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Response of nitrogen and bio-fertilizers on growth and yield of banana cv. Grand Nain

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i6q.10926>**Abstract**

Banana (*Musa* spp.) is one of the important fruit crops of the tropics. Higher productivity in banana is possible through improved planting material and nutritional management. The objective of experiment includes studying the response of various level of nitrogen and bio fertilizer on growth and yield parameters of banana. The experiment contains fifteen (15) treatment combinations with three replications laid out in a randomized block design with factorial concept. The treatment consists as three levels of nitrogen (100%, 80% and 60%) and five levels of bio-fertilizers (*Azotobacter*, *Azospirillum*, *Rhizobium*, 50% of B₁ + 50% of B₂ + 50% of B₃ and No bio-fertilizer (Control)). The treatment received 100% recommended dose of nitrogen (RDN) along with *Azotobacter* (20ml two times) noted positive reaction towards all growth parameters also significantly positive response to yield parameters *i.e.* weight of bunch (kg) number of hands per bunch, number of fingers per bunch, weight of third hand (kg), yield (t/ha).

Keywords: Banana, nitrogen, bio-fertilizer, growth and yield parameters

Introduction

Banana (*Musa* sp.) is an important fruit of tropics. Banana, an antique fruit crop of the world is known as 'Apple of the Paradise' and botanically named as *Musa* spp. Banana is widely grown in many countries like India, Mexico, Philippines, Thailand, Kenya, Colombia, Brazil, China, Venezuela, Israel, South Africa, Bangladesh, Fiji, Hawaii, Indonesia, Taiwan, Sri Lanka, Cuba, Panama, Jamaica, Malaysia, West Indies and Australia. Banana is a heavy feeder of nutrients and thus need balanced nutrition for optimum growth and fruit production, and in turn potential yields. A deficiency or excess of nutrients can cause substantial damage to the plant. Studies have clearly demonstrated that, application of recommended dose of essential nutrients at appropriate growth stage is necessary for high productivity of banana (Pandey *et al.*, 2005 and Thangaselvabai *et al.*, 2009)^[6, 9]. Bio-fertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen both in association with and without plant roots. The use of bio-fertilizer is increasing day by day due to increase in the price of chemical fertilizers, its beneficial effect on soil health and increase in production of crop. However, information on the combined use of inorganic fertilizers and bio-fertilizers is limited. Generation of such information is of immense importance for switching over better fertilizer technology and to produce export quality bananas. In view of the paucity of information pertaining to the integrated nutrient management in banana under high density plantation, the present study on "Response of nitrogen and bio-fertilizers on growth, yield and quality of banana cv. Grand Nain" was planned.

Material and Methods

A field experiments was conducted during the year 2018-19 at Regional Horticulture Research Station, ASPEE College of Horticulture and Forestry, NAU, Navsari, Gujarat to study Response of nitrogen and bio-fertilizers on growth and yield of banana cv. Grand Nain. There were totally fifteen treatments in three replications which were laid out in randomized block design with factorial concepts. Each plot consisted rows of 2.4 m length with spacing of 1.8 m between rows. Recommended cultural practices were adopted for the cultivation of banana crop. Observations on growth parameters *viz.*, pseudostem height (cm), pseudostem girth (cm), number of functional leaves per plant, leaf area (cm²), number of days to flowering, number of

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days to harvest and total crop duration. While yield parameters *viz.*, weight of bunch (kg) number of hands per bunch, number of fingers per bunch, weight of third hand (kg), yield (t/ha), finger length (cm) and finger girth (cm) were recorded at different stages of the crop.

Treatment details

The experiment was portrayed in Randomized blocked design with factorial concept along with two factors which are given in detail below

Factor-A Nitrogen level Factor-B Bio-fertilizers

D₁:	100% RDN	B₁:	<i>Azotobacter</i> (20 ml/plant)
D₂:	80% RDN	B₂:	<i>Azospirillum</i> (20 ml/plant)
D₃:	60% RDN	B₃:	<i>Rhizobium</i> (20 ml/plant)
		B₄:	50% of B ₁ + 50% of B ₂ + 50% of B ₃
		B₅:	No bio-fertilizer (Control)

Result and Discussion

Three levels of nitrogen (100% RDN, 80% RDN and 60% RDN) and Five different bio fertilizers 20 ml each (*Azotobacter*, *Azospirillum*, *Rhizobium*, 50% of B₁ + 50% of B₂+ 50% of B₃ and No bio-fertilizer (Control)) were used. The interaction effect between nitrogen levels and biofertilizer were non-significant in all the growth characters observed during experiment and the best result was found in 100% RDN with *Azotobacter* (D₁B₁) treatment.

Effect of nitrogen levels and biofertilizers on Growth parameters

Data presented in Table-1 showed that application of different levels nitrogen along with biofertilizer influence on all the growth characters. It was noted that treatment combination D₁B₁ *i.e.* 100% RDN application along with 20 ml *Azotobacter* twice during the growth period of banana found better for all the parameters. Treatment combination D₁B₁ was noted non-significant result in all the growth characters *i.e.* pseudostem height, pseudostem girth, number of functional leaves per plant, leaf area and days to flowering, days to harvest and crop duration but higher value of growth characters (pseudostem height, pseudostem girth, number of functional leaves per plant, leaf area) and minimum days (days to flowering, days to harvest and crop duration) was registered in the same treatment. It may be due to we all known that banana is heavy feeder crop requiring large amount of nutrient. In this regard, banana plant treated with

judicial application of 100% RDN *i.e.*, 300 g N/plant utilized efficiently by plant and significantly influenced the pseudostem girth and number of leaf at 7 month after planting. Both are the important factors, because leaves are the structural size bearing photosynthetic machinery which assimilating maximum sunlight through leaf lamina and may utilized maximum efficiency of CO₂ assimilation with primary productivity of C₆H₁₂O₆. (EI-Monlem and Radwan, 2003) [1]. *Azotobacter* has the capacity to accumulation of polyhydroxybutyric acid which gave rise to vegetative cell. Moreover, pigment production and activated enzymes are important characteristics of *Azotobacter*, which involves in protein synthesis and has direct effect on vegetative characters which were accordance with Kumar *et al.* (2009) [3]. and Kumar *et al.* (2013) [4], in banana as well as Ram and Rajput (2000) [8], in guava.

Effect of nitrogen levels and bio fertilizers on Yield parameters

Data presented in Table-2 about effect of nitrogen levels and biofertilizers on yield parameters of banana *i.e.* weight of bunch, number of hands per bunch, number of fingers per bunch, weight of third hand, yield, finger length and finger girth were found significant when banana plants treated with different levels of nitrogen and biofertilizers yield parameters like weight of bunch, no of hand per bunch, weight of third hand and yield per hectare were noted significantly higher in 100% RDN along with twice application of *Azotobacter* (D₁B₁) as compare to other combination of nitrogen levels and biofertilizers. No. of finger per bunch, finger length and finger girth was found non-significant but maximum value of all these parameters recorded in D₁B₁: 100% RDN with *Azotobacter*. It may be due synergistic use of INM strategy not only increases nutrient use efficiency but also help in partial substitution of costly chemical fertilizer. Judicial application of 100% RDN with *Azotobacter* was utilized efficiently by plant and significantly influenced the growth which leads source of sink relationship for increased bunch weight, number of hands per bunch. This is due to inorganic source of nitrogen hasten the growth and fruit development, while application of *Azotobacter* @ 20 ml/plant with common treatment of PSB and KMB release the require nutrient at appropriate time and fulfill the nutrient requirement and also make in available form at right time which were similar with research work by Patil and Shinde, 2013, Jeeva *et al.* (1988) [2], and Mia *et al.* 2005 in banana.

Table 1: Effect of nitrogen levels and bio fertilizers on growth parameters banana

Treatment	Pseudo stem height (cm)	Pseudo stem girth (cm)	No. functional leaves per plant	leaf area (cm ²)	Days to flowering	Days to harvest	Crop duration
D1B1	118.23	43.01	14.42	11.25	258.10	98.65	345.95
D1B2	111.98	39.35	13.55	10.95	270.43	104.33	357.25
D1B3	110.42	38.43	13.00	10.83	273.51	105.75	360.07
D1B4	115.10	41.18	13.67	11.08	264.26	101.49	351.60
D1B5	99.48	32.03	12.00	10.23	295.09	115.68	379.84
D2B1	116.67	42.10	14.33	11.17	261.18	100.07	348.77
D2B2	108.85	37.52	13.09	10.74	276.59	107.16	362.90
D2B3	105.73	35.69	14.38	10.57	282.76	110.01	368.54
D2B4	113.54	40.26	12.92	11.00	267.35	102.91	354.42
D2B5	97.91	31.12	12.17	10.14	298.17	117.10	382.66
D3B1	107.29	36.60	13.08	10.65	279.67	108.58	365.72
D3B2	102.60	33.86	11.75	10.40	288.92	112.84	374.19
D3B3	101.04	32.94	12.25	10.31	292.00	114.26	377.02
D3B4	104.16	34.78	12.91	10.48	285.84	111.42	371.37

D3B5	96.35	30.20	11.58	10.05	301.25	118.52	385.49
SEm±	6.84	1.44	0.69	0.63	15.32	6.01	17.56
CD@5%	NS	NS	NS	NS	NS	NS	NS
CV%	11.05	8.91	9.22	10.33	9.51	9.58	8.32

Table 2: Effect of nitrogen levels and bio fertilizers on yield parameters banana

Treatment	Weight of bunch (kg)	No. of fingers per bunch	No. of hands per bunch	Finger length (cm)	Finger girth (cm)	Weight of 3 rd hand (kg)	Yield (t/ha)
D1B1	40.74	243.97	14.04	20.89	13.56	4.25	111.81
D1B2	37.89	236.99	13.59	20.22	12.94	4.09	99.73
D1B3	34.94	207.59	13.27	20.05	12.79	3.58	98.51
D1B4	38.45	225.85	14.38	20.56	13.25	3.75	105.59
D1B5	26.01	161.76	10.06	18.87	11.71	2.22	73.64
D2B1	40.75	239.25	13.29	20.72	13.41	4.43	114.65
D2B2	38.85	214.38	12.75	19.88	12.63	3.41	108.86
D2B3	30.75	214.16	11.81	19.55	12.33	3.07	85.76
D2B4	35.59	221.56	14.16	20.39	13.10	3.92	99.47
D2B5	24.94	162.21	9.84	18.71	11.56	2.06	69.44
D3B1	31.93	211.95	12.42	19.71	12.48	3.24	88.88
D3B2	28.22	180.71	11.02	19.21	12.02	2.73	78.75
D3B3	27.97	192.42	10.70	19.04	11.86	2.56	76.32
D3B4	29.91	213.09	11.18	19.38	12.17	2.90	79.90
D3B5	25.28	165.62	9.97	18.54	11.40	2.39	68.62
SEm±	1.63	11.82	0.47	0.83	0.64	0.16	4.52
CD@5%	4.72	NS	1.36	NS	NS	0.46	13.09
CV%	8.60	9.93	6.68	7.25	8.85	8.77	8.84

Conclusion

From foregoing research data base, banana plants treated with 100% recommended dose of nitrogen (RDN) along with *Azotobacter* (20ml per plant two times) noted positive response to growth parameters and yield like weight of bunch (kg) number of hands per bunch, number of fingers per bunch, weight of third hand (kg), yield (t/ha).

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