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Effect of post shooting foliar spray on yield attributes, yield and economics of tissue culture Nendran banana

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Abstract
A field experiment was conducted during 2019 in the western agro-climatic zone, Tamil Nadu with the objectives of studying the effect of post shooting foliar spray on yield attributes, yield and economics of tissue culture nendran banana. The experiment was laid out in a randomized block design and replicated four times. Six treatments comprising of three potassium containing nutrient spray (Potassium dihydrogen phosphate, potassium sulphate and potassium silicate), two plant growth regulators (gibberellic acid and brassinosteroid) were tested. Besides, control (water spray) (T_1) was considered as the benchmark for ascertaining the performance of other treatments. The results revealed that foliar spray of gibberellic acid at 100mg/l (T_5) recorded higher finger length (30.2 cm), finger circumference (16.0 cm), finger weight (296.3 g), pulp weight (217.6 g), peel weight (76.1 g), pulp peel ratio (2.86), bunch weight (27.1 kg/bunch), yield (61.4 t/ha) and higher B:C ratio (4.42) in tissue culture nendran banana.

Keywords: Foliar spray, potassium nutrients, growth regulators, nendran banana

Introduction
Banana (*Musa* × *paradisiacal* L.) is an important fruit crop of tropical and subtropical regions of the world. There has been an increase in the area, production and productivity of banana to the tune of 80, 87 and 34.6 per cent respectively in 2015-2016 compared to 2001-2002 [12]. Banana being a gross feeder requires a high amount of nutrients for proper growth and production. Under drip fertigation system of banana cultivation, crop receives its nutrients only from soil to support the nutrient requirement of the crop until harvest. The practice of application of nutrients, plant growth regulators and bunch management treatments are taken for improving the growth, maturity, yield and quality of banana fruits are gaining popularity. Thus, the foliar application of chemicals provides a considerable scope to safeguard the economy of the farmer by improving the yield potential and quality of the produce [5]. Many reports have indicated about the usefulness of post shooting foliar spray of various nutrients and growth regulators during the fruit development stage influencing the fruit yield, shelf life and quality of banana [6]. It might be seen that the application of various potassium nutrients and plant growth regulators resulted in improved yield parameters, yield, shelf life and quality of fruits. Post shooting spray is the most efficient approach which favorably influenced the production of banana, thus increases the economic efficiencies. Further, limited literature available for drip fertigation along with post shooting foliar spray of suitable potassium nutrients or plant growth regulators are needed to elicit more information concerning tissue culture nendran banana. Keeping all these aspects in view, the present research programme was planned and conducted in tissue culture banana cv. nendran.

Materials and Methods
A field experiment was conducted during *Kharif* 2019 at farmer's field, Sirumugai village, Coimbatore District, Tamil Nadu. The experimental field was situated in western Zone of Tamil Nadu geographically located at 11º North latitude and 77º East longitude and an altitude of 384 meters above mean sea level (MSL). The experiment comprised often treatments of control (Water spray) (T_1), Potassium dihydrogen phosphate (KH_2PO_4) (0.5%) (T_2), Sulphate of Potash (2%) (T_3), Potassium silicate (6 ml/l) (T_4), Gibberellic Acid (100 mg/l) (T_5) and Brassinosteroid (2 ml/l) (T_6) were tested in randomized block design and replicated four times. Post shooting plants maintained under 100% RDF (250:150:500 g NPK per plant) through fertigation using water soluble fertilizers *i.e.*, urea (N - 46%), MAP (N-12% and P - 61%) and SOP (K - 50%) and fertigation was scheduled based on different growth stages of crop and given at once in four days.

Proper weed management and plant protection measures were carried out at the appropriate time as per the recommendation. This field was selected for post shooting foliar spray. The foliar spray was given at fifteen days intervals for four times. The first spray was given immediately after the last hand opening. Yield parameters, yield and economics were recorded as per the standard methodology. To evaluate the effect of different drip fertigation on yield attributes and yield, the data were statistically analyzed using "Analysis of variance test". The critical difference at 5% level of significance was calculated to find out the significance of different treatments over each other [4].

Results and discussions

In the present study increase finger length (cm) and finger girth (cm), finger weight (g) from second hand, bunch weight (Kg) and fruit yield (t/ha) were found superior in a foliar spray of gibberellic acid at 100 mg/l (T_5). The number of hands and fingers is unaffected by sprays applied after shooting; hence, fruit size is the primary determinant of yield after shooting. Since an increase in fruit size will also increase bunch weight. So, parameters of fruit size, namely finger weight, length, and circumference, were given particular attention.

Finger length (cm)

The finger character related results revealed that finger length was significantly influenced due to the application of different foliar spray (Table 1). Significantly the longer finger length (30.2 cm) was noted in treatment gibberellic acid at 100 mg/l (T_5) and it was on par with sulphate of potash (SOP) spray at 2% (T_3) (27.6 cm). The shorter finger length (24.3 cm) was noticed in control (water spray) (T_1). Gibberellic acid is reported to promote growth by increasing the plasticity of the cell wall followed by the hydrolysis of starch into sugars which reduces the cell water potential, resulting in the entry of water into the cell causing cell elongation (Richard, 2006). Therefore the increase in fruit length may result from cell enlargement. The result of the present study is in line with those of [3].

Finger circumference (cm)

The finger circumference was significantly influenced by the different post-shooting foliar spray treatments (Table 1). Post-shooting bunch spray of gibberellic acid at 100 mg/l (T_5) recorded the maximum finger circumference (16.04 cm) and it was comparable with SOP 2% spray (T_3) (15.61 cm). The minimum finger circumference (12.30 cm) was recorded in control (water spray) (T_1). These can be attributed to the nature of gibberellins to increase to vegetative growth due to mobilized metabolites to the fruits that may have improved fruit circumference. The results are in agreement with findings of [8].

Total number of fingers per bunch (Nos.)

Total number of fingers was found to be non-significant due to different foliar spray (Table 1). The probable reason could be that the plant regulators were applied after the complete opening of inflorescence, whereas, the number of hands and fingers were already fixed at the initiation of inflorescence from underground stem long before also there was no significant improvement in number of hands and fingers. The findings are supported by those of [13].

Finger weight (g)

In the present experiment, the post-shooting bunch spray of nutrients and growth regulators had a significant effect on the average finger weight (Table 1). Significantly the higher finger weight (296.3 g) was observed under gibberellic acid at 100 mg/l (T_5) and it was statistically at par with 2% SOP spray (T_3) (276.6 g). The lower average finger weight (226.8 g) was recorded in control (water spray) (T_1). An increase in fruit weight may be attributed to the strengthening of the middle lamella and consequently cell wall, which later may have increase solutes in free passage of the fruits. By the application of GA3, certain changes of fruit are improved which reflected in more accumulation of water and enhanced deposition of soluble solids. The higher fruit weight due to the application of GA3 may be attributed to their stimulatory effect on plant metabolism. These findings conform to the results reported by [7].

Pulp and peel weight (g)

It is apparent from the data that peel weight was significantly influenced due to applications of different foliar spray (Table 2). Significantly the higher pulp weight (217.6 g) was recorded in gibberellic acid at 100 mg/l (T_5). The treatment was at par with 2% SOP spray (T_3) (202.5 g) and KH_2PO_4 (T_2) (196.8 g). The minimum pulp weight (172.7 g) was recorded in control (water spray) (T_1). The higher peel weight (76.1 g) was recorded with the application of gibberellic acid spray at 100 mg/g (T_5) and it was on par with the application of SOP spray at 2% (T_3), KH_2PO_4 (T_2) and brassinosteroid at 2 ml/l (T_6). The lower peel weight (64.1 g) was registered in control (water spray) (T_1). The increase in fruit pulp weight may be due to stimulating cell division and increased volume in the newly divided cells[9] or maybe enhance uptake of water and accumulation of sugar and other food reserves in a greater amount as well as increased volume of intracellular spaces in the pulp of fruit due to GA3. Moreover, higher pulp content may be due to higher accumulation and translocation of the extra metabolite from other parts of the tree towards developing fruits. The results are in agreement with findings showed by [10] in banana.

Bunch weight (kg)

The data pertaining on bunch weight was given in Table 2. The post-shooting bunch spray of gibberellic acid at 100 mg/l (T_5) resulted in maximum bunch weight (27.1 kg) and it was statistically on par with SOP spray at 2% (T_3) (25.3 kg) The minimum bunch weight (24.26 kg) were registered in control (water spray) (T_1). This might be due to gibberellins control fruit development in various ways and at different developmental stages. Fruit development is a complex and tightly regulated process. Gibberellins are known to influence both cell division and cell enlargement [1]. The results were in agreement with those achieved by [14]. These activities improve the size, width, length and weight of fruits which ultimately increased the bunch weight of fruits. Similar results were found by [11].

Yield (t/ha)

Among the different foliar spray treatments, gibberellic acid at 100 mg/l (T_5) was recorded significantly higher yield of 61.4 t/ha which was at par with SOP spray at 2% (T_3) (57.4 t/ha). Control (water spray) (T_1) recorded a significantly lower yield (47.8 t/ha) (Table 2). The increased yield attributing characters by foliar spray might be due to rapid cell division, cell elongation by enlargement of vacuoles and loosening of cell wall after increasing cell wall plasticity,

translocation of sugars, which contributed towards such an increase in average yield tones per hectare in banana. The results are following the findings of [2].

Economics

Economics *i.e.* cultivation cost, gross return, net return and B:C ratio was calculated and presented in Table 3. The economic analysis revealed that the higher cost of cultivation of Rs.637502/ha was recorded with the application of SOP at 2% spray (T_3). This was followed by brassinosteroid (T_6) with Rs. 631062/ha. Lower cost of cultivation (Rs. 610862/ha) was recorded in control (water spray) (T_1). The maximum gross return (Rs. 24,58,512/ha), net return (Rs. 18,33650/ha) and B:C ratio (3.93) was obtained from treatment gibberellic acid spray at 100 mg/g (T_5) followed by application of foliar spray of SOP at 2% (T_3) (Rs. 22,95,216/ha, Rs. 16,57,714/ha and 3.60, respectively). Minimum gross return (Rs. 19,14,192/ha) and net return (Rs. 13,03,330/ha), B:C ratio (3.13) was observed in foliar application of water spray (control) (T_1).These higher gross returns, net returns and benefit cost ratio might be due to higher fruit yield obtained by the application of gibberellic acid spray at 100 mg/g (T_5). The lower gross return was in the control because of poor yield obtained in control.

Conclusion

The results of the experiment revealed that the yield parameters and yield *viz*., finger length, finger circumference, finger weight, pulp and peel weight and yield were influenced positively by the post shooting foliar spray and higher fruit yields were obtained with gibberellic acid spray at 100 mg/g (T_5) which was on a par with SOP spray at 2% (T_3) in tissue culture nendran banana.

Table 1: Effect of post shooting foliar spray on yield parameters of tissue culture nendran banana

S. No	Treatments	Finger length (cm)	Finger circumference (cm)	Total number of fingers/ bunch (Nos.)	Finger weight (g)
T_1	Control (Water spray)	24.3	12.30	125.5	226.8
T_2	Potassium di hydrogen phosphate (0.5%)	27.3	14.31	127.0	267.7
T_3	Sulphate of Potash (2%)	27.6	15.61	124.1	276.6
T_4	Potassium silicate (6 ml/l)	27.1	13.96	128.3	255.6
T_5	Gibberellic Acid (100 mg/l)	30.2	16.04	125.6	296.3
T_6	Brassinosteroid (2 ml/l)	27.2	14.12	127.5	263.1
SEd		1.3	0.74	6.5	13.2
CD (P=0.05)		2.8	1.58	NS	28.2

Table 2: Effect of post shooting foliar spray on pulp, peel, bunch weight and yield of tissue culture nendran banana

S. No	Treatments	Pulp weight (g)	Peel weight (g)	Bunch weight (kg)	Yield (t/ha)
T_1	Control (Water spray)	172.7	64.1	21.1	47.8
T_2	Potassium di hydrogen phosphate (0.5%)	196.8	72.3	24.4	55.3
T_3	Sulphate of Potash (2%)	202.5	74.4	25.3	57.4
T_4	Potassium silicate (6 ml/l)	190.9	67.3	23.8	53.9
T_5	Gibberellic Acid (100 mg/l)	217.6	76.1	27.1	61.4
T_6	Brassinosteroid (2 ml/l)	192.9	70.9	24.1	54.5
SEd		10.3	3.61	1.26	2.85
CD (P=0.05)		21.9	7.70	2.68	6.07

Table 3: Effect of post shooting foliar spray on economics of tissue culture nendran banana

S. No	Treatments	Economics			
		Cost of cultivation (₹ /ha)	Gross return (₹ /ha)	Net return (₹ /ha)	B:C ratio
T_1	Control (Water spray)	610862	1914192	1303330	3.13
T_2	Potassium di hydrogen phosphate (0.5%)	618962	2213568	1594606	3.58
T_3	Sulphate of Potash (2%)	637502	2295216	1657714	3.60
T_4	Potassium silicate (6 ml/l)	615530	2159136	1543606	3.51
T_5	Gibberellic Acid (100 mg/l)	624862	2458512	1833650	3.93
T_6	Brassinosteroid (2 ml/l)	631062	2186352	1555290	3.46

References

1. Adams PA, Montague MJ, Tepfer M, Rayle DL, Ikuma H, Kaufman PB. Effect of gibberellic acid on the plasticity and elasticity of *Avena* stem segments. Plant Physiol. 1975; 56:757-760.
2. Agrawal S, Dikshit SN. Studies on the effect of plant growth regulators on growth and yield of Sapota (*Achras sapota* L.) cv. criket ball. Indian J Agric. Res. 2008; 42:207-211.
3. Gaikwad PS, Tambe TB, Gaonkar YA. Effect of foliar application of chemicals on yield of pomegranate cv. Bhagwa. International Journal of Chemical Studies. 2019; 7(1):524-528.
4. Gomez KA, Gomez AA. Statistical procedures for agricultural research (Ed.). A Willey Inter Science Pub, New York, USA, 1984.
5. Kachhadia, Palak, Tank RV, Bhanderi DR, Vagadia PS. Response of post-shooting bunch spray of chemicals on quality of ratoon banana (*Musa paradisiaca* L.) Cv. Grand Nain. Trends in Biosciences. 2017, 10(27).
6. Kannan S. Mechanism of foliar uptake of plant nutrients: Accomplishments and prospects. J Pl. Nutr. 1980; 2:717-735.
7. Kumar S, Singh AK, Yadav AL. Effect of foliar application of GA_3, NAA, KNO_3 and borax on fruit quality of rainy season guava cv. L - 49. Pl. Arch. 2010; 10(1):317-319.

8. Laila Mostafa Y, Hatem RM. Kotb. Effect of Brassinosteroids and Gibberellic acid onparthenocarpic fruit formation and fruit quality of Sugar Apple *Annona squamosa* L. Middle East Journal of Agriculture Research. 2018; 7(4):1341-1351.
9. Metraux JP. Gibberellins and plant cell elongation. In: Davies PJ. Plant hormones and their role in plant growth and development. 2 ed. Dordrecht: Kluwer Academic, 1988, 296-317.
10. Mulagund J, Kumar S, Soorianathasundaram K, Parika H. Influence of post-shooting sprays of sulphate of potash and certain growth regulators on bunch characters and fruit yield of banana cv. Nendran (French Plantain Musa AAB). Bioscan. 2015; 10(1):153-159.
11. Nanhe Lal Saroj, Verma RS, Som Prakash, Verma SS, Viplaw Kumar. Studies on the effect of foliar spray of micronutrient and plant growth regulators on physical parameter of guava (*Psidium guajava* L.) cv. Allahabad Safeda. Journal of Pharmacognosy and Phytochemistry. 2018; 7(5):01-02.
12. NHB. Banana area, production and productivity. http://www.nhb.gov.in, 2017.
13. Parmar BR, Chundawat BS. Effect of growth regulators and sleeving on maturity and quality of banana cv. Basari. South Indian Hort. 1984; 32(4):201-204.
14. Pradhan SK, Bandyopadyay A, Mitra SK, Sen SK. Effect of growth substances on fruit size, yield and quality of banana var. Giant Governor. Progressive Hort. 1988; 20(3-4):326-330.