

*Short communication***Influence of nitrogen and phosphorus fertilization on fruiting and yield characteristics in ratoon crop of banana (*Musa spp.* AAA) cv. Grande Naine****K.S. Navaneethakrishnan, H.S. Dhaliwal, M.I.S. Gill and J.S. Brar**

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**ABSTRACT**

In ratoon crop of banana cv. Grande Naine, date of shooting could be advanced by 35 days with application of 200g N in 5 splits + 60g P<sub>2</sub>O<sub>5</sub> (86 days), compared to 300g N in 5 splits + 60g P<sub>2</sub>O<sub>5</sub> (121 days). Subsequently, date of harvest also got advanced by 53 days, and fruits were harvested on 9<sup>th</sup> December in the same treatment. Higher dose of N fertilization delayed shooting and harvesting period, taking 121 days for shooting and 145 days from shooting to harvest in the treatment 300g N (5 split doses) + 90g P<sub>2</sub>O<sub>5</sub>. Various N and P treatments affected bunch weight and number of hands per bunch significantly. Although N and P combination-treatments had no significant effect on bunch weight or number of hands per bunch, application of 200g N in 5 splits and 60g P<sub>2</sub>O<sub>5</sub> per plant gave maximum bunch weight (18.11kg) and number of hands per bunch (10.61). Minimum bunch weight (15.37kg) and the least number of hands per bunch (7.08) were obtained with 150g N in 5 splits + 90g P<sub>2</sub>O<sub>5</sub>. Hand-weight (2.20kg), number of fingers per hand (19.75), and finger length (20.30cm) was highest with application of 200g N in 5 splits + 60g P<sub>2</sub>O<sub>5</sub> per plant. Least hand-weight (1.64kg), number of fingers per hand (15.77), and finger-length (17.92cm) was recorded with 150g N in 5 splits + 90g P<sub>2</sub>O<sub>5</sub>. Bunch weight, number of hands per bunch, hand-weight and number of fingers per hand too was affected significantly with sole application of nitrogen or phosphorus.

**Key words:** Banana, fertilization, nitrogen, phosphorus, yield

Banana is the leading fruit crop of India at nearly 32.56% of the total fruit production in the country. In India, banana ranks third in terms of area (0.776 million ha) and first in terms of production (26.51 million tonnes) among fruit crops (Anon., 2013). Banana is a very popular fruit due to its low price, year-round availability, varietal range, taste, medicinal value and nourishment, among all the fruits. In the banana crop, it is essential to induce quick growth and produce more leaves with a larger leaf area. It is a gross feeder of nutrients and responds well to nitrogen and phosphorus. Indian soils are deficient in nitrogen (N) and phosphorous (P) and these two plant nutrients, together with organic manure, play an important role in getting good crop returns (Datt and Sundharam, 2005). Dosage and type of nutrient to be applied depends up on the cultivar, inherent soil-fertility, stage of plant growth, climate, etc. A better vegetative growth ensures better bunch development. High fertilization-requirement in banana is due mainly to its rapid and vigorous growth, and high fruit yield. Banana as a crop is new to Punjab, therefore, requisite information on nutrient

management for optimal growth and fruiting needs to be generated. Thus, an urgent need was felt for gathering this valuable information for optimal production of banana under the sub-tropical conditions of Punjab. Therefore, the present investigations were carried out to study the effect of N and P on fruiting and yield characteristics in banana cv. Grande Naine under Punjab conditions.

The investigation was carried out at Fruit Research Farm of Department of Fruit Science, Punjab Agricultural University, Ludhiana. Nitrogen and phosphorus-containing fertilizers were applied to the ratoon crop of banana cv. Grande Naine. The plants were subjected to uniform cultural practices, excepting fertilizer treatments. These included two P treatments, viz., 60g and 90g per plant and six N treatments, viz., 150g (5 split doses), 150g (4 split doses), 200g (5 split doses), 250g (4 split doses), 250g (5 split doses), 300g (5 split doses); twelve N and P combination-treatments were also tested, viz., T<sub>1</sub>- 150g N (5 split doses) + 60g P<sub>2</sub>O<sub>5</sub>; T<sub>2</sub>- 150g N (5 split doses) + 90g P<sub>2</sub>O<sub>5</sub>; T<sub>3</sub>- 200g

**Table 1. Effect of various combinations of N and P fertilizers on shooting and date of harvest in the ratoon crop of banana cv. Grand Naine**

Treatment	Date of shooting	Days taken to shooting	Date of harvest	Days taken from shooting to harvest	Bunch weight (kg)	No. of hands per bunch	Hand weight (kg)	No. of fingers per hand	Finger-length (cm)
T <sub>1</sub> -150g N(5 split doses)+60g P <sub>2</sub> O <sub>5</sub>	Sept.19	98	Jan. 3	106	15.88	7.19	1.66	16.51	18.25
T <sub>2</sub> -150g N(5 split doses)+90g P <sub>2</sub> O <sub>5</sub>	Sept. 25	104	Jan. 6	102	15.37	7.08	1.64	15.77	17.92
T <sub>3</sub> -200g N(4 split doses)+60g P <sub>2</sub> O <sub>5</sub>	Sept. 10	89	Dec. 14	95	17.57	10.08	2.04	19.19	19.24
T <sub>4</sub> -200g N(4 split doses)+90g P <sub>2</sub> O <sub>5</sub>	Sept. 20	98	Dec. 24	95	17.17	9.41	2.01	18.80	18.74
T <sub>5</sub> -200g N(5 split doses)+60g P <sub>2</sub> O <sub>5</sub>	Sept. 7	86	Dec. 9	92	18.11	10.61	2.20	19.75	20.30
T <sub>6</sub> -200g N(5 split doses)+90g P <sub>2</sub> O <sub>5</sub>	Sept. 13	91	Dec. 19	96	17.65	9.98	2.08	19.40	19.40
T <sub>7</sub> -250g N(4 split doses)+60g P <sub>2</sub> O <sub>5</sub>	Sept. 23	102	Jan. 5	129	16.83	9.09	1.96	18.14	19.00
T <sub>8</sub> -250g N(4 split doses)+90g P <sub>2</sub> O <sub>5</sub>	Oct. 4	114	Feb. 22	140	16.51	8.50	1.84	17.92	18.36
T <sub>9</sub> -250g N(5 split doses)+60g P <sub>2</sub> O <sub>5</sub>	Oct. 3	113	Feb. 23	142	16.08	7.51	1.76	16.98	17.85
T <sub>10</sub> -250g N(5 split doses)+90g P <sub>2</sub> O <sub>5</sub>	Oct. 9	112	Mar. 4	145	15.79	7.30	1.64	16.07	17.59
T <sub>11</sub> -300g N(5 split doses)+60g P <sub>2</sub> O <sub>5</sub>	Oct. 9	119	Mar. 2	143	16.42	8.11	1.88	17.74	18.55
T <sub>12</sub> -300g N (5 split doses) +90g P <sub>2</sub> O <sub>5</sub>	Oct.11	121	Mar. 6	145	16.12	7.62	1.78	17.21	17.98
CD (5%)	-	-	-	-	NS	NS	NS	NS	NS

N (4 split doses) + 60g P<sub>2</sub>O<sub>5</sub>; T<sub>4</sub>- 200g N (4 split doses) + 90g P<sub>2</sub>O<sub>5</sub>; T<sub>5</sub>- 200g N (5 split doses) + 60g P<sub>2</sub>O<sub>5</sub>; T<sub>6</sub>- 200g N (5 split doses) + 90g P<sub>2</sub>O<sub>5</sub>; T<sub>7</sub>- 250g N (4 split doses) + 60g P<sub>2</sub>O<sub>5</sub>; T<sub>8</sub>- 250g N (4 split doses) + 90g P<sub>2</sub>O<sub>5</sub>; T<sub>9</sub>- 250g N (5 split doses) + 60g P<sub>2</sub>O<sub>5</sub>; T<sub>10</sub>- 250g N (5 split doses) + 90g P<sub>2</sub>O<sub>5</sub>; T<sub>11</sub>- 300g N (5 split doses) + 60g P<sub>2</sub>O<sub>5</sub>; and T<sub>12</sub>- 300g N (5 split doses) + 90g P<sub>2</sub>O<sub>5</sub>. For supplying nitrogen, urea was applied in four, and five, split doses in the months of May, June, July and August, and, in the months of May, June, July, August and September, respectively. Phosphorus was applied in the form of single-super-phosphate at the time of planting, along with farm yard manure. The date of shooting, i.e., the first distinguishing feature between the vegetative and reproductive apex (involving production of the bract primordium with thinner base) was noted in each plant. Number of hands per bunch was recorded, and, the average of eight plants was pooled; number of fingers per hand was recorded as an average of three hands selected randomly, i.e., upper, lower and middle, finger length of randomly selected hands was measured with a scale, weight of the 2<sup>nd</sup> and 3<sup>rd</sup> hand of the bunch was recorded in kilograms; bunch weight in each plant was recorded and date of harvest noted for each of the experimental plants as per criteria given by Dhillon *et al* (2002).

Date of shooting was observed to be affected by different doses of N, P and combinations thereof. Maximum number of days (121) taken to shooting was recorded in the treatment T<sub>12</sub> (300g N in 5 split doses+ 90g P<sub>2</sub>O<sub>5</sub>), whereas, it took minimum number of days (86) in the treatment T<sub>5</sub> (200g N in 4 split doses + 60g P<sub>2</sub>O<sub>5</sub>). Thus, there was a delay of 35 days in T<sub>12</sub> compared to T<sub>5</sub> (Table 1). Similarly,

**Table 2. Effect of various doses of applied N fertilizer on bunch weight (kg) and number of hands per bunch in the ratoon crop of banana cv. Grand Naine**

Treatment	Bunch weight (kg)	No. of hands per bunch	Hand-weight (kg)	No. of fingers per hand	Finger-length (cm)
N <sub>1</sub> -150g N (5 split doses)	15.63	7.13	1.65	16.14	18.08
N <sub>2</sub> -150g N (4 split doses)	17.37	9.75	2.02	18.99	18.99
N <sub>3</sub> -200g N (5 split doses)	17.88	10.29	2.14	19.58	19.85
N <sub>4</sub> -250g N (4 split doses)	16.67	8.80	1.90	18.03	19.68
N <sub>5</sub> -250g N (5 split doses)	15.93	7.40	1.70	16.52	17.72
N <sub>6</sub> -300g N (5 split doses)	16.27	7.86	1.83	17.47	18.26
CD (P=0.05)	0.22	0.35	0.05	0.37	0.37

date of harvest was also affected by fertilizer application. Maximum number of days (145) from shooting to harvest was recorded in the treatments T<sub>10</sub> and T<sub>12</sub> (250g N in 5 splits + 90g P<sub>2</sub>O<sub>5</sub>, and 300g N in 5 splits + 90g P<sub>2</sub>O<sub>5</sub>, respectively); whereas, harvesting was advanced by 53 days in the treatment in T<sub>5</sub> (200g N in 5 splits + 90g P<sub>2</sub>O<sub>5</sub>) which took just 92 days to harvest. Delay in harvest at higher dose of fertilization may be due to the increased vegetative growth stimulated by N application. However, Babu and Bujarbaruah (2001) reported that application of N stimulated early shooting and reduced the number of days taken to maturity. Sole application of N (Table 2) or P (Table 3) influenced bunch-weight significantly as also the mean number of hands per bunch; but, in combined application,

**Table 3. Effect of two different doses of applied P fertilizer on hand-weight (kg), number of fingers per hand, and finger-length (cm) in the ratoon crop of banana cv. Grand Naine**

Treatment	Bunch weight (kg)	No. of hands per bunch	Hand-weight (kg)	No. of fingers per hand	Finger-length (cm)
P <sub>1</sub> - 60g P <sub>2</sub> O <sub>5</sub>	16.81	8.76	1.92	18.05	18.86
P <sub>2</sub> - 90g P <sub>2</sub> O <sub>5</sub>	16.43	8.31	1.83	17.53	18.33
CD ( <i>P</i> =0.05)	0.32	0.02	0.01	0.82	NS

these nutrients did not affect bunch-weight or number of hands per bunch significantly. In the case of N treatments, maximum bunch-weight (17.88kg) and number of hands per bunch (10.29) was seen in N<sub>3</sub> treatment (200g N in 5 splits), followed by N<sub>2</sub> treatment (200g N in 4 splits). Similarly, hand-weight, number of fingers per hand, and finger-length were also significantly higher in N<sub>3</sub> treatment (200g N in 5 splits). In P treatments, bunch-weight (16.81), number of hands per bunch (8.76), hand-weight (1.92kg) and number of fingers per hand were significantly higher in P<sub>1</sub> treatment (60g P<sub>2</sub>O<sub>5</sub>), than in P<sub>2</sub> (90g P<sub>2</sub>O<sub>5</sub>). Increased bunch-weight with N application may be attributed to increased growth, consequently more number of fingers per hand and more number of hands per bunch (perhaps due to increased availability of the nutrient at critical stages of growth, which may have enhanced photosynthates that led to accumulation of more carbohydrates and other metabolites, and, ultimately translocation to the fruit tissue) (Harold and George, 1960). Phosphorus also increased growth and improved the foliar status of the plant, thus enhancing ATP formation and providing physiological efficiency. This may indirectly increase the yield (Parida *et al*, 1994). Singh and Suryanarayana (1999) also reported highest bunch weight, number of hands per bunch and highest number of fingers per hand with application of 200g N per plant in 4 split doses in banana cv. Dwarf Cavendish. Yield-attributing characters like bunch weight, number of hands per bunch and number of fingers per hand markedly increased upon treatment with 300g N, 200g P<sub>2</sub>O<sub>5</sub> and 250g K<sub>2</sub>O per plant in 5 split applications in banana cv. Dwarf

Cavendish (Tirkey *et al*, 2003). Naresh and Sharma (2004) also reported an increase in the yield of banana cv. Jahajee with application of 240g N. In conclusion, it can be inferred that application of 200g N in 5 split doses (May, June, July, August and September) and 60g P<sub>2</sub>O<sub>5</sub> (in the month of May) per plant in banana cv. Grande Naine proved was the best among all treatments tested, in terms of bunch formation and fruit yield.

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