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Effect of Integrated Nutrient Management on Growth Parametres of Banana cv. Rajapuri

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ABSTRACT

Banana (Musa spp.) is one of the important fruit crops of the tropics. The fruits are rich source of carbohydrate and energy. The research on effect of integrated nutrient management practices on banana with commercial formulations of organic fertilizers is new under the soil and climatic conditions of arid dry zone of Karnataka. . The cv. Rajapuri is the commercial variety used for the study. The objective of experiment includes to study the effect of integrated nutrient management on growth parameters of banana. The experiment contains six treatments and four replications laid in a randomized block design. The treatments consist of T_1 - RDF 100% (200:100:300 g NPK + 20kg FYM per plant) T_2-RDF100% (200:100:300 g NPK + 20kg FYM per plant) + PSB (20g)+ Azospirilum (20g) T_3 - RDF 75% + 25% , N and P through organic sources T_4 - RDF 50%+ 50% ,N and P through organic sources T_5 - RDF 25%+75%,N and P through organic sources T_6-100%,N, P and K through organics sources. The treatment received 100% recommended dose of fertilizers (RDF) along with Vermicompost (2kg) + Neemcake (250g) + Azospirillum (50g) + PSM (50g) + VAM (250g) recorded the highest plant height, pseudostem girth, number of functional leaves, total leaf production, total leaf area and leaf area index. The consumption pattern of banana is increasing day by day due to its nutritional value and high economic returns. Higher productivity in banana is possible through quality planting material, proper nutritional management and other novel cultural practices.

Key words: *Rajapuri, INM (Integrated Nutrient Management), Banana, Azospirillum, Biofertilizer*

INTRODUCTION

Banana (*Musa* spp.) is one of the important fruit crops of the tropics. The fruits are rich source of carbohydrate and energy. It is grown over 130 countries across the world with an area of 10.10 mha and producing 121.85 MT of banana. India is the largest producer of banana and contributing about 27% of the world production. The major banana growing states in India are Tamil Nadu, Maharashtra, Karnataka, Gujarat, Andra Pradesh, Bihar and Madhya Pradesh. Application of inorganic fertilizers though, increases the yield substantially but could not able to sustain the fertility status of the soil[2] and have caused several undesirable consequences in the fragile soil eco-system, leading to gradual decline in productivity.

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Considering the present situation of soil quality and environmental security, it is necessary to go for an integrated nutrient management, involving various sources of organic manures and bio-fertilizers besides using chemical fertilizers in banana. An integrated nutrient management in banana is being practiced and experimented in various parts of our country. Bhalerao *et al.*[1] observed that combined application of 100% recommended dose of NPK along with organic manures increased the growth and also yield attributes.

MATERIAL AND METHODS

The present investigation was carried out during 2016-17 in the experimental field at the College of Horticulture, Haveli, Bagalkot district, Karnataka, India. The cv. Rajapuri is the commercial variety used for the study. The objective of experiment includes to study the effect of integrated nutrient management on growth parameters of banana. The experiment contains six treatments and four replications laid in a randomized block design (RCBD). Observations on growth parameters were recorded at 60 days interval till shooting from five tagged plants in each treatment from four replications by following the methods of Yang and Rao. The plant height was measured from the ground level from the marked point upto the angle between youngest first and second leaf axils in the pseudostem was noted and the mean was expressed in centimetres. The circumference of pseudostem was measured at 30cm above the ground level for 60 days intervals up to shooting of the plants and expressed in centimetres. Actual number of functional fully opened green leaves on the plant was counted and average was calculated. Third fully opened banana leaf was selected to calculate leaf area. Leaf area was calculated by multiplying leaf length and breadth with a constant factor 0.8 to arrive the actual leaf area of the plants and the average was worked out and expressed in m^2 Hewitt[5].

Leaf area = Leaf length × Leaf width × 0.8

The LAI of functional leaves was calculated by using the formula suggested by Watson[18].

$$\text{LAI} = \frac{\text{Leaf area per plant}}{\text{Land area occupied by the plant}}$$

Phyllochron is the rate of leaf production. The number of days required for phyllochron was counted and expressed as number of days. The interval between leaf appearances can be recorded in both standard measurements of time as we as thermal time. No significantly robust equation to predict phyllochrons has been developed. The total leaf area was calculated by adding the leaf area of the functional leaves. The number of days required from planting to shooting, shooting to harvest and planting to harvest (duration) were counted and expressed as number of days

RESULTS AND DISCUSSION

Plant height and pseudostem girth

In the present study, INM practices significantly influenced on the plant height and pseudostem girth in banana cv. Rajapuri. The plants provided with RDF100% (200:100:300 g NPK + 20kg FYM per plant) + PSB (20g)+*Azospirilum* (20g) (T2) recorded the maximum plant height (35.55 cm) at 60DAP. Application of RDF100% (200:100:300 g $N:P_2O_5:K_2O$ + 20kg FYM per plant) + PSB(20g)+*Azo* (20g) (T2) registered the maximum plant height (197.44cm) at shooting and the minimum plant height (177.45cm) was recorded in (T1) at the time of shooting (Fig.2), where girth of pseudostem varied between T5 (60.05 cm) and (73.05 cm) T2 (Fig.3).In the initial stages of vegetative growth the treatment T2 produced maximum plant height and girth of plant due to the application of biofertilizer could be increased the availability of nutrients compared to other treatments. According to Lenka and Lencka[8], application of biofertilizers such as, *azospirillum* inoculation along with 100% N increased the vegetative character in banana. The increase in plant height and girth in the

present investigation of INM practices might have increased the photosynthetic compound inside the plant tissue and it could be attributed to the balanced application of nutrients and better uptake helped in the development of vegetative growth of plant. Similar results were reported by[3,1013]. Plants with thicker pseudostem are desirable as they reflect on bunch size and other related characters. Besides, they also give better anchorage to the plant. Hence, the available NPK status, organic carbon and microbial biomass and dehydrogenase activity were enhanced due to application of inorganic fertilizers along with organic manures, which would have helped in increasing pseudostem girth of banana plants[7].The increase in plant height could be attributed to the higher uptake of nutrients, particularly nitrogen. This fact is supported by the works of Pafli[11] found that the uptake of N, the chief constituent of chlorophyll, protein and amino acids is accelerated through its increased supply at appropriate time to the plants[12].The beneficial response of biofertilisers on plant girth might be due to the accumulation of polyhydroxybutyric acid which gives rise to vegetative cells. Pigment production is one of the important characteristics of *Azotobacter* spp. These strains are also known to produce growth substances[12].

Table 1: Effect of INM on plant height at different intervals in banana cv. Rajapuri (AAB)

Treatment		Plant height (cm) at different intervals (DAP)			
		60	120	180	At shooting
T_1	RDF100%(200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant)	30.80	67.03	144.70	177.45
T_2	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant) + PSB(20g)+*Azo* (20g)	35.55	82.40	123.78	197.44
T_3	RDF75% + 25% K_2O through organic source	32.75	76.45	155.10	188.30
T_4	RDF50%+ 50% K_2O through organic source	32.15	94.16	149.25	181.50
T_5	RDF25%+ 75% K_2O through organic source	26.40	99.00	134.15	179.95
T_6	100% K_2O through organic source	27.75	77.70	159.16	178.95
S. Em.±		3.11	7.68	0.63	0.92
C.D. at 5%		9.38	23.13	1.89	2.77

In the present study, INM practices, significantly influenced the number of leaves in banana cv. Rajapuri. The plants provided with 100%, N, P and K through organic sources (T6) recorded the maximum number of leaves (6.05). The minimum number of leaves was observed in (T1) the plants provided with RDF 100% (200:100:300 g NPK + 20kg FYM per plant) (5.15) at 60 days after planting .whereas, application of RDF100% (200:100:300 g NPK + 20kg FYM per plant) + PSB(20g)+*Azo* (20g) (T2) registered the maximum number of leaves (17.85) While,the minimum number of leaves (15.20) was recorded in treatment control (T1) at the time of shooting. It could be attributed to the fact that the total number of leaves produced during the growth and the rate of production were influenced by mineral nutrition. Higher amount of nutrient application resulted in more number of leaves, increased leaf area and leaf area index. The increase in production of leaves might have helped to synthesize more photosynthates and flowering stimulus influencing early flowering[3,14] .Phyllochron or the rate of leaf production is an important factor to be considered during vegetative growth. The phyllochron was found to differ significantly among the INM treatments at shooting stage of banana. In general, the plants supplied with RDF 100% (200:100:300 g NPK + 20kg FYM per plant) + PSB (20g)+*Azospirillum* (20g) (T_2) recorded minimum number of days

(6.10days) for phyllochron. The maximum number of days (7.76 days) for phyllochron was recorded in treatment T3. This was explained that higher vegetative growth in the treatment with organic manures improved the nutrient availability and thereby causing the higher protein synthesis resulting in better growth and in turn faster leaf production. This was confirmed from the findings of Sosamma *et al*[16]. This could be attributed to the fact that the major nutrients with micronutrients stimulate the enzymatic activity in the plant tissues, which help to enhance the vegetative growth of the plant. These findings are in line with those of Jayabaskaran and Pandey[6] (Fig.4).The plants supplied with 200:100:300 g NPK along with biofertilizers recorded the optimum leaf area and leaf area index at shooting stage than compared to other treatments.The different workers on banana have reported that, higher levels of nitrogen and potash promote faster rate of leaf production resulting in increased leaf area[13,15] . Stover[17] was of the opinion that, LAI is an useful guide in the canopy management of banana. The reason for increasing leaf area index might be due to integrated application of chemical fertilizers along with organic manures, which attributed the increase in nutrient levels of NPK; especially nitrogen enhanced the vegetative growth like number of leaves and leaf area and simultaneously enhanced the leaf area index. This fact was already reported by Hazarika and Ansari[4] in banana. According to Kuttimani *et al.*[7] discernible variation in leaf area was observed due to the INM treatments at shooting stage of banana over control. Greater leaf area aids the plant to synthesize more metabolites exhibiting high photosynthetic rate during the period of growth and development in banana[9]. In the present investigation, the total leaf area measured at shooting stages revealed that application of 200:100:300 g NPK per plant along with fertilizers and FYM @ 20kg per plant continued to register the maximum leaf area. It could be attributed to the fact that the increase in nutrient levels of NPK along with organic manures especially nitrogen, enhanced the vegetative growth and simultaneously increased the leaf area. Increase in leaf area at any stages of growth is very critical in banana as it has a close bearing on photosynthetic efficiency, which in turn influences the biomass production. Greater leaf area aids the plant to synthesize more metabolites, exhibiting high photosynthetic rate during the period of growth and development[12] (Fig.5). The crop duration can be divided into two phases. The first is the days taken for shooting from planting and second phase is the days taken for maturity from shooting varied significantly due to INM practices over the control. The total crop duration was strongly influenced by various integrated nutrient management practices. The shorter crop duration might be due to the higher net assimilation rate on account of better growth leading to the production of endogenous metabolites earlier in optimum level enabling early flower bud initiation and thereby early shooting in banana[4].Application of T2 RDF100% (200:100:300 g NPK + 20kg FYM per plant) + PSB(20g)+*Azospirillum* (20g), results early shooting (220.35) compared to other treatments .Whereas, RDF 100% (200:100:300 g NPK + 20kg FYM per plant) results late shooting (244.25). The early shooting was attributed due to better activities of *Azospirillum* and PSB in vegetative growth. With regard to the days taken for harvesting from shooting, in the present investigation, application of T2 RDF 100% (200:100:300 g NPK + 20kg FYM per plant) + PSB (20g)+*Azospirillum* (20g) recorded the minimum number of days *i.e.*, 95.65 days against 100.55 days under T1 (RDF 100% (200:100:300 g NPK + 20kg FYM per plant) (Fig.6). This might be due to the optimum quantity of nutrients available through chemical and organic fertilizers hastened the process of initiation and emergence of inflorescence due to earlier production of leaves with larger leaf area/plant and better disposition of photosynthetic activity resulting in higher required net assimilation[7].

Table 2: Effect of INM on pseudostem girth at different intervals in banana cv. Rajapuri (AAB)

Treatment		pseudostem girth (cm) at different intervals (DAP)			
		60	120	180	At shooting
T_1	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant)	6.32	20.04	42.35	67.35
T_2	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant) + PSB(20g)+*Azo* (20g)	9.87	30.94	41.01	73.05
T_3	RDF75% + 25% K_2O through organic source	7.29	18.56	42.53	70.60
T_4	RDF50%+ 50% K_2O through organic source	6.21	27.18	32.31	68.35
T_5	RDF25%+ 75% K_2O through organic source	6.33	22.68	37.56	60.05
T_6	100% K_2O through organic source	8.51	25.77	41.10	60.65
S. Em.±		1.04	3.22	1.46	0.70
C.D. at 5%		NS	NS	4.39	2.09

Table 3: Effect of INM on number of functional leaves at different intervals and phyllochron upto shooting in banana cv. Rajapuri (AAB)

Treatment		Functional leaves at different intervals (DAP)				Phyllochron upto shooting
		60	120	180	At shooting	
T_1	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant)	5.15	11.25	13.55	15.20	7.20
T_2	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant) + PSB(20g)+*Azo* (20g)	5.40	9.15	13.70	17.85	6.10
T_3	RDF75% + 25% K_2O through organic source	5.80	11.70	15.30	16.20	7.76
T_4	RDF50%+ 50% K_2O through organic source	5.55	10.80	14.15	16.90	7.30
T_5	RDF25%+ 75% K_2O through organic source	5.70	11.60	13.90	15.35	7.36
T_6	100% K_2O through organic source	6.05	12.10	16.30	15.35	6.80
S. Em.±		0.71	0.85	0.24	0.27	0.16
C.D. at 5%		2.15	2.57	0.72	0.80	0.49

Table 4: Effect of INM on Total leaf area at different intervals in banana cv. Rajapuri (AAB)

Treatment		Total Leaf area (m^2) at different intervals (DAP)			
		60	120	180	At shooting
T_1	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant)	1.29	3.35	7.40	9.25
T_2	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant) + PSB(20g)+*Azo* (20g)	1.40	4.10	8.20	9.98
T_3	RDF75% + 25% K_2O through organic source	1.54	2.80	7.50	8.70
T_4	RDF50%+ 50% K_2O through organic source	1.30	3.70	8.20	9.50
T_5	RDF25%+ 75% K_2O through organic source	1.35	2.13	7.26	7.30
T_6	100% K_2O through organic source	1.90	3.33	7.12	7.80
S. Em.±		0.17	0.20	0.09	0.33
C.D. at 5%		NS	0.60	0.28	1.00

Table 5: Effect of INM on leaf area index at different intervals in banana cv. Rajapuri (AAB)

Treatment		Leaf area index at different intervals (DAP)			
		60	**120**	**180**	**At shooting**
T_1	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant)	0.24	0.83	1.74	2.20
T_2	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant) + PSB(20g)+*Azo* (20g)	0.40	1.13	2.20	2.60
T_3	RDF75% + 25% K_2O through organic source	0.27	0.69	1.80	2.42
T_4	RDF50%+ 50% K_2O through organic source	0.27	0.77	2.00	2.38
T_5	RDF25%+ 75% K_2O through organic source	0.34	0.74	1.73	1.81
T_6	100% K_2O through organic source	0.38	0.92	2.11	1.95
S. Em.±		0.024	0.05	0.02	0.03
C.D. at 5%		0.073	0.15	0.07	0.09

Table 6: Effect of INM on crop duration of banana cv. Rajapuri (AAB)

Treatment		Days from planting to shooting	Days from shooting to harvest	Days from planting to harvest
T_1	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant)	244.25	100.55	344.80
T_2	RDF100% (200:100:300 g N:P_2O_5 :K_2O + 20kg FYM per plant) + PSB(20g)+*Azo* (20g)	220.35	95.65	316.00
T_3	RDF75% + 25% K_2O through organic source	233.85	102.20	336.05
T_4	RDF50%+ 50% K_2O through organic source	242.30	101.20	343.95
T_5	RDF25%+ 75% K_2O through organic source	237.65	103.65	341.30
T_6	100% K_2O through organic source	235.65	98.60	334.25
S. Em.±		0.75	0.37	0.71
C.D. at 5%		2.24	1.10	2.12

REFERENCES

1. Bhalerao, V. P., Patil, N. M., Badgujar, C. D. and Patil, D. R., Studies on integrated nutrient management for tissue cultured Grand Naine banana. *Indian J. Agric. Res.*, **43(2):** 107-112 (2009).
2. Bharadwaj, V. and Omanvar, P. K., Long term effect of continuous rotational cropping and fertilization on crop yield and soil properties. *J. Indian Soc. Soil Sci*., **42:** 387-392 (1994).
3. Elains Apsara., Effect of planting density and spacing on growth and yield of banana cv. Nendran (AAB). M.Sc. (Hort.) *Thesis* submitted to TNAU. Coimbatore (1997).
4. Hazarika B.N, Ansari S. Effect of integrated nutrient management on growth and yield of banana cv. Jahaji. *Indian J. Hort.*, **67(2):** 270-273 (2010).
5. Hewitt, C. W., Leaf analysis as a guide to the nutrition of banana. *Emp. J. Exp. Agric*. **23:** 11-16 (1955).
6. Jayabaskaran, K. J. and Pandey, S. D., Effect of foliar spray of micronutrients in banana under high soil PH condition. *Indian J. Hort.*, **65(1):** 102-105 (2008).
7. Kuttimani, R. and Velayudam, K. and Somasundarm, E., Growth and yield parameters and nutrient uptake of banana as influenced by integrated nutrient management practices.. *International J. Recent Sci. Res.*, **4(5):** 680-686 (2013).
8. Lenka, J. and Lenka, P.C., Effect of integrated nutrient management on growth and yield of banana (*Musa*.sp) variety. Grand Naine. *J. crop and weed*, **10(1):** 182-185 (2014).
9. Mahadevan, V.C., Effect of foliar nutrition of NPK on banana cv. Nendran (AAB). M.Sc. (Hort.) Thesis, Tamil Nadu Agrl. Univ., Coimbatore (1988).

10. Natesh, B. B., AravindAkshan, M. and Vastalakumari, P. K., Effect of split application of fertilizers in banana, *Musa* AAB 'Nendran'. *South Indian Hort*., **41(2):** 67-73 (1993).
11. Pafli, G., Relations between abundant N supply and amino acid concentration on leaves of rice plants. *Plant Soil* **23:** 275-284 (1965).
12. Patil, V. K. and Shinde, B.N., Studies on integrated nutrient management on growth and yield of banana cv.Ardhapuri(Musa AAA).*J. Hort.Forest.* **5(9):** 130-138 (2013).
13. Raju Besagarahalli, Micropropagation and nutritional studies of tissue cultured banana var. Grand Naine, Ph.D. (Hort.) thesis submitted to UAS, Bangalore (1996).
14. Robinson, J. C. and Nel, D. J., The influence of banana cv. Williams, plant density and canopy characteristics on ratoon cycle interval and yield. *Acta Hort*., **175:** 227-232 (1986).
15. Roy, S.K. and Chakraoborty, A.K., Vegetables of tropical climate commercial and dietary importance, In: R.M. MacRae., R.K. Robinson., M.J. Sandler. (Ed). Encyclopaedia of Food Science, *J.Food Technology and Nutrition*, Academic press, London.715 (1993).
16. Sosamma, Y.K., Koshy, P.K., Effect of *Glomus mossae* on nematodes infesting banana under coconut based high density multi species cropping system. In. Proc. of the third Int. symp. on 'Nematology-Challenges and opportunities in 21st century', Afro-Asian Society of Nematalogist (TISSASN), 94-97 (1998).
17. Stover, R. H., Canopy management in valery and Grand Naine using leaf area index and photosynthetically actual radiation measurements. *Fruits*. **39:** 89-93 (1984).
18. Watson, D. J., The Physiological basis of variation in yield. *Adv*. *Agron*. **4:** 101-45 (1952).