Environment and Ecology 41 (3B) : 1815—1820, July—September 2023
Article DOI: https://doi.org/10.60151/envec/ISDL9245
ISSN 0970-0420

# Effect of Post Shooting Application of Fertilizers through Pouch Feeding on Quality Characteristics of Banana cv Grand Naine

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Received 14 March 2023, Accepted 28 May 2023, Published on 21 August 2023

## ABSTRACT

The present investigation entitled "Effect of post shooting application of fertilizers through pouch feeding on quality characters of banana cv Grand Naine" was carried out at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during 2018-19 in RBD with three replications and 15 treatments comprising 16 plants per treatment. The findings revealed that significantly maximum pulp : Peel ratio (3.34), total soluble solids (21.80 ºBrix), ascorbic acid content (8.36 mg/100g), reducing sugars (6.59 %) and shelf life (11.60 days) with minimum titrable acidity content of fruit (0.210 %) were recorded in banana bunch fed with cow dung slurry (300 g) + $(NH_4)_2SO_4$ (10 g) + SOP (10 g) while, maximum non-reducing sugars content of fruit (8.39 %) was recorded in bunch of banana cv Grand Naine fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (20 g) + SOP (10 g) and the higher value of total sugars content of fruit (14.75 %) was recorded in bunches fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (20 g) + SOP (10 g). Moreover, poor performance was recorded in banana bunch fed with control.

**Keywords** Banana, Grand Naine, Pouch feeding, Post shooting application.

## INTRODUCTION

Banana (*Musa paradisiaca* L.) is a large herbaceous perennial monocotyledonous and monocarpic plant which belongs to the Musaceae family and the order Scitamineae which has been originated from South East Asia. Among the banana varieties grown in India, the cultivar 'Grand Naine' belongs to Cavendish subgroup of AAA group. 'Grand Naine' is literally translated from French meaning large dwarf. It is shorter than the Gaint Cavendish and taller than Dwarf Cavendish cultivars. Its characteristics medium height and large fruit yields make it ideal for commercial cultivation.

Under commercial cultivation, the fruit qualities like size, uniform ripening, free from blemishes and defects and hands arrangement in bunch are very important to satisfy the market demands. Nutrients play a significant role in production of good quality fruits. Providing appropriate quantities of nutrients in the right proportion at right time is most essential

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tactic of nutrient management in successful banana cultivation. Among the several factors affecting fruit quality, adequate nutrients specially nitrogen and potassium application is considered to be most important in banana cultivation (Islam *et al*. 2020).

During fruit development, the plant nutrient status and uninhibited flow of nutrients to the developing bunch influence the bunch size and quality of banana plant. Soil characters and environmental factors may cause considerable loss to the soil applied nutrients leading to insufficient supply of nutrient after shooting to meet the nutrient demand of developing bunch. Hence, the technology of bunch feeding of nutrients is very useful because it provides a considerable scope not only for the effective utilization of nutrients but also to increase marketability by improving the quality of the produce.

## MATERIALS AND METHODS

The present investigation was carried out at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. This experiment was laid out on existing plot of banana, which was planted on last week of June 2018. In these experiment banana cv Grand Naine was fed with 15 treatments viz., $T_1$: Control, $T_2$: 300g cow dung slurry + Panchagavya (15 ml), $T_3$: 300g cow dung slurry + Panchagavya (15 ml) + $(NH_4)_2SO_4$ (10g), $T_4$: 300g cow dung slurry + Panchagavya (15 ml) + SOP (10g), $T_5$: 300g cow dung slurry + Panchagavya (15 ml) + $KNO_3$ (10g), $T_6$: 300g cow dung slurry + Novel (10 ml), $T_7$: 300g cow dung slurry + Novel (10 ml) + $(NH_4)_2SO_4$ (10g), $T_8$: 300g cow dung slurry + Novel (10 ml) + SOP (10g), $T_9$: 300g cow dung slurry + Novel (10 ml) + $KNO_3$ (10g), $T_{10}$: 300g cow dung slurry + $(NH_4)_2SO_4$ (10g), $T_{11}$: 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) + SOP (10g), $T_{12}$: 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) + $KNO_3$ (10g), $T_{13}$: 300g cow dung slurry + SOP (10g), $T_{14}$: 300g cow dung slurry + $KNO_3$ (10g) and $T_{15}$: 300g cow dung slurry + $(NH_4)_2SO_4$ (20g) + SOP (10g).

Treatments were imposed after emergence of inflorescence. Uniform bunches were selected for bunch stalk-feeding. Male bud was excised by giving slant cut at the distal end of bunch rachis immediately after all the pistillate flowers had set fruits. Black plastic bag of 200 gauge and 15 cm x 25 cm size was used for pouch feeding. In a plastic bags, blending 200 g fresh cow dung slurry with 100 ml of water (300 g cow dung slurry) and different fertilizer as per treatments. After banana bunch stalk deep in a way that 5-8 cm stalk immered in slurry and tied securely by dipping the excised rachis and maintained till harvest according to the treatments.

Bunches were harvested according to treatment and replication. However, 4 plants (net plot) were considered for recording the yield and quality parameters from each replication for all the treatments and observations were recorded on fruit quality parameters like pulp: Peel ratio, total soluble solids, reducing sugars, non-reducing sugars, total sugar, titrable acidity, ascorbic acid content and shelf life.

The pulp: Peel ratio was computed by using following formula,

$$\text{Pulp: Peel ratio} = \frac{\text{Pulp weight (g)}}{\text{Peel weight (g)}}$$

The method described by Ranganna (1986) was adopted for estimation of titrable acidity as well as ascorbic acid content and calculated by using following formulae,

$$\text{Acidity (\%)} = \frac{\text{Titre}}{\text{Volume of sample taken for estimation}} \times \frac{\text{Normality of Alkali} \times \text{Volume made up}}{\text{Weight of sample taken fof estimation}} \times 100 \times 100$$

$$\text{Ascoribic acid (mg/100g)} = \frac{\text{Titre}}{\text{Aliquat of extract taken for estimation}} \times \frac{\text{Dye factor} \times \text{Volume made up}}{\text{Weight of sample taken for estimation}} \times 100$$

The total sugars content was expressed as percentage in terms of invert sugars according to the formula,

$$\text{Total sugars (\%)} = \frac{\text{Glucose eq of Fehling's solution}}{\text{Titre}} \times \frac{\text{Total volume made up}}{\text{Weight of pulp taken}} \times \frac{\text{Volume made up after inversion}}{\text{Aliquot taken for inversion}} \times 100$$

The data on various observations recorded during the course of investigation were subjected to statistical analysis of variance for randomized Block Design following the method described by Panse and Sukhatme (1985).

## RESULTS AND DISCUSSION

### Pulp: Peel ratio

The results pertaining from data (Table 1) revealed that bunches of banana cv Grand Naine fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (10 g) + SOP (10 g) resulted with maximum pulp: Peel ratio (3.34) compared to other bunch feeding treatments which, indicates the beneficial role of potassium to get good pulp recovery. This might be due to less physiological loss in weight experienced by fruits contribute towards the more pulp weight (Pavan Kumar 2016). The increase in pulp thickness may be related to the role of potassium in influencing the developing fruit, which act as a strong sink for potassium than for other nutrients. Parallel findings were recorded by Sreekanth *et al*. (2018) in banana cv Robusta.

### Total soluble solids (°Brix)

Total soluble solids content of fruit was significantly maximum (21.80° Brix) in bunches of banana cv. Grand Naine fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (10 g) + SOP (10 g) among all other treatments (Table 1). These improvements in a prime factor like total soluble solids which determines the quality of fruits might be due to the hydrolysis of insoluble starch into soluble sugars. Similarly, sulphate of potash when supplied exogenously also source of K increased the flow of plant assimilates into the developing fruits especially when assimilate flow from other parts of plant becomes limited explained by Pavan Kumar (2016) in cv Grand Naine. Similar significant results were reported by Adinarayana *et al*. (2016) in banana cv Grand Naine and Garasangi *et al*. (2018) in banana cv Rajapuri.

### Titrable acidity (%)

The minimum acidity content of fruit (0.210 %) was found in bunches fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (10 g) + SOP (10 g) compared to other bunch feeding treatment was mentioned in Table 1. The reduced titrable acidity might be due to the

**Table 1.** Effect of post shooting application of fertilizers through pouch feeding on pulp: Peel ratio, TSS, titrable acidity and ascorbic acid of banana fruit cv Grand Naine.

| Treatments | Pulp : Peel ratio | TSS (°Brix) | Titrable acidity (%) | Ascorbic acid (mg/100g) |
|---|---|---|---|---|
| $T_1$- Control | 2.52 | 18.53 | 0.332 | 6.29 |
| $T_2$- 300g cow dung slurry + Panchagavya (15 ml) | 2.59 | 19.80 | 0.288 | 6.80 |
| $T_3$- 300g cow dung slurry + Panchagavya (15 ml) + $(NH_4)_2SO_4$ (10g) | 3.04 | 21.13 | 0.224 | 8.00 |
| $T_4$- 300g cow dung slurry + Panchagavya (15 ml) + SOP (10g) | 2.72 | 20.93 | 0.257 | 7.56 |
| $T_5$- 300g cow dung slurry + Panchagavya (15 ml) + $KNO_3$ (10g) | 2.68 | 20.80 | 0.256 | 7.66 |
| $T_6$- 300g cow dung slurry + Novel (10 ml) | 2.55 | 19.03 | 0.302 | 6.52 |
| $T_7$- 300g cow dung slurry +Novel (10 ml) + $(NH_4)_2SO_4$ (10g) | 2.74 | 21.20 | 0.232 | 7.72 |
| $T_8$- 300g cow dung slurry + Novel (10 ml) + SOP (10g) | 2.84 | 20.93 | 0.251 | 7.73 |
| $T_9$- 300g cow dung slurry + Novel (10 ml) + $KNO_3$ (10g) | 3.02 | 21.27 | 0.222 | 8.03 |
| $T_{10}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) | 2.65 | 20.73 | 0.258 | 7.28 |
| $T_{11}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) + SOP (10g) | 3.34 | 21.80 | 0.210 | 8.36 |
| $T_{12}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) + $KNO_3$ (10g) | 3.17 | 21.27 | 0.220 | 8.16 |
| $T_{13}$- 300g cow dung slurry + SOP (10g) | 2.80 | 20.33 | 0.260 | 7.12 |
| $T_{14}$- 300g cow dung slurry + $KNO_3$ (10g) | 2.77 | 19.87 | 0.269 | 6.96 |
| $T_{15}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (20g) + SOP (10g) | 3.27 | 21.53 | 0.212 | 8.23 |
| SEm ± | 0.17 | 0.51 | 0.006 | 0.44 |
| CD at 5% | 0.48 | 1.48 | 0.018 | 1.27 |
| CV% | 10.11 | 4.30 | 4.350 | 10.12 |

additional dose of K as bunch feeding resulted in reduced acid content of fruits because of the fact that under low K regime, phosophenol pyruvate (PEP) was apparently shunted into alternate pathways resulting in shortage of acetyl CO-A. Hence, oxalo-acetate appeared to be preferentially formed from PEP in plants with low levels of K and this organic acid derivative is accumulated (Garasangi *et al*. (2018) in banana cv Rajapuri). Neutralization of organic acids due to high K level in tissues could have also resulted in reduction in acidity was stated by Sreekanth *et al*. (2018) in banana cv Robusta.

**Ascorbic acid (mg/100g)**

Bunch fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (10 g) + SOP (10 g) gave maximum ascorbic acid content of fruit (8.36 mg/100g) than other treatments (Table 1). These might be due to potassium and sulfur could have helped to slow down the enzyme system that encouraged the oxidation of ascorbic acid, thus helping the plants to accumulate more ascorbic acid content in the fruits. The high energy status in crops well supplied with K also promotes synthesis of secondary metabolites, like Vitamin C (Vivela *et al*. 2013). The similar results were noticed by Shira *et al*. (2013) in cv Martaman (Musa AAB), Pavan Kumar (2016) in banana cv Grand Naine and Garasangi *et al*. (2018) in banana cv Rajapuri.

**Reducing sugars (%)**

The results pertaining from data (Table 2) revealed that banana bunches fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (10 g) + SOP (10 g) showed significantly maximum reducing sugars content of fruit (6.59 %) compared to other bunch feeding treatment. Increase in reducing sugars might be due to application of cow dung and potassium to the distal stalk end of bunches which significantly improved the reducing sugars content of the fruits. Post shoot application of potassium causes conversion and utilization of energy for finger development which would be otherwise lost for opening of the remainder of the flower and also leads to removal of a strong and active competing sink for photosynthates and also potassium involved in carbohydrate synthesis, breakdown and translocation and synthesis of protein and post shooting application of potassium favors the conversion of starch into simple sugars during ripening by activating sucrose

**Table 2.** Effect of post shooting application of fertilizers through pouch feeding on reducing sugars, non reducing sugars, total sugars and shelf life of banana fruit cv Grand Naine.

| Treatments | Reducing sugars (%) | Non reducing sugars (%) | Total sugars (%) | Shelf life (days) |
|---|---|---|---|---|
| $T_1$- Control | 4.06 | 5.53 | 9.59 | 7.80 |
| $T_2$- 300g cow dung slurry + Panchagavya (15 ml) | 4.84 | 5.99 | 10.83 | 7.60 |
| $T_3$- 300g cow dung slurry + Panchagavya (15 ml) + $(NH_4)_2SO_4$ (10g) | 6.23 | 7.44 | 13.67 | 9.27 |
| $T_4$- 300g cow dung slurry + Panchagavya (15 ml) + SOP (10g) | 5.69 | 7.26 | 12.95 | 8.53 |
| $T_5$- 300g cow dung slurry + Panchagavya (15 ml) + $KNO_3$ (10g) | 5.39 | 7.22 | 12.61 | 8.33 |
| $T_6$- 300g cow dung slurry + Novel (10 ml) | 4.08 | 5.85 | 9.93 | 7.53 |
| $T_7$- 300g cow dung slurry +Novel (10 ml) + $(NH_4)_2SO_4$ (10g) | 5.87 | 7.39 | 13.26 | 8.53 |
| $T_8$- 300g cow dung slurry + Novel (10 ml) + SOP (10g) | 5.81 | 7.36 | 13.17 | 8.93 |
| $T_9$- 300g cow dung slurry + Novel (10 ml) + $KNO_3$ (10g) | 6.32 | 7.61 | 13.93 | 9.47 |
| $T_{10}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) | 5.25 | 7.29 | 12.53 | 8.47 |
| $T_{11}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) + SOP (10g) | 6.59 | 7.71 | 14.3 | 11.60 |
| $T_{12}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (10g) + $KNO_3$ (10g) | 6.55 | 7.70 | 14.25 | 10.67 |
| $T_{13}$- 300g cow dung slurry + SOP (10g) | 5.01 | 6.5 | 11.51 | 8.07 |
| $T_{14}$- 300g cow dung slurry + $KNO_3$ (10g) | 4.83 | 6.21 | 11.04 | 8.00 |
| $T_{15}$- 300g cow dung slurry + $(NH_4)_2SO_4$ (20g) + SOP (10g) | 6.51 | 8.24 | 14.75 | 10.93 |
| SEm ± | 0.19 | 0.41 | 0.43 | 0.30 |
| CD at 5% | 0.55 | 1.18 | 1.23 | 0.87 |
| CV% | 6.00 | 10.22 | 5.88 | 5.83 |

synthase enzyme, resulting in high sugars content of the fruit. Parallel results were observed in findings of Garasangi *et al*. (2018) in banana cv Rajapuri and Sreekanth *et al*. (2018) in banana cv Robusta.

**Non-reducing sugars (%)**

Significantly the maximum non-reducing sugars content of fruit (8.39 %) was recorded in bunch of banana cv Grand Naine fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (20 g) + SOP (10 g) was mentioned in Table 2. Similar findings were also reported by Garasangi *et al*. (2018) in banana cv Rajapuri and Sreekanth *et al*. (2018) in banana cv Robusta as that of the present investigation.

**Total sugars (%)**

The higher value of total sugars content of fruit (14.75 %) was recorded in bunches fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (20 g) + SOP (10 g) compare to all other treatments (Table 2). Enhanced quality of fruits particularly the sugars content might be due to the role of sulphate ($SO_4$) ions released from sulphate of potash as sulphate favored, while chloride reduced, the activity of anabolic enzymes and resulted in accumulation of highly polymerized carbohydrates (starch), which would have subsequently disintegrated into sugars on ripening. While, potassium in sulphate of potash favors conversion of starch into simple sugars during ripening by activating the sucrose synthatase enzyme thus resulting in higher sugars percentage in potassium treated bunches. In plants supplied with potassium, the osmotic potential of the phloem sap and the volume flow were higher than in bunches with low K supply and as a result, sucrose concentration in content of fruits was increased (Sreekanth *et al*. 2018). The results were in close conformity with findings of Pavan Kumar (2016) in banana cv Grand Naine.

**Shelf life (days)**

The results pertaining from data (Table 2) revealed that the fruits were stored at ambient temperature for the maximum period of time (11.60 days) when bunch fed with 300 g cow dung slurry + $(NH_4)_2SO_4$ (10 g) + SOP (10 g). This could be attributed to the potassium nutrient supplied through bunch feeding enhances storage and shipping quality of bananas and also extends their shelf life. Among the various nutrients, potassium not only improves yields but also benefits various aspects of quality. It also promotes long shelf life and adequate processing quality for industry. This is evident from the fact that, low potassium nutrition results in thin and fragile bunch with shorter shelf life (Garasangi *et al*. 2018). Similar significant results were reported by Sreekanth *et al*. (2018) in banana cv Robusta.

## CONCLUSION

It can be concluded from the present study that post shoot application of fertilizers through pouch feeding is very helpful in improving quality attributes of banana cv Grand Naine which intern increases the economic return to the formers.

Bunches of banana cv Grand Naine fed through pouch with 300 g cow dung slurry + $(NH_4)_2SO_4$ (10 g) + SOP (10 g) was found better for improving quality parameters of banana.

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