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Effect of Water Soluble Nutrients on quality of Banana cv. Grand Naine under Hill Zone of Karnataka

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ABSTRACT: A field experiment was carried out in farmer's field at Anajooru village, Mudigere taluk, Chikkamagaluru district during the year 2021-2022. The experiment was laid out in Randomized Complete Block Design (RCBD) with ten treatments, which were replicated thrice. Among the treatments, T_9- Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) recorded maximum green life (11.23 days), shelf life (10.85 days), fruit weight (178.36 g), pulp weight (135.24 g), peel weight (43.12 g), pulp to peel ratio (3.14), TSS (23.91°Brix), reducing sugars (15.75 %), non-reducing sugars (2.98 %), total sugars (18.73 %),sugar to acid ratio (69.37) with minimum titratable acidity (0.27 %) and physiological loss in weight (11.24 %). 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

One of the oldest tropical fruits to be domesticated by humans was the banana (*Musa* spp.), which has significant socioeconomic value. It is cultivated across the tropical world and vital to the economies of many developing nations. Banana is the second-most significant fruit crop in India after the mango. It is known as kalpatharu (a plant of virtues) because of its versatile use from rhizome to the male flower. It is recognized as the fourth most important global food crop in terms of the gross value of production after paddy, wheat and milk (Adinarayana *et al*., 2016).

Supply of the nutrients to the plants through foliar application has become an established practice in developed countries and is gaining popularity in India. In such application, much of the applied nutrient results in quick absorption and utilization, avoiding losses due to fixation and leaching, at the same time there is scope for economizing the amount of nutrients used, thereby, influencing the growth and yield of plants (Sandhya *et al*., 2018).

Potassium is often referred as the quality element for crop production and it has been widely proven to have a crucial role in many crop quality parameters. The secondary nutrients such as calcium (Ca), magnesium (Mg), and sulphur (S) and micronutrient boron are required for the growth and development of banana. Even though they are less often limiting to plant growth than the primary nutrients. They are as critical for crop growth and development as the primary nutrients.

MATERIALS AND METHODS

The field experiment was carried out in a farmer's field, Anajooru village, Mudigere taluk of Chikkamagalur 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 7^{th} months of planting and compared with control. After harvesting, the selected five fingers from each treatment having true representation were analyzed for quality parameters and the average was worked out and subjected to statistical analysis.

RESULTS AND DISCUSSION

The findings were considerably interpreted and listed in Table 1 and 2 based on the observations recorded in the present research.

Effect of water soluble nutrients on postharvest parameters. The data regarding green life, shelf life, physiological loss in weight, fruit weight, pulp weight, peel weight and pulp to peel ratio showed significant difference among the treatments.

Green life (days). The perusal of data indicated that, there exists significant difference among treatments. The highest green life (11.23 days) was recorded in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas the lowest green life (6.98 days) was found in T_1-control (Table 1).

Sandhya *et al*. (2018) reported that, increase in green life may be due to potassium element responsible for cytokinin concentration in plant but in general cytokinin delays the senescence process hence, green life of the fruit has increased. The result of the present investigation is in close conformity with the findings of Pujari *et al*. (2010).

Shelf life (days). The maximum shelf life (10.85 days) was reported in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) and minimum shelf life (5.00 days) was found in T_1-control (Fig. 1).

The increased shelf life of the fruits by the application of calcium, magnesium and boron may be due to its role in the maintenance of fruit firmness, retardation of respiration rates as well as transpiration and delayed senescence. The results are corroborated with the findings of Sandhya *et al*. (2018); Kumar *et al*. (2008).

Physiological loss in weight (%). The data revealed that, there is a significant difference among the treatments. The minimum physiological loss in weight (11.24 per cent) recorded in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas maximum physiological loss in weight (19.57 per cent) was registered in T_1-control (Table 1).

The increase in the evapo-transpiration changes with progress of storage period might be responsible for high PLW of fruits. The decrease in weight loss by the application of calcium may be due to its role in the maintenance of fruit firmness, retardation of respiratory rates as well as transpiration and delayed senescence was reported by Bhatt *et al*. (2012); Kumar *et al*. (2008).

Fruit weight (g). The maximum fruit weight at ripe stage (178.36 g) was obtained in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas minimum fruit weight (128.51 g) was recorded in T_1-control (Table 1).

The decrease in weight loss there by maintaining fruit weight by the application of calcium may be due to its role in the maintenance of fruit firmness, retardation of respiratory rates as well as transpiration will influence the fruit weight these results are in conformity with Bhatt *et al*. (2012); Sandhya *et al*. (2018).

Pulp weight and peel weight (g). The maximum pulp weight (135.24 g) and peel weight (43.12 g) at ripe stage recorded in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%), whereas minimum pulp weight (92.59 g) and peel weight (35.92 g) at ripe stage was found in T_1-control (Table 1).

The maximum amount of pulp content was might be due to foliar application of secondary nutrients, boron and potassium might have made rapid synthesis of metabolites particularly carbohydrates and their translocation to the fruits causing relatively greater pulp content, whereas calcium and magnesium influenced peel weight similar results reported by Singh *et al*. (2010); Sandhya *et al*. (2018).

Pulp to peel ratio. The maximum pulp to peel ratio (3.14) was recorded in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) and minimum pulp to peel ratio (2.58) was recorded in T_1-control (Fig. 2).

This indicates the beneficial role of potassium and secondary nutrients to get good pulp recovery physiological loss in weight by fruits may contribute towards the more pulp weight. Thereby maintains the pulp to peel ratio. The results were in conformity with those obtained by Kumar *et al*. (2008); Nandan *et al*. (2011).

Effect of water soluble nutrients on biochemical parameters. The data regarding biochemical parameters such as TSS, titratable acidity, reducing sugars, nonreducing sugars, total sugars and sugars to acid ratio showed significant difference among the treatments.

TSS (°Brix). Results from the present study recorded the maximum total soluble solids (23.91°Brix) in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) and the minimum total soluble solids (18.97°Brix) was recorded in T_1-control (Table 2). Increase in TSS due to sulphate of potash may be due to when sulphate of potash supplied exogenously increased the flow of plant assimilates from source into the developing fruits. Further increase in total soluble solids may be due to the boron which helped in sugar transport there by it was possible to improve TSS. The results were in accordance with the findings of Kumar and Kumar (2007); Sandhya *et al*. (2018).

Titratable acidity (%). The treatment T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) recorded minimum acidity (0.27 %) while the maximum acidity was found in T_1-control (0.46 %) (Table 2). This might be due to more accumulation of sugar in fruit. The results were in close conformity with Nalina and Kumar (2007); Patel *et al*. (2010).

Reducing sugar, non-reducing sugar and total sugar (%). Reducing sugars (15.75 per cent), Non reducing sugars (2.98 per cent) and total sugars (18.73 per cent) were recorded in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) and minimum (13.00 %, 2.46 % and 15.46 %) were found in T_1-control (Table 2). Applied water soluble nutrients favoured the activity of anabolic enzymes and resulted in accumulation of highly polymerized carbohydrates, which would have subsequently disintegrated into sugars on ripening. The similar results were found by Sandhya *et al*. (2018); Kumar *et al*. (2008).

Sugar-acid ratio. The maximum sugar to acid ratio (69.37) was recorded in T_9-Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) and minimum sugar to acid ratio (33.61) was found in T_1-control (Table 2). The increase in sugar-acid ratio is mainly due to the decrease in acidity Kumar and Kumar (2007 and 2010); Nandan *et al*. (2011).

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

Treatments	Green life (days)	Physiological loss in weight (%)	Fruit weight (g)	Pulp weight (g)	Peel weight (g)
T_1- Control	6.98	19.57	128.51	92.59	35.92
T_2- Sulphate of Potash (1%)	8.92	17.42	137.04	99.83	37.21
T_3- Sulphate of Potash (1%) + Calcium Nitrate (0.3%)	10.11	13.24	148.85	108.00	40.85
T_4- Sulphate of Potash (1%) + Magnesium Sulphate (0.2%)	9.87	14.56	155.36	115.25	40.11
T_5- Sulphate of Potash (1%) + Borax (0.2%)	9.05	15.86	150.53	111.84	38.69
T_6- Sulphate of Potash (1%) + Calcium Nitrate (0.3%) +Magnesium Sulphate (0.2%)	10.96	11.82	174.75	131.92	42.83
T_7- Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Borax (0.2%)	10.71	12.07	167.18	125.07	42.11
T_8- Sulphate of Potash (1%) + Magnesium Sulphate (0.2%) + Borax (0.2%)	10.35	12.34	170.48	128.40	42.08
T_9- Sulphate of Potash (1%) + Calcium Nitrate (0.3%)+ Magnesium Sulphate (0.2%) + Borax (0.2%)	11.23	11.24	178.36	135.24	43.12
T_{10}- Potassium Schoenite (1%) + Borax (0.2%)	10.18	12.87	163.91	122.09	41.82
S. Em.±	0.16	0.21	2.03	1.87	0.59
C.D. at 5%	0.47	0.62	6.03	5.55	1.76

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

Treatments	Total soluble solids (°B)	Titratable acidity (%)	Reducing sugars (%)	Non reducing sugars (%)	Total sugars (%)	Sugar to acid ratio
T_1- Control	18.97	0.46	13.00	2.46	15.46	33.61
T_2- Sulphate of Potash (1%)	20.35	0.42	13.58	2.54	16.12	38.38
T_3- Sulphate of Potash (1%) + Calcium Nitrate (0.3%)	21.15	0.4	14.13	2.62	16.75	41.88
T_4- Sulphate of Potash (1%) + Magnesium Sulphate (0.2%)	22.05	0.37	14.9	2.74	17.64	47.68
T_5- Sulphate of Potash (1%) + Borax (0.2%)	21.76	0.39	14.71	2.68	17.39	44.59
T_6- Sulphate of Potash (1%) + Calcium Nitrate (0.3%) +Magnesium Sulphate (0.2%)	23.38	0.30	15.66	2.90	18.56	61.87
T_7- Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Borax (0.2%)	22.85	0.32	15.16	2.85	18.01	56.28
T_8- Sulphate of Potash (1%) + Magnesium Sulphate (0.2%) + Borax (0.2%)	23.01	0.31	15.44	2.88	18.32	59.10
T_9- Sulphate of Potash (1%) + Calcium Nitrate (0.3%)+ Magnesium Sulphate (0.2%) + Borax (0.2%)	23.91	0.27	15.75	2.98	18.73	69.37
T_{10}- Potassium Schoenite (1%) + Borax (0.2%)	22.42	0.36	15.02	2.81	17.83	49.53
S. Em.±	0.34	0.01	0.23	0.05	0.27	0.93
C.D. at 5%	1.01	0.03	0.68	0.16	0.83	2.76

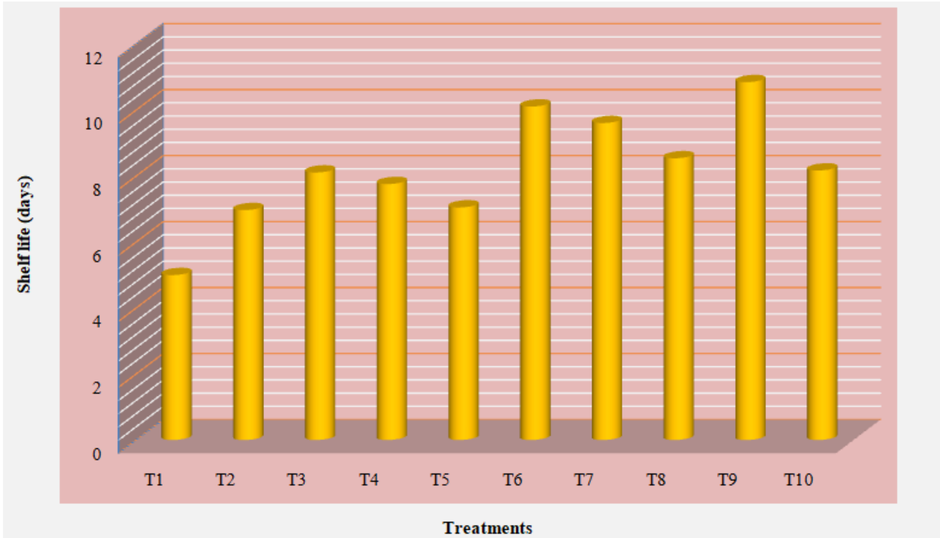

Fig. 1. Effect of water soluble nutrient on shelf life of banana cv. Grand Naine.

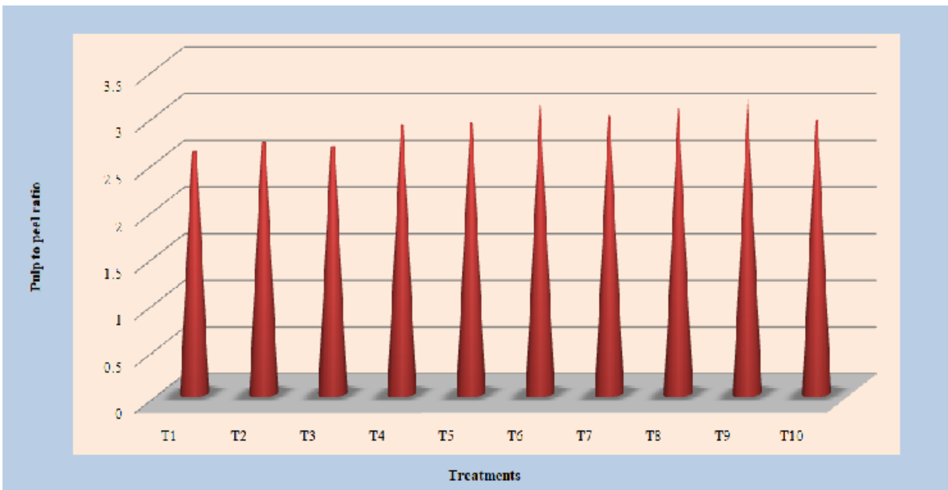

Fig. 2. Effect of water soluble nutrient on pulp to peel ratio of banana cv. Grand Naine.

CONCLUSION

The plants treated with foliar spray of water soluble nutrients on quality and post harvest parameters of banana cv. Grand Naine under hill zone of Karnataka. The treatment T_9 foliar spray of Sulphate of Potash (1%) + Calcium Nitrate (0.3%) + Magnesium Sulphate (0.2%) + Borax (0.2%) proved to be best. The treatment T_9 had influenced fruit postharvest parameters and biochemical parameters of banana and there by helps farmers to get enhanced benefit-cost ratio in banana cv. Grand Naine under hill zone of Karnataka.

FUTURE SCOPE

The future studies need to be carried out on combination of secondary nutrients and micronutrients on banana.

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Conflict of Interest. None.

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