Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8610

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(2), 41-46

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Effect of Different Organic Manures and Comparing the Organics with Inorganic Fertilizer on the Growth and Yield Parameters of Banana cv. Amritsagar (AAA)

Jaiz Isfaqure Rahman*, D. N. Hazarika and S. Langthasa

Department of Horticulture, B.N. College of Agriculture, AAU, Biswanath Chariali -784176, Assam

*Corresponding Author E-mail: jaizrahman29@gmail.com

Received: 25.01.2021 | Revised: 27.02.2021 | Accepted: 6.03.2021

ABSTRACT

A field experiment was conducted during 2016-17 in order to study the "Effects of different organic manures and comparing the organics with inorganic fertilizer on growth and yield parameters of banana cv. Amritsagar (AAA). The treatments were T_1: FYM (Farm Yard Manure) + Microbial Consortia, T_2: Enriched Compost, T_3: Vermicompost, T_4: Microbial Consortia, T_0: RDF (Manure + NPK). The treatments T_1, T_2, T_3 and T_4 were laid out in certified organic block in RBD with 5 replications while the treatment T_0 was laid out outside the organic block with five replications.

Among the organics, T_1 recorded the highest pseudostem height (63.22 cm and 161.57 cm) and girth (21.62 cm and 39.80 cm) in both vegetative stage and shooting stage respectively. T_1 produced the highest number of functional leaves at shooting (12.46) and at harvest (5.37). Highest bunch weight of 6.60 kg/plant and yield of 14.96 t/ha were recorded in T_1 while lowest bunch weight of 3.95 kg/plant and yield of 8.95 t/ha were recorded in T_4. Comparing the growth characters and yield parameters of the plants under organic treatments with that of RDF treated plants, it was found that plants treated with RDF performed better that the plants treated with organics. Considering the higher vegetative growth, bunch weight the treatment (T_1) i.e. FYM @ 12 kg/plant and microbial consortia @ 30 g/plant applied at planting followed by application of FYM @ 6 kg/plant and microbial consortia 15 g/plant might be recommended for organic cultivation of banana.

Keywords: *Organics, FYM (Farm Yard Manure), Microbial Consortia, Enriched Compost, Vermicompost, RDF (Recommended Dose of Fertilizer).*

INTRODUCTION

Banana (*Musa* spp.) is one of the most important commercial fruit crops especially in the tropics and has a high consumer demand worldwide (Tamuli, 2017). Banana belongs to the family Musaceae with 1000 varieties in the world (Purseglove, 1976).

Cite this article: Rahman, J. I., Hazarika, D. N., & Langthasa, S. (2021). Effect of Different Organic Manures and Comparing the Organics with Inorganic Fertilizer on the Growth and Yield Parameters of Banana cv. Amritsagar (AAA), *Ind. J. Pure App. Biosci. 9*(2), 41-46. doi: http://dx.doi.org/10.18782/2582-2845.8610

Banana was originated in South East Asia (Spiden, 1926: & Sauer, 1952) and introduced to both tropical and sub-tropical regions (Simmonds & Shepherd, 1955). Banana is grown with an enormous popularity in North-Eastern India and is regarded as a centre of diversity. Its year round availability, affordability, varietal range, taste, nutritive and medicinal values makes it the favourite fruit among all classes of people.

Banana is a heavy feeder of nutrients and requires large quantities of nutrients for its growth, development and yield. There is a tremendous pressure on land and non renewable energy resources to meet the increasing demand of quality fruits. The intensive banana culture has caused a gradual decrease in soil fertility to such a extent that today 100 per cent more fertilizer is required to produce the same amount of the yield per hectare that was previously obtained (Romero, 1998). The soil has lost its biological dynamic due to repeated and indiscriminate use of agro-chemicals mainly inorganic source of fertilizer. Organic fertilization is another option for supplying nutrient to banana production. The organic materials improve soil structure and reduce soil temperature, resulting better root growth and more efficient use of water and nutrients (Casale et al., 1995). They also provide slow release of nitrogen and other nutrients and increase the nutrient holding properties of the soil, lowering the need for heavy applications of nitrogen fertilizer and hence decrease possible nitrate contamination of water. Ramesh et al. (2010) surveyed that organic farming improves soil quality in terms of various parameters, *viz*. physical, chemical, biological properties, indicating an enhanced soil health and sustainability of crop production.

Besides all these benefits from organic farming, growing awareness of health and environmental issues associated with the intensive use of chemical inputs has led to interest in alternate forms of agriculture in the world. Therefore, the present study is envisaged to develop an appropriate organic production technology for banana cv. Amritsagar (AAA).

MATERIALS AND METHODS

The field experiment was conducted in the Instructional cum Experimental Farm, Department of Horticulture, Biswanath College of Agriculture, AAU, Biswanath Chariali during 2016-2017. The prevailing climatic condition of Biswanath Chariali is subtropical having hot and humid summer, dry and cold winter seasons. The station is receiving average annual rainfall of 1980.0 mm. The experiment was laid out in a certified organic block. Four treatments (T_1, T_2, T_3 and T_4) were laid out in randomized block design replicated five times. The net plot size was 6 m x 6 m. There were altogether twenty plots of equal size in the organic block under the experiment. Five plots of equal size were laid out for the treatment of T_0 (inorganic fertilizer application) outside the organic block. Banana plantlets cv. Amritsagar were planted at 2.1m x2.1m spacing. Treatment details was as below.

Table 1: Detail of the treatments

Notation	Treatments
T_1	FYM @ 12 kg/plant + Microbial Consortia @ 30 g/plant at planting followed by FYM @ 6 kg/plant+ Microbial Consortia @ 15 g/plant at 5 months after planting
T_2	Enriched Compost @ 5 kg/plant at planting + Enriched Compost @ 3 kg/plant at 5 month after planting
T_3	Vermicompost @ 5 kg/plant + Vermicompost @ 3 kg/plant at 5 months after planting
T_4	Microbial Consortia @ 30 g/plant during planting as slurry + Microbial consortia @ 15 g/plant at 5 month after planting by mixing with 1 kg compost
T_0	Recommended dose of fertilizer (RDF)

Recording growth parameters of banana:

Three plants having uniform growth were tagged in each plot and marked for different observations. Height of the pseudostem was measured at vegetative stage (at 4th month after planting) and at shooting. The height was measured from the ground level to the axil of the two youngest functional leaves and expressed in centimetre (cm). Girth of the pseudostem at 30cm above the ground level was measured at vegetative stage and at shooting and expressed in centimetre (cm). The number of functional leaves at vegetative stage, shooting stage and at harvest were recorded by counting the green and healthy leaves. When two third or whole of the total leaf lamina were photosynthetically active they were considered as functional leaves. On the other hand, when more than two third of the total leaf lamina became yellowish either by natural ageing or due to the attack of disease, they were discarded.

Recording yield and yield attributes parameters of banana:

Five numbers of representative fingers from the middle portion of the second of the bunch were selected after harvest and their length were measured from the base of the pedicel up to the tip along the dorsal curve and their mean length was expressed in cm. Girth of finger was measured at the middle portion of the finger using a measuring tape and expressed in cm. Fingers were selected from the second hand of the bunch. Weight of the finger from the middle portion of the second hand was taken as representative finger for determining average weight of the finger and expressed in gram (g). The fruit volume was determined by water displacement method and expressed in cubic centimetre (cc). The bunch weight was recorded at harvest with all the hands and the peduncle and expressed in kg per plant. While harvesting, peduncle was cut leaving 22.5 cm above the first hand and 5 cm below the last hand. Yield in tonnes per hectare was calculated by multiplying the average bunch weight with the total number of plants accommodated in one hectare.

RESULTS AND DISCUSSION

The finding of the present study as well as relevant discussion have been presented under following heads:

Effect on growth parameters of banana:

The results on growth parameters, pseudostem height and girth in (Table 2) indicated that, among the organics, FYM + microbial consortia (T_1) produced highest pseudostem height (63.22 cm and 161.57 cm) and girth (21.62 cm and 39.80 cm) in both vegetative stage and shooting stage respectively. The increase in plant height and girth might be due to improvement of physical properties of soil and increased activity of microorganisms which were manifested in the form of enhanced growth and higher carbohydrate production as explained by Prasad and Singh (1980), Acharya et al. (1988) and Hussain et al. (1988). These effects might be due to synthesis of phytohormones enhanced by *Azospirillum* near root morphology and in turn influencing assimilation of nutrients. But comparing the organic manures with inorganic (T_0) it was observed that highest pseudostem height (65.91 cm and 219.96 cm) and girth (24.99 cm and 54.29 cm) in both vegetative stage and shooting stage respectively was obtained in T_0. This might be due to the effect of chemical fertilizers that supply the nutrients in readily available form to the plants immediately after application (Upadhyay, 1988) and more particularly with respect to nitrogen which helped in increasing the pseudostem height and girth. The absorbed nitrogen ultimately leads to the formation of complex nitrogenous substances like proteins and amino acids to build up new tissues.

Table 2: Pseudostem height and girth at different stages of growth of banana

Treatments	Pseudostem height (cm)		Pseudostem girth (cm)	
	Vegetative stage	Shooting	Vegetative stage	Shooting
T_1: FYM+ Microbial consortia	63.22	161.57	21.62	39.80
T_2: Enriched compost	55.30	154.12	20.30	37.55
T_3 : Vermicompost	55.86	153.30	20.05	36.55
T_4: Microbial consortia	55.02	146.97	20.45	34.75
SEd±	2.98	7.68	0.94	2.60
CD (P=0.05)	**5.21**	**13.41**	**NS**	**4.54**
Organics (Mean)	57.35	153.99	20.60	37.16
T_0(Mean)	65.91	219.96	24.99	54.29

NS= Non significant

The role of functional leaves retained at shooting is crucial in determining the yield potential. Leaf production in banana is related to increase rate of plant growth (Sathyanarayana, 1985). The result revealed that the number of functional leaves in the plants (Table 4) was higher at shooting than at vegetative stage. The number of leaves produced and leaf longevity have profound influence on fruiting of banana (Barkar & Steward, 1962; Simmonds, 1966; & Turner, 1970). Robinson et al. (1992) found that retention of 8.0 numbers of leaves at flower emergence was sufficient to achieve maximum yield and finger length in banana. Among the different treatments, production of higher number of leaves by the plants in T_0 (manure + NPK) *i.e.* at shooting (13.73) and harvest (6.40), might be due to incorporated FYM on physio-chemical and fertility properties of soil that finally helped to release nutrient required by banana plant to produce more leaves. Among the organics, T_1 (FYM + microbial consortia) produced the highest number of leaves at shooting and at harvest which might be due to the reason put forwarded by Turner (1970). Application of organics and bio-fertilizer might have increased total soil microbial population resulting improved availability of phosphorus and nitrogen and their uptake by the plants. It might be the reason for enhanced vegetative growth and simultaneously increased number of functional leaves in the present study. Mahajan (2009) also reported similar results with the application of organics and bio-fertilizers in colocasia.

Table 3: Number of functional leaves production per plant at different stages of growth

Treatments	Functional leaves at		
	Vegetative stage	Shooting	Harvest
T_1: FYM+ Microbial Consortia	7.97	12.46	5.37
T_2: Enriched compost	8.07	11.40	5.00
T_3 : Vermicompost	7.62	11.16	4.54
T_4: Microbial consortia	8.02	10.04	4.82
SEd±	0.18	0.76	0.42
CD (P=0.05)	**0.31**	**1.32**	**0.74**
Organics (Mean)	7.92	11.26	4.93
RDF (Mean)	9.52	13.73	6.40

Effect on yield and yield parameters of banana:

The yield attributing characters presented in Table 4, finger length, girth, volume and weight of the fingers were highest in T_0 (manure + NPK) and among the organics T_1 (FYM + microbial consortia) recorded maximum. This might be due to better filling of fruits and their growth. Increased uptake of nutrients from the soil helped the plants to produce enough carbohydrates in the leaves which might have translocated to the sink for better filling of fruits. The results are in conformity with the work of Pathak et al. (1992). The similar results was also reported by Jeybhaskaran et al. (2001) and Kumar and Shangmugavelu (1988) in banana.

The leaf growth characteristics decide the duration of crop and also the grade of the bunch in regard to their size and weight which finally results in production potentialities. Greater accumulation of dry matter conferred greater ability to give higher yield. The highest bunch weight (17.12 kg/plant) and yield (38.82 t/ha) was recorded in T_0 (manure + NPK). On the other hand among organics T_1 (FYM + microbial consortia) were found to be the best with bunch weight (6.60 kg/plant) and yield (14.96 t/ha). This result might be due to the vigorous plant growth character. In these treatments, increased number of leaves might have increased the photosynthetic activity resulting in higher accumulation of carbohydrates. Relatively higher amount of carbohydrate could have promoted the growth rate and in turn increased the bunch weight. The increased yield might be due to more absorption of available nutrients. Similar increase in yield was also reported by Kumar and Shanmugavelu (1988), Jeeva et al. (1988), Tiwary et al. (1998) and Chezhigen et al. (1999) in banana.

Table 4: Yield attributing character and yield

Treatments	Finger length (cm)	Finger girth (cm)	Finger volume (cc)	Finger weight (g)	Bunch weight (kg/ plant)	Yield (t/ha)
T_1	16.58	12.11	115.38	118.69	6.60	14.96
T_2	15.50	12.07	112.57	113.15	6.26	14.19
T_3	15.41	12.07	105.38	108.67	5.85	13.26
T_4	14.84	11.00	93.17	97.66	3.95	8.95
SEd±	0.74	0.59	12.16	11.60	0.35	0.70
CD (P=0.05)	**1.30**	**1.04**	**21.24**	**20.26**	**0.62**	**1.22**
Organics (Mean)	15.58	11.81	106.62	109.54	5.66	12.83
T_0 (Mean)	17.33	13.06	146.25	139.78	17.12	38.82

CONCLUSION

Though the effect of organic treatments in growth and yield of banana in the present study was not at par as compared to the plants fertilized with inorganic fertilizers but the impact of organic is slower but sustainable. In the present study, the organic treatments could not influence crop growth and yield within a period of one year but in due course the result would be better due to the improvement of soil status. The study thus, concluded that after three years of cultivation organic manures could perform equally good with inorganic fertilizer. Considering the higher vegetative growth, bunch weight and yield the treatment T_1 (FYM + Microbial consortia) might be recommended for organic cultivation of banana in Assam.

REFERENCES

Acharya, C. L., Bishnoi, S. K., & Yaduvanshi, H. S. (1988). Effect of long-term application of fertilizers and organic and inorganic amendments in a Alfisol. *Indian J. Agric. Sci. 58*(7), 509-516.

Barkar, W. G., & Steward, F. C. (1962). Growth and Development of banana plant- I the growing regions of vegetative shoot-II. Transition from the vegetative to floral shoot in *M. acuminata* cv. Gros Michel. *Ann.Bot. 26*, 389-411.

Casale, W. L., Menge, V. J. A., Lovatt, C. J., Pand, E., Johnason, E., & Guillemet, F. (1995). Urban agricultural wastes for use as delivery of microbial

biocontrol agents. *Journal of Horticultural Sciences*. *70*(2), 315-332.

Chezhiyan, N., Balasubramani, P., Harris, C. V., & Anathan, M. (1999). Effect of inorganic and biofertilizer on growth and yield of hill banana var. Virupakashi. *South Indian Hort. J. 47*, 1-6.

Hussain, I., Manhot, S. C., & Mathur, A. M. (1988). Biogas plant slurry- A promising organic manure. In: *Management and utilization of biogas plant slurry*. Himanchu Publ., Udaipur. pp: 31-36.

Jeeva, S., Kulasekharan, M., Shanmugavelu, K. G., & Obilisami, G. (1988). Effect of *Azospirillum*on growth and development of banana cv. Poovan (AAB). *South Indian Hort. 36*(1), 1-4.

Jeybaskaran, K. J., Pandey, S. D., Mustafa, M. M., & Sathiamoorthy, S. (2001). Effect of different organic manures with graded levels of inorganic fertilizers on ratoon of Poovan banana. *South Indian Hort. 49*, 105-108.

Kumar, A., & Shanmugavelu, K. G. (1988). Effect of foliar spray of urea and *Azotobacter* applied to soil on banana cv. Robusta, *Banana Newsl. 11*, 11-12.

Mahajan, S. (2009). Integrated nutrient management in colocasia (*Colocasia esculenta* L. Schott). M.Sc. Thesis Assam Agriculture University, Jorhat.

Pathak, R. A., Singh, B. V., & Ojha, C. M. (1992). Studies on the growth and yield of banana cv. 'Horichal'. In: *Symp. Optimization and Productivity and Utilization of Banana,* Sept. 22-23. p: 38.

Prasad, B., & Singh, A. B. (1980). Changes in soil properties with long term use of fertilizers, lime and FYM. *J. Indian Soc. Soil Sci. 28*, 465-468.

Purseglove, J. W. C. (1976). *Tropical Crops: Monocotyledons.* Longmans, N.Y. pp: 273-283.

Ramesh, P., Parwar, N. R., Singh, A. B., Ramana, S., & SubbaRao, A. (2010). Status of organic farming in India.*Current Science*. *98*(9), 1190-1194.

Robinson, J. C., Anderson, T., & Eckstein, K. (1992). The influence of functional leaf removal at flower emergence on components of yield and photosynthetic compensatrion in banana. *J. Hortic. Sci. 67*(3), 403-410.

Romero, J. O. (1998). Organic fertilizers and their application in banana cropping. *Proc. Organic/Environmentally Friendly Banana Production*, Costa Rica. July 27-29. pp: 79-85.

Sathyanarayan, M. (1985). Effect of number of functional leaves on growth and yield of dwarf Cavendice banana (AAB). *Banana Newsletter*. *9*, 34.

Sauer, A. (1952). In: Fruits of India Tropical and Subtropical, Bose, T. K. (ed.), NayaPrakash, Calcutta. p: 125.

Simmonds, N. W. (1966). Bananas.Longmans. London.

Simmonds, N. W., & Shepherd, K. (1955). Taxonomy and origin of cultivated bananas. *Bot. J. Linn. Soc. 55*, 302-312.

Spiden, H. J. (1926). Banana and its culture In: Fruits of India: Tropical and sub tropical, Bose, T. K. (ed.), Naya Prakash , Calcutta. p: 125.

Tamuli, P. P. (2017). Organic and integrated nutrient management for sustainable banana production. *International Journal of Agriculture Sciences*. *9*(35), 4520-4523.

Tiwary, D. K., Hasan, M. A., & Chattopadhyay, P. K. (1998). Studies on the effect of inoculation with *Azotobacter*and*Azospirillum* on growth, yield and quality of banana.*Indian Agriculturist. 42*(4), 235-240.

Turner, D. W. (1970). The growth of the banana. *J. Aus. Inst. Agric. Sci. 36*, 102-111.

Upadhyay, N. P. (1988). Effect of N, P and K fertilizers on growth, yield and quality of banana (*Musa cavindish* L.) varity Harichal. *Prog. Hort. 20*, 257-262.