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Effect of water soluble nutrients on yield of banana cv. Grand Naine

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Abstract

A field experiment on “Studies on Efficacy of Water Soluble Nutrients on Yield and Quality of Banana cv. Grand Naine under hill zone of Karnataka” was carried out in farmer’s field at Anajooru village, Mudigere taluk, Chikkamagaluru district during the year 2021-2022. The treatments consist of foliar application viz., Sulphate of Potash (1%), Calcium Nitrate (0.3%), Magnesium Sulphate (0.2%), Borax (0.2%) and Potassium Schoenite (1%) at an interval of one month from 7th months of planting and compared with control. The experiment was laid out in Randomized Complete Block Design (RCBD) with ten treatments, which were replicated thrice. Among the treatments, T₉- Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) recorded maximum Finger weight (200.95 g), finger length (22.38 cm), finger girth (43.88 mm), finger circumference (13.78 cm), number of fingers per hand (20.13), number of fingers per bunch (182.00), hand weight (4.02 kg), internodal length between hands (12.04 cm), bunch length (95.87 cm), bunch weight (39.21 kg), yield per hectare (98.03 t). The present findings can be commercially used in making banana production more profitable by the application of sulphate of potash, secondary nutrients and boron under hill zone of Karnataka.

Keywords: Banana, Grand Naine, sulphate of potash (SOP), secondary nutrients and quality

Introduction

Now a days tissue culture banana cv. Grand Naine is acquiring lots of importance in all parts of Karnataka because of its better suitability, quality of planting material, uniformity in growth, earliness in flowering, uniformity in harvesting and tall stature which helps in better harvesting and better yield. Usually, tissue culture plants produce twice amount of roots than the normal plants. Hence, more nutrients will be absorbed by the plants to produce good yield. Under traditional farming system, banana crop receives its last dose of fertilizers at 7th month after planting i.e., just before shooting, which has to support the requirement of nutrients until harvest since large quantity of photosynthates are to move from the source to the sink i.e., developing bunches at this phase. Any limitation in the supply of nutrients at this crucial stage affects the bunch size and quality. Hence, an additional dose of fertilizer after shooting has become imperative. However, it is not advisable to go for soil application of fertilizers at finger development stage, since the uptake is slow and low at this stage (Veerannah *et al.*, 1976) ^[13].

Materials and Methods

The field experiment was carried out at a farmer’s field, Anajooru village, Mudigere taluk of Chikkamagaluru district during 2021 – 2022. The experiment was laid out in a Randomized Complete Block Design (RCBD) with ten treatments and replicated thrice. Plants were selected randomly for recording observations from each treatment. The treatments consist of foliar application viz., Sulphate of Potash (1%), Calcium Nitrate (0.3%), Magnesium Sulphate (0.2%), Borax (0.2%) and Potassium Schoenite (1%) at an interval of one month from 7th months of planting and compared with control.

Results and Discussion

Finger parameters

Finger weight

The maximum finger weight (200.95 g) was recorded in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), while, the minimum

finger weight (159.78 g) was found in control (T₁) (Table 1). The increase in finger weight might be due to the rapid multiplication and enlargement of cells and greater accumulation of sugars or carbohydrates and water in the expanded cells. The results are in conformity with those reported by Kumar and Kumar (2007)^[2] and Sandhya *et al.* (2016)^[10].

Length of finger, girth of finger and finger circumference

The maximum finger length (22.38 cm) was recorded in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), while, the minimum finger length (12.31 cm) was registered in T₁-control (Table 1).

The maximum finger girth (43.88 mm) was obtained in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) while, the minimum finger girth (30.51 mm) was recorded in control (T₁) (Table 1).

The maximum finger circumference (13.78 cm) was recorded in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) while, the minimum finger circumference (10.83 cm) was found in T₁-control (Table 1).

The results were in close conformity with Kumar and Kumar (2007)^[2] and Nandan *et al.* (2011)^[6], who have reported that nutrients supplied would have been utilized for cell elongation of fruits and formation of larger intercellular spaces during later part of fruit growth.

Hand parameters

Hand weight and Number of fingers per hand

The maximum hand weight (4.02 kg) recorded in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas minimum weight of hand (2.67 kg) was registered in control (T₁) (Table 2).

The maximum number of fingers per hand (20.13) was noticed in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas minimum number of fingers per hand (16.73) was found in control (T₁) (Table 2).

This might be due to foliar application of secondary and micronutrients helps in multiplication and enlargement of cells and more accumulation of food materials like sugars and water in expanded cells. These results are corroborated with the findings of Sree *et al.* (2020)^[12] and Pujari *et al.* (2010)^[9].

Internodal length between the hands

The maximum internodal length between the hands (12.04 cm) was noticed in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), where as minimum internodal length between the hands (8.01 cm) was recorded in control (T₁) (Table 2).

The increased internodal length between hands might be due to the to the additional dose of nutrient supplied through potassium, secondary nutrients and boron, which utilized more for cell elongation rather cell division. The similar findings were reported by Patel *et al.* (2010)^[8] and Shetty *et al.* (2014)^[11].

Bunch parameters

Bunch weight

The results obtained from the present investigation on bunch

weight revealed that the treatment T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), followed by (39.21 kg) and minimum bunch weight (30.01 kg) in T₁- Control (Table 3).

The increase in weight of bunch might be due to increased carbon assimilation and/or allocation to the fruit because of the application of potassium and secondary nutrients mainly sulphur reported by Israeli *et al.* (1995)^[1]. The similar results were also obtained by Nandan *et al.* (2011)^[6] and Kumar and Kumar (2007 and 2010)^[2, 3].

Bunch length

The maximum bunch length (95.87 cm) was obtained in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas minimum bunch length (78.02 cm) was observed in T₁-Control and there was a significant difference among treatments (Table 3).

The increased length of the bunch might be due additional supply of potassium and secondary nutrients which helps in cell division and cell expansion by their effect on RNA and DNA synthesis (Mostafa, 2015)^[5]. The result of the present investigation is in close conformity with the findings of Shetty *et al.* (2014)^[11], Sree *et al.* (2020)^[12] and Pujari *et al.* (2010)^[9].

Number of hands per bunch

There was no significant difference observed among the treatments with respect to number of hands per bunch, however, the minimum number of hands per bunch (9.09) was recorded in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) and T₁-Control with maximum number of hands (9.87) (Table 3).

Number of fingers per bunch

The maximum number of fingers per bunch (182.00) was recorded in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas minimum number of fingers per bunch (169.45) was recorded in T₁-Control (Table 3).

This might be due to exogenous application of secondary and micronutrients helps to improve the physical properties of fruit and increasing the cell elongation and cell multiplication. The similar results were obtained by Pathak *et al.* (2011)^[7] and Patel *et al.* (2010)^[8].

Yield

Yield per acre and yield per hectare

The maximum yield per acre (39.21 t) and yield per hectare (98.03 t) was obtained in T₉-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), where as minimum yield per acre (30.01 t) and yield per hectare (75.03 t) was recorded in T₁-control and there was a significant difference among treatments (Table 4). Presence of sulphur in SOP had a synergistic effect with zinc, which is essential for carbon dioxide absorption and utilization, synthesis of RNA, auxin and also essential for chlorophyll formation, which improves the photosynthetic activity. Sulphur can increase the absorption of potassium or it can react with nitrogen and potassium. The findings are in close conformity with the results of Kumar *et al.* (2008)^[4] and Sree *et al.* (2020)^[12].

Table 1: Effect of water soluble nutrients on finger parameters of banana cv. Grand Naine

Treatments	Finger weight (g)	Finger length (cm)	Finger girth (mm)	Finger circumference (cm)
T ₁ - Control	159.78	12.31	30.51	10.83
T ₂ - Sulphate of Potash (1%)	165.95	14.63	34.54	11.07
T ₃ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)	171.57	15.02	36.86	11.56
T ₄ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%)	181.83	16.53	38.72	12.05
T ₅ - Sulphate of Potash (1%) + Borax (0.2%)	178.91	15.57	38.01	11.92
T ₆ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) +Magnesium Sulphate (0.2%)	198.17	21.46	41.36	13.02
T ₇ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Borax (0.2%)	190.13	18.92	40.73	12.79
T ₈ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%) + Borax (0.2%)	194.48	19.73	41.3	12.97
T ₉ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)+ Magnesium Sulphate (0.2%) + Borax (0.2%)	200.95	22.38	43.88	13.78
T ₁₀ - Potassium Schoenite (1%) + Borax (0.2%)	188.12	17.28	39.39	12.37
S.Em.±	1.04	0.39	0.84	0.19
C.D. at 5%	3.09	1.16	2.49	0.58

Table 2: Effect of water soluble nutrients on hand parameters of banana cv. Grand Naine

Treatments	Hand weight (kg)	Number of fingers per hand	Internodal length between the hands (cm)
T ₁ - Control	2.67	16.73	8.01
T ₂ - Sulphate of Potash (1%)	2.91	17.50	8.93
T ₃ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)	3.00	17.50	9.45
T ₄ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%)	3.31	18.00	10.23
T ₅ - Sulphate of Potash (1%) + Borax (0.2%)	3.10	17.35	10.03
T ₆ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) +Magnesium Sulphate (0.2%)	3.89	19.67	11.86
T ₇ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Borax (0.2%)	3.58	18.85	10.91
T ₈ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%) + Borax (0.2%)	3.76	19.34	11.15
T ₉ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)+ Magnesium Sulphate (0.2%) + Borax (0.2%)	4.02	20.13	12.04
T ₁₀ - Potassium Schoenite (1%) + Borax (0.2%)	3.46	18.39	10.68
S.Em.±	0.07	0.21	0.36
C.D. at 5%	0.20	0.64	1.06

Table 3: Effect of water soluble nutrients on bunch parameters of banana cv. Grand Naine

Treatments	Bunch weight (kg)	Bunch length (cm)	Number of hands per bunch	Number of fingers per bunch
T ₁ - Control	30.01	78.02	9.87	169.45
T ₂ - Sulphate of Potash (1%)	31.62	85.61	9.87	173.29
T ₃ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)	32.12	86.39	9.78	170.69
T ₄ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%)	34.03	88.22	9.45	172.09
T ₅ - Sulphate of Potash (1%) + Borax (0.2%)	32.94	87.13	9.71	170.38
T ₆ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) +Magnesium Sulphate (0.2%)	38.15	94.08	9.13	179.15
T ₇ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Borax (0.2%)	36.08	91.77	9.31	175.56
T ₈ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%) + Borax (0.2%)	37.31	93.02	9.21	178.11
T ₉ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)+ Magnesium Sulphate (0.2%) + Borax (0.2%)	39.21	95.87	9.09	182.00
T ₁₀ - Potassium Schoenite (1%) + Borax (0.2%)	35.78	89.14	9.54	175.49
S.Em.±	0.58	2.45	0.21	2.69
C.D. at 5%	1.73	7.28	NS	8.01

Table 4: Effect of water soluble nutrients on yield of banana cv. Grand Naine

Treatments	Yield per pit (kg)	Yield per acre (tonnes)	Yield per hectare (tonnes)
T ₁ - Control	30.01	30.01	75.03
T ₂ - Sulphate of Potash (1%)	31.62	31.62	79.05
T ₃ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)	32.12	32.12	80.30
T ₄ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%)	34.03	34.03	85.08
T ₅ - Sulphate of Potash (1%) + Borax (0.2%)	32.94	32.94	82.35
T ₆ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) +Magnesium Sulphate (0.2%)	38.15	38.15	95.38
T ₇ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Borax (0.2%)	36.08	36.08	90.20
T ₈ - Sulphate of Potash (1%) + Magnesium Sulphate (0.2%) + Borax (0.2%)	37.31	37.31	93.28
T ₉ - Sulphate of Potash (1%) + Calcium Nitrate (0.3%)+ Magnesium Sulphate (0.2%) + Borax (0.2%)	39.21	39.21	98.03
T ₁₀ - Potassium Schoenite (1%) + Borax (0.2%)	35.78	35.78	89.45
S.Em.±	0.58	0.60	1.22
C.D. at 5%	1.73	1.79	3.63



Plate 1: Effect of water soluble nutrients on hand parameters



Plate 2: T₁ (Control) and T₉ (best performing) treatment



Plate 3: Effect of water soluble nutrients on bunch parameters

Conclusion

From this study it can be concluded that spraying of combination of Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) increases the yield and yield parameters in banana cv. Grand Naine under hill zone of Karnataka.

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Conflict of Interest

None

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