths. The pseudostem continues to grow in height as the leaves emerge one after the other and reaches its maximum height when the flower emerges at the top of the plant. It is a monocarpic and bears male, female and hermaphrodite type of flowers.

In recent years, more emphasis is being given to higher productivity by adopting various methods like using tissue culture, high yielding varieties, fertigation, bunch feeding, high density planting etc. Banana is a short duration fruit crop and provides ample scope for doubling the production per unit area. A large number of banana cultivars are grown in south Karnataka. Though south Karnataka is having congenial condition for commercial cultivation of tissue culture banana, but the average yield obtained from different genotypes within the state is variable as compared to the many other states. This might be due to suckers used as planting materials, soil condition, genetic factor, improper selection of high yielding varieties and lack of systematic management practices or good management practices. Banana is one of the most important food and cash crops in Karnataka. However, most of the local cultivars grown particularly which low yielders are because of suckers used as planting materials and also not suitable for commercial production.

Material and Methods

A field trial was carried out on "Evaluation of elite tissue culture raised banana varieties for growth, yield and quality under southern dry zone of Karnataka (Bengaluru condition)" during 2018 to 2020 at Department of Horticulture, University of Agricultural Sciences, Gandhi Krishi Vigyan Kendra, Bengaluru. The healthy and vigorous uniform sized twelve tissue culture raised Banana varieties namely Grand Naine, Williams, Red Banana, Kamalapur Red Banana, Udhayam, Rajapuri, Yelakki bale, Nanjangud Rasabale, Monthan, Nendran, Quintal Nendran and Swarnamukhi Nendran were collected from different locations and planted with a trench method at spacing of 1.8 m X 1.8 m. The yield and cost benefit ratio were recorded and the design was

adopted was randomised complete block design. The data was subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1985)^[3].

Results and Discussion

The source of planting materials obtained for the experiment from the different places (Table 1). The data on cost benefit ratio was calculated among all the twelve tissue culture raised banana varieties (Table 2). The highest cost benefit ratio was recorded in Grand Naine (1: 3.45), which was followed by Williams (1: 3.05). Whereas, the lowest cost benefit ratio was registered in Monthan (1: 0.74). This might be due to the consumer's preference of the variety and market price. The cooking genotypes were not preferred by the consumers and have fewer market prices in Bengaluru region. The consumers prefer more dessert varieties, but cooking genotypes cannot be neglected because it has good market value in other states like Tamil Nadu and Kerala where they are using for cooking as well as vegetable purpose. The similar results were observed by Sagar *et al.* (2017)^[4]. The data on cost benefit ratio of banana ratoon crop was calculated among all the twelve tissue culture raised banana varieties (Table 3). The variety Grand Naine (1: 3.30) registered the maximum cost benefit ratio which was followed by Williams (1: 2.90). Whereas, the minimum cost benefit ratio noticed in Monthan (1: 0.93). This might be due to the consumer's preference of the variety and market price. The cooking genotypes were not preferred by the consumers and have fewer market prices in Bengaluru region. The similar results were observed by Sagar *et al.* (2017)^[4]. The cost of cultivation of tissue culture raised banana varieties in main and ratoon crop (Table 4 (a and b) and Table 5)

Table 1: Source of planting materials obtained for the experiment

Sl. No	Varieties	Genomic Group	Source of collection
1	Grand Naine	AAA	Jayashree Biotechnology, Plant Tissue Culture Lab, Hosur, Tamilanadu
2	Williams	AAA	Jayashree Biotechnology, Plant Tissue Culture Lab, Hosur, Tamilanadu
3	Red Banana	AAA	Jayashree Biotechnology, Plant Tissue Culture Lab, Hosur, Tamilanadu
4	Kamalapur Red Banana	AAA	UHS, Bagalkot, Karnataka
5	Udhayam	AAB	NRC on Trichi, Tamilanadu
6	Rajapuri	AAB	UHS, Bagalkot, Karnataka
7	Yalakki bale	AB	Jayashree Biotechnology, Plant Tissue Culture Lab, Hosur, Tamilanadu
8	Nanjangud Rasabale	AAB	Plant Tissue Culture Lab, UAS, GKVK, Bengaluru
9	Monthan	ABB	Jayashree Biotechnology, Plant Tissue Culture Lab, Hosur, Tamilanadu
10	Nendran	AAB	Jayashree Biotechnology, Plant Tissue Culture Lab, Hosur, Tamilanadu
11	Quintal Nendran	AAB	Jayashree Biotechnology, Plant Tissue Culture Lab, Hosur, Tamilanadu
12	Swarnmukhi Nendran	AAB	Jayashree Biotechnology, Plant Tissue Culture Lab Hosur, Tamilanadu

Table 2: Performance of tissue culture raised banana varieties on yield and cost benefit ratio on main crop

Varieties	Yield t/ha	Gross income (Rs.)	Cost of cultivation (Rs.)	Net profit (Rs.)	C : B ratio
V ₁ : Grand Naine (AAA)	81.32	11,38,480	2,55,974	8,82,506	1: 3.45
V ₂ : Williams (AAA)	74.01	10,36,140	2,55,974	7,80,166	1: 3.05
V ₃ : Red Banana (AAA)	25.90	8,02,900	286834	7,05,310	1: 1.79
V ₄ : Kamalapur Red Banana (AAA)	25.51	7,90,810	286834	5,03,976	1: 1.75
V ₅ : Udhayam (AAB)	31.44	6,28,800	3,02,264	3,26,536	1: 1.00
V ₆ : Rajapuri (AAB)	30.00	6,00,000	255974	3,44,026	1: 1.34
V ₇ : Yelakki (AB)	25.00	8,00,000	2,86,834	5,13,166	1: 1.78
V ₈ : Nanjangud Rasabale (AAB)	27.01	8,91,330	286834	6,04,495	1: 2.10
V ₉ : Monthan (ABB)	52.58	5,25,800	302264	2,23,536	1: 0.74
V ₁₀ : Nendran (AAB)	22.90	7,09,900	3,02,264	4,07,636	1: 1.35
V ₁₁ : Quintal Nendran (AAB)	26.40	8,18,400	3,02,264	5,16,136	1: 1.71
V ₁₂ : Swarnmukhi Nendran (AAB)	24.69	7,65,390	3,02,264	4,63,126	1: 1.53

Table 3: Performance of tissue culture raised banana varieties on yield and cost benefit ratio on ratoon crop

Varieties	Yield t/ha	Gross income (Rs.)	Cost of cultivation (Rs.)	Net profit (Rs.)	C : B ratio
V ₁ : Grand Naine (AAA)	75.05	8,25,550	1,91,934	6,33,616	1: 3.30
V ₂ : Williams (AAA)	68.22	7,50,420	1,91,934	5,58,486	1: 2.90
V ₃ : Red Banana (AAA)	22.22	6,22,160	1,91,934	4,30,226	1: 2.24
V ₄ : Kamalapur Red Banana (AAA)	21.48	6,01,440	1,91,934	4,09,506	1: 2.13
V ₅ : Udhayam (AAB)	27.57	4,13,550	1,91,934	2,21,616	1: 1.15
V ₆ : Rajapuri (AAB)	26.16	4,18,560	1,91,934	2,26,626	1: 1.18
V ₇ : Yelakki (AB)	20.88	6,26,400	1,91,934	4,34,466	1: 2.26
V ₈ : Nanjangud Rasabale (AAB)	22.91	6,41,480	1,91,934	4,49,546	1: 2.34
V ₉ : Monthan (ABB)	46.38	3,71,040	1,91,934	1,79,106	1: 0.93
V ₁₀ : Nendran (AAB)	19.19	4,79,750	1,91,934	2,87,816	1: 1.50
V ₁₁ : Quintal Nendran (AAB)	22.63	5,65,750	1,91,934	3,73,816	1: 1.94
V ₁₂ : Swarnamukhi Nendran (AAB)	20.17	5,04,250	1,91,934	3,12,316	1: 1.63

Table 4(a): Cost of cultivation of tissue culture raised banana varieties in main crop

Sl. No	Particulars	Grand Naine	Williams	Red Banana	Kamalapur Red Banana	Udhayam	Rajapuri
1.	Ploughing tractor rent and leveling	6000	6000	6000	6000	6000	6000
2.	Planting materials	46290	46290	77150	77150	92580	46290
3.	Irrigation charges	10000	10000	10000	10000	10000	10000
4.	Dripe	45000	45000	45000	45000	45000	45000
5.	FYM 40 tonnes @ Rs 3500 for one tractor	70000	70000	70000	70000	70000	70000
6.	Urea-200 kg/ha (Rs 5.4/kg)	1065	1065	1065	1065	1065	1065
7.	Single Super Phosphate- 120 kg /ha (Rs 7.6/kg)	918.3	918.3	918.3	918.3	918.3	918.3
8.	Murate of Potash- 250 kg/ha (Rs 23.8/kg)	5951	5951	5951	5951	5951	5951
9.	Earthing up, weeding, desuckering	24000	24000	24000	24000	24000	24000
10.	Propping poles	10000	10000	10000	10000	10000	10000
11.	Plant protection	5000	5000	5000	5000	5000	5000
12.	Trench making	8000	8000	8000	8000	8000	8000
13.	Filling the pits and planting (Rs 250/man day) 15 no	3750	3750	3750	3750	3750	3750
14.	Fertilizer application 10 labour (Rs 250 each)	2500	2500	2500	2500	2500	2500
15.	Harvesting and mattocking – (20 labours/ha)	5000	5000	5000	5000	5000	5000
16.	Plant protection measures – (10 labour)	2500	2500	2500	2500	2500	2500
17.	Misc. expenses	10000	10000	10000	10000	10000	10000
	Total amount (Rs)	2,55,974	2,55,974	2,86,834	2,86,834	3,02,264	2,55,974

Table 4(b): Cost of cultivation of tissue culture raised Banana varieties in main crop

Sl. No	Particulars	Yelakki	Nanjangud Rasabale	Monthan	Nendran	Quintal Nendran	Swarnmukhi Nendran
1.	Ploughing tractor rent and levelling	6000	6000	6000	6000	6000	6000
2.	Planting materials	77150	77150	92580	92580	92580	92580
3.	Irrigation charges	10000	10000	10000	10000	10000	10000
4.	Dripe	45000	45000	45000	45000	45000	45000
5.	FYM 40 tonnes @ Rs 3500 for one tractor	70000	70000	70000	70000	70000	70000
6.	Urea-200 kg/ha (Rs 5.4/kg)	1065	1065	1065	1065	1065	1065
7.	Single Super Phosphate- 120 kg /ha (Rs 7.6/kg)	918.3	918.3	918.3	918.3	918.3	918.3
8.	Murate of Potash- 250 kg/ha (Rs 23.8/kg)	5951	5951	5951	5951	5951	5951
9.	Earthing up, weeding, desuckering	24000	24000	24000	24000	24000	24000
10.	Propping poles	10000	10000	10000	10000	10000	10000
11.	Plant protection	5000	5000	5000	5000	5000	5000
12.	Trench making	8000	8000	8000	8000	8000	8000
13.	Filling the pits and planting (Rs 250/man day) 15 no	3750	3750	3750	3750	3750	3750
14.	Fertilizer application 10 labour (Rs 250 each)	2500	2500	2500	2500	2500	2500
15.	Harvesting and mattocking – (20 labours/ha)	100000	100000	100000	100000	100000	100000
16.	Plant protection measures – (10 labour)	2500	2500	2500	2500	2500	2500
17.	Misc. Expenses(analysis and transportation cost)	5000	5000	5000	5000	5000	5000
	Total amount (Rs)	2,86,834	2,86,834	3,02,264	3,02,264	3,02,264	3,02,264

Table 5: Cost of cultivation of tissue culture raised banana varieties on ratoon crop

Sl. No	Particulars	Cost of cultivation of all varieties
1.	Irrigation charges	10000
2.	Dripe	45000
3.	FYM 40 tonnes @ Rs 3500 for one tractor	70000
4.	Urea-200 kg/ha (Rs 5.4/kg)	1065
5.	Single Super Phosphate- 120 kg /ha (Rs 7.6/kg)	918.3
6.	Murate of Potash- 250 kg/ha (Rs 23.8/kg)	5951
7.	Earthing up, weeding, desuckering	24000

8	Propping poles	10000
9.	Plant protection	5000
10.	Fertilizer application 10 labour (Rs 250 each)	2500
11.	Harvesting and mattocking – (20 labours/ha)	10000
12.	Plant protection measures – (10 labour)	2500
13.	Misc. Expenses (analysis and transportation cost)	5000
	Total amount (Rs)	1,91,934

Conclusion

From this study concluded that, all twelve tissue culture raised banana varieties were evaluated, the better performance on growth parameters like early shooting, early harvesting and least crop duration was noticed in Grand Naine. Similarly, yield parameters like number of hands, number of fingers, weight of bunch per plant and yield was recorded maximum in Grand Naine, followed by Williams. The varieties Grand Naine, Williams and Yelakki are best suitable for cultivation under Bengaluru condition.

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