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**Research Article**

# Effect of Bunch Feeding on Yield Parameters of Banana cv. Grand Naine in Ratnanagar, Chitwan, Nepal

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## Abstract

A field experiment consisting of bunch stalk feeding with different treatments on yield of banana cv. Grand Naine (G9) was conducted during 2022 in Ratnanagar-12, Jamunapur of Chitwan, Nepal. The experiment was laid in Random Complete Block Design (RCBD) with 7 treatments and 3 replications. Bunch fed with dipping the cut end in the combination of 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water resulted significantly higher finger length (20.36 cm), finger weight (0.18kg), finger diameter (36.28mm, bunch length (101.90 cm), bunch weight (32.37 kg), peel weight (19.05 g). and pulp weight (82.39 g) compared with control (without bunch stalk feeding). Thus, the research shows that the bunch feeding with 500gm cow dung, 10g urea, 20g SOP and 15mg of GA3 improves yield parameters of banana cv. Grand Naine.

**Keywords:** Banana Cv. Grand Naine; Bunch Stalk Feeding; Gibberellic Acid; Yield Parameters

## Introduction

The banana (Musa spp.) plant is the largest herbaceous flowering plant. Banana is classified as a hybrid of two species *Musa acuminata* and *Musa balbisian* as recognized by the International Code of Nomenclature for Cultivated Plants. Banana is one of the major commercial fruit crops grown in the tropics, subtropics and plays a key role in the economy of developing countries. It is one of the most important fruit crops of Nepal, which is cultivated throughout the year. It is regarded as a tree of wisdom and is one of the most important tropical fruits. It is prized over the world for its flavor, nutritional benefits, and year-round availability. Banana plants are normally tall and fairly sturdy, and are often mistaken for trees, but what appears to be a trunk is actually a "false stem" or pseudo stem which is composed of the leaf sheath and a terminal crown of leaves through which inflorescences emerges. In Nepal, bananas are cultivated in an area of 21,633 hectares and production

of 408,388 metric tons with productivity of 15.97 MT/ha. (MoALD., 2020/21).

The banana is a heavy nutrient feeder and needs a steady supply of both nutrients and water in order to grow, develop, and produce. According to (Lahav, 1995) total nitrogen uptake by banana plants is closely correlated with total dry matter production. Aside from utilising the nutrient for growth, banana plants are unable to store nitrogen. Because of this, even when the crop is cultivated on extremely fertile soils, this nutrient is still seen as being in insufficient supply (Robinson, 1996). The most important nutrients for plant growth, development, and fruit production are potassium and nitrogen. Denavelling does not allow the food to flow in undesirable sink section due to which the fruit size increases. To achieve high yields, the banana plant is supplied with nutrients via soil and foliage, de-navelling (removal of male inflorescence for nutrient diversion), and post-shoot feeding of nutrients via the distal stalk-end of the rachis. The plant's nutrient status and the unrestricted flow of nutrients to the developing bunch influence bunch size and fruit quality during fruit development. In the bunch feeding technique the nutrients are directly feed to the denavelled end of stalk by packing them in the bio degradable bags. In banana, gibberellic acid delayed peel color changes, weight loss, ethylene, $CO_2$ production and total sugar content. This indicates that gibberellic acid prevents the fruit ripening. Therefore, an attempt is to know the influence of de-navelling and bunch stalk feeding on vegetative parameters feeding urea, SOP, ammonium sulphate, vermicompost and banana special in combination through the excised distal stalk-end of rachis after de-navelling and to determine influence of treatments on vegetative parameters of “Grand Naine” banana.

## Materials and methodology

The experiment was carried out in farmers field in Ratnanagar-12, Jamunapur of Chitwan district of Nepal. Chitwan district is located in the Bagmati Province's southwest corner and extends from 27°36'21.60" N longitude to 84°22'47.28" East with the altitude of 201 meters from the sea level. The experiment used Randamized complete block design (RCBD) with seven treatments replicated for three time.

For bunch stalk feeding, uniform bunches were chosen for each treatment. The prepared solution was immediately placed in a thick polythene bag and tied to the stalk end where rachis was extirpated from the bunch's distal end, along with a male bud, resulting in a slant cut. (De-navelling by rachis excision 10 cm after the last hand) performed shortly after all pistillate flowers set fruits, i.e., 15 days after flower emergence, and was maintained until harvest. Detail of Treatments used during the experiment is given in Table 1.

***Study Parameters***

Bunch length(cm), bunch weight (kg), finger length(cm), finger weight(kg), finger diameter(mm), peel weight(g) and pulp weight(g) were recorded from the treated plants. All the parameter was recorded after harvest of fully mature bunches. Bunches were cut when the fingers were fully developed and the fruit's surface was free of ridges.

**Table 1**: Detail of Treatments used during the experiment.

| **Treatment No.** | **Treatment** |
|---|---|
| T1 | 7.5g urea +7.5g SOP + 500g cow dung +100ml water |
| T2 | 10g urea +10g SOP +5g banana special +300g vermicompost |
| T3 | 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml of water |
| T4 | 500g cow dung + 20g $K_2SO_4$+ 100ml water |
| T5 | 500g cow dung + 20g urea + 100ml water |
| T6 | 20g Ammonium sulphate + 10g SOP + 300g cow dung + 100ml water |
| T7 | Control (without bunch stalk feeding) |

## Result and Discussion

***Bunch Weight***

Bunch feeding with dipping the cut end in the 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water (T3) which showed higher bunch length (101.90cm) and bunch weight (32.37kg). Whereas, the control (T7) which did not receive any additional nutrients supplement recorded the lowest bunch weight (19.67kg) and bunch length (72.67cm).

Bunch fed with combination of 500 ml of cow dung slurry and 20 g of K2SO4 increased the characters of bunch weight, green life, shelf life, benefit: cost ratio and reduced titrable acidity and physiological loss in weight (Soumya, Athani *et al*., 2018). Sulfur is present in SOP, resulting in

increased bunch weight and length. Sulfur may have a direct impact on catalase peroxidase enzyme activation in plants by forming iron-sulphur protein (ferredoxin) (Sreekanth *et al*., 2017)**.** Sulfur results in intensification of absorption of potassium or it can react with nitrogen and potassium (Farrag, 1990). Furthermore, sulfur in SOP had a synergistic effect with zinc, which is required for carbon dioxide absorption and utilization, RNA synthesis, and auxin synthesis. Sulfur aids in energy transformation and enzyme activation in carbohydrate metabolism, resulting in greater photosynthetic partitioning. **(**Devraj *et al*., 2019). The influence of Sulfur in enhancing bunch weight in bananas was stressed by (Lahav, 1995) suggested the influence of Sulphur in enhancing in enhancing the bunch weight. SOP also activated the maximum nitrate reductase in the majority of growth phases. Since nitrate reductase is the key enzyme of nitrate assimilation, the maintenance of the high rate of enzyme activity is imperative for enhanced protein content of the plants (Lahav, 1995). The K ion is also very much essential in this enzyme activity by (Evans & Sorger, 1996). In bunch feeding, direct feeding of ammonium sulphate provides nitrogen which was effectively replaced by urea to supply additional N has a higher urease activity in fruit (Ancy *et al*., 1998) This may facilitate hydrolysis of urea to ammonia for easy absorption and assimilation of N.

GA3 (Gibberellic acid) is the plant growth regulator which stimulated cell division and elongation, resulting in better fruit length and weight (Kumar *et al*., 2017)

***Bunch Length***

The longest bunch length (101.90cm) was obtained in the bunches fed with (T3) where, the bunch fed with dipping the cut end in the500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water. While, the shortest bunch length (72.67cm) was obtained in control (T7) where no additional nutrients were supplied. Additional potassium and GA3 supply may contribute to bunch length. Treatment with K affects RNA and DNA synthesis, both of which contribute to cell division and elongation, as does GA3.

***Finger Length***

The longest finger length (20.36 cm) was obtained in the bunches fed with (T3) where, the bunch fed with dipping the cut end in the 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water While, the shortest finger length (16.23 cm) was obtained in control (T7). The nutrients supplied during the latter stages of fruit growth by bunch feeding would have been used for fruit cell elongation and the formation of larger intercellular spaces (Kotur, 2015)

***Finger Weight***

The bunch fed with (T3) dipping the cut end in the 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water recorded the significantly highest finger weight (0.18 kg). While, the lowest finger weight (0.12 kg) was recorded in control (T7). The increase in finger weight might be due to the rapid multiplication and enlargement of cells and greater accumulation of the sugar and carbohydrates and water in the expanded cells. (Pandey & Sinha, 1996) Suggested that the increased finger weight in the SOP-treated plot was due to sulphur from SOP, which has been discovered to be responsible for the formation of iron-sulphur protein in plants, which may have a direct impact on activating the catalase and peroxidase enzymes. (Wagle *et al*., 2022) also proved that the use of GA3 at a concentration of 100 ppm increased the length, girth, and weight of the bananas.

***Finger Diameter***

The greater finger diameter (36.28 mm) was obtained in the bunches fed with (T3) where, the bunch fed with dipping the cut end in 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water While, the shortest finger diameter (29.60 mm) was obtained in control (17).

The increase in diameter was reflected in an increase in finger weight, indicating that bunch feeding has a positive impact on the banana's finger diameter. Following the opening of its full hand, both the elements Sulphur and potassium are thought to be used more for cell elongation, resulting in greater finger girth (Mustaffa *et al*., 2004) in cv. Nendran, (Kumar, 2007)**.** in cv. Ney poovan.

The increase in length and diameter of the banana fruit could be attributed to the exogenous supply of micronutrients and PGR (GA3), which had a similar effect in the cape gooseberry fruit experiment. GA3 appears to play a direct role in hastening the process of cell division as well as cell elongation, resulting in increased size and weight in cape gooseberry. (Kumar *et al*., 2017).

***Pulp Weight***

The pulp of Grand Naine is thick and at the edible stage the pulp becomes thicker. The greater pulp weight was obtained in T3, dipping the cut end in the 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water (82.39 gm) while less was found in T7 (Control) which could be attributed to less experienced physiological weight loss by fruits .The potassium in SOP is thought to play a beneficial role in achieving good pulp weight (Millik *et al*., 2018).

***Peel Weight***

The maximum peel weight was found in (T3) dipping the cut end in 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml water (19.05 gm) while the less was obtained in control (T7) (11.45 gm). This result was supported by (Shira *et al*., 2012).

**Table 2**: Effect of Bunch Feeding on yield parameters of Banana cv. Grand Naine

| Treatment | Bunch length (cm) | Bunch Weight (kg) | Finger length (cm) | Finger weight (kg) | Finger Diameter (mm) | Peel Weight (g) | Pulp Weight (g) |
|---|---|---|---|---|---|---|---|
| 7.5g urea +7.5g SOP + 500g cow dung +100ml water | 76.33$^{bc}$ | 25.09$^{cd}$ | 18.83$^{ab}$ | 0.15$^{b}$ | 33.55$^{ab}$ | 14.58$^{b}$ | 65.55$^{b}$ |
| 10g urea +10g SOP +5g banana special +300g vermicompost | 88.00$^{b}$ | 27.71$^{b}$ | 17.73$^{bc}$ | 0.15$^{b}$ | 31.77$^{ab}$ | 13.49$^{bc}$ | 65.79$^{b}$ |
| 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml of water | 101.9$^{a}$ | 32.37$^{a}$ | 20.36$^{a}$ | 0.18$^{a}$ | 36.28$^{a}$ | 19.05$^{a}$ | 82.39$^{a}$ |
| 500g cow dung + 20g k2so4 + 100ml water | 77.20$^{bc}$ | 24.62$^{d}$ | 16.0$^{c}$ | 0.15$^{b}$ | 35.66$^{a}$ | 13.66$^{bc}$ | 66.46$^{b}$ |
| 500g cow-dung + 20g urea + 100ml water | 83.5$^{bc}$ | 26.71$^{bc}$ | 17.43$^{bc}$ | 0.15$^{b}$ | 30.3$^{b}$ | 13.23$^{bc}$ | 65.91$^{b}$ |
| 20g Ammonium sulphate + 10g SOP + 300g cow dung + 100ml water | 85.23$^{b}$ | 24.36$^{d}$ | 17.33$^{bc}$ | 0.13$^{bc}$ | 29.90$^{b}$ | 14.24$^{bc}$ | 69.34$^{b}$ |
| Control | 72.66$^{c}$ | 19.66$^{e}$ | 16.23$^{c}$ | 0.12$^{c}$ | 29.60$^{b}$ | 11.45$^{c}$ | 62.43$^{b}$ |
| GM | 83.54 | 25.79 | 17.70 | 0.148 | 32.44 | 14.25 | 68.27 |
| LSD | 12.13 | 1.77 | 2.02 | 0.02 | 4.71 | 12.29 | 6.88 |
| SEm | 46.504 | 0.99 | 1.28 | 0.00014 | 7 | 3.11 | 8.35 |
| C.V% | 8.16 | 3.86 | 6.40 | 7.98 | 8.15 | 3.07 | 22.076 |

## Conclusion

The bunch feeding technique in banana was found to be effective to improve the yield parameter. The bunch characters were found to be superior in treated plot also the improved finger characters were obtained in treated plots. After, the excision of male bud the rachis dipped in the solution 500gm cow dung + 10g urea + 20g SOP + 15mg of GA3 + 100ml of water was found to give better results in term of bunch weight, finger length, finger weight, finger girth, peel weight and pulp weight.

## Authors' Contribution

S. Shrestha designed the research plan; S. Shrestha, S. Bhattarai & A. Ranabhat performed experimental works & collected the required data. S. Bhattarai, P. Tamang & A. Ranabhat analysed the data; S. Shrestha prepared the manuscript. S. Bhattarai, P. Tamang & A. Ranabhat critical revised and finalized the manuscript. Final form of manuscript was approved by all authors.

## Conflict of Interest

The authors declare that there is no conflict of interest with the present publication.

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