academicJournals

Vol. 5(9), pp. 130-138, October, 2013
DOI 10.5897/JHF2013.0314
ISSN 2006-9782 ©2013 Academic Journals
http://www.academicjournals.org/JHF

Journal of Horticulture and Forestry

Full Length Research Paper

Studies on integrated nutrient management on growth and yield of banana cv. Ardhapuri (*Musa* AAA)

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Accepted 29 July, 2013

A field experiment was laid out in a randomized block design with 10 treatments and 3 replications consisting of recommended dose of fertilizers (RDF) and RDF was combined with organic manures and biofertilizers [Vesicular-arbuscular mycorrhizae (VAM), *azotobacter,* and Phosphate solubilising bacterial (PSB)] at different combinations to know their effect on growth and yield of banana. The vegetative growth parameters which are, plant height, plant girth, number of leaves per plant, leaf area and crop duration were influenced significantly due to different treatments. The maximum plant height (190.84 cm) and plant girth (81.34 cm) were recorded in treatment 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant) while the maximum leaves (32.30) per plant and leaf area (17.93 m^2) were recorded in Treatment T_3. The minimum number of days (211.03) for shooting after planting and number of days for harvesting after shooting (117.46) were recorded with 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant). Similarly, the yield parameters that is, bunch weight (19.31 kg) and per hectare (85.80 t/ha) were recorded in Treatment T_3. The application of 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) was found beneficial for growth and yield of banana cv. Ardhapuri.

Key words: Banana, organic manures, shooting, biofertilizers.

INTRODUCTION

Banana (*Musa* spp.) is one of the most important staple foods in the globe. It is known for its antiquity and is interwoven with Indian heritage and culture. The plants are considered as the symbol of prosperity and fertility. In India, banana is the second largest growing fruit crop next to mango and the leading producer in the world contributes more than 20% of global production. Banana requires high amount of mineral nutrients for proper growth and production. One tone of banana requires 7 to 8 kg of Nitrogen (N), 0.7 to 1.5 kg of Phosphorous (P) and 17 to 20 kg of Potassium (K) (Anonymous, 2004). These nutrients must be replenished every year through different nutrient sources including organic manures, mineral fertilizers as well as bio-fertilizers in order to maintain soil fertility and to permit continuous production.

A thorough knowledge of the critical levels of different nutrient elements, time and method of application of nutrients is essential to get better growth, yields, and also to maintain optimum nutrient balancing, a prerequisite enhancing nutrient use efficiency (Basagarahally, 1996). In this scenario, efficient nutrient management plays an important role to better production of banana (Mustaffa et al., 2009a). Beneficial microbes increase nutrient availability, reduce disease, reduce nutrient losses, and help degrade toxic compounds (Subba, 1998). The present experiment was planned as an attempt in this direction.

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MATERIALS AND METHODS

The present investigation was carried out at farmer's field of Shri. Kalyan Kaldate of Bramangaon village, taluka Parbhani, during 2010 to 2011 and 2011 to 2012 entitled, "Studies on Integrated Nutrient Management in banana cv. Ardhapuri (*Musa* aaa)". The different treatment manipulated as follows: T_0 - 100% recommended dose of NPK (RDF) + FYM (Control), T_1-100% RDF + FYM + *Azotobacter* (50 g/plant) + Phosphate solubilising bacterial (PSB) (50 g/plant) + Vesicular-arbuscular mycorrhizae (VAM) *Glomus fasciculatum* (250 g/plant), T_2 - 75% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant), T_3 - 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant), T_4 - 100% RDF + FYM + *Azotobacter* (50 g/plant), T_5 - 100% RDF + FYM + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant), T_6 - 75% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant), T_7 - 75% RD of N + 100% RD of PK + FYM + PSB (50 g/ plant) + VAM *G. fasciculatum* (250 g/plant), T_8 - 50% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant), T_9 - 50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant). The treatments were arranged in a randomized block design with 10 treatments in 3 replications. The required dose of organic and inorganic manures and biofertilizers as VAM, *azotobacter* and PSB was calculated and applied in 3 split doses at the 2nd, 4th, and 6th month after planting as per the treatments. The recommended dose of fertilizers followed for the experiment consisted of 200 g N, 160 g P_2O_5, and 200 g K_2O per plant (Anonymous, 2013).

RESULTS AND DISCUSSION

Growth parameters

Plant height (cm)

From the data given in the Table 1 it is revealed that, among the growth parameters, the maximum plant heights (127.48 cm) at 120 Days after planting (DAP) was observed in 100% RDF + FYM. The treatment receiving 50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) recorded maximum plant height of 156.99, 175.67, 187.76, and 190.84 cm, respectively at 150, 180, 210 DAP and at shooting stage. 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 (1965) 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.

Plant girth (cm)

The data revealed that, plant girth was found to be non-significant at 60 and 90 DAP. The significantly maximum plant girth (52.56, 60.82, 68.20, 76.46 and 81.34 cm) respectively at 120, 150, 180, 210 DAP and at the shooting stage (Table 2) was recorded in Treatment T_3 containing 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) and it was significantly superior over rest of the treatments. The minimum plant girth was recorded under control treatment. The beneficial response of biofertilisers on plant girth might be due to the accumulation of poly hydroxybutyric acid which gives rise to vegetative cells. Pigment production is one of the important characteristics of *Azotobacter sps.* These strains are also known to produce growth substances (Mohandas, 1996).

Number of leaves per plant

The data at 60 and 90 DAP produced non-significant results (Table 3). Maximum number of leaves per plant (20.73) was produced by the plant treated with 50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) after 120 DAP. However, at 150,180, and 210 DAP and at shooting stage, the Treatment T_3 produced maximum number of leaves (23.57, 25.90, 30.63, and 32.30, respectively) per plant. Minimum number of leaves per plant was recorded in control. The increase in number of leaves might be due to the higher vegetative growth of VAM treated plants which may be due to the growth promotory effect of VAM that improves the phosphorus availability and thereby causing higher protein synthesis resulting in more morphological growth. The VAM compensations at reduced P application were very much effective in increasing the number of total leaves per plant. The number of leaves was managed at lower fertility (Singh and Singh, 2004).

Leaf area (cm^2)

The maximum leaf area (2.65, 7.31, 10.73, 11.93, 14.23, 17.79, and 17.93 cm^2 at 60, 90, 120, 150, 180, 210 DAP and at shooting stage, respectively) (Table 4) was recorded in Treatment T_3 containing 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) and it was significantly superior over rest of the treatments. While significantly minimum leaf area was recorded in control. 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 (Mahadevan, 1988).

Crop duration (days)

The early shooting, harvesting and total crop duration were recorded in Treatment T_3, which received 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) (Table 5). It

Table 1. Effect of different treatments on plant height (cm) of banana cv. Ardhapuri at different days after planting (Pooled)**.**

Treatment no.	Treatment	Plant height (cm)						
		60 DAP	90 DAP	120 DAP	150 DAP	180 DAP	210 DAP	At shooting stage
T_0	100% Recommended dose of NPK (RDF) + FYM (control)	56.33	99.43	127.48	132.61	146.66	157.34	161.11
T_1	100% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	58.79	99.64	122.13	138.81	151.28	166.92	170.14
T_2	75% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/ plant) + VAM *Glomus fasciculatum* (250 g/plant)	53.25	98.73	124.68	152.44	166.11	178.97	182.47
T_3	50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	53.89	98.33	121.50	156.99	175.67	187.76	190.84
T_4	100% RDF + FYM + *Azotobacter* (50 g/plant)	54.21	97.49	119.51	143.13	156.86	168.29	171.64
T_5	100% RDF + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	53.18	98.64	119.29	137.35	150.87	166.89	170.39
T_6	75% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	54.50	97.76	119.64	147.66	161.67	173.45	181.14
T_7	75% RD of N + 100% RD of PK + FYM + PSB (50 g/ plant) + VAM *Glomus fasciculatum* (250 g/plant)	56.55	99.73	120.70	147.17	157.25	170.96	176.36
T_8	50% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	53.20	99.44	120.50	150.53	161.62	176.57	181.67
T_9	50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	57.27	100.66	126.28	142.63	152.79	166.81	171.63
	S.E. ±	0.91	0.80	0.75	0.83	0.70	1.12	0.51
	C.D. at 5%	NS	NS	2.16	2.39	2.02	3.23	1.48

RDF-Recommended dose of fertilizer, DAP-Days after planting, PSB-Phosphate solublising bacteria, VAM-Vesicular arbuscular mycorrhizae, NS-Non significant.

was observed that, minimum days required for shooting and (211.03 and 117.46 days) was recorded in the Treatment T_3, all the treatments were significantly superior over control which recorded maximum days (246.13 and 134.98 days), respectively for shooting after planting.

Table 2. Effect of different treatments on plant girth (cm) of banana cv. Ardhapuri at different days after planting (Pooled).

Treatment no.	Treatment	Plant girth (cm)						
		60 DAP	90 DAP	120 DAP	150 DAP	180 DAP	210 DAP	At shooting stage
T_0	100% Recommended dose of NPK (RDF) + FYM (control)	25.37	36.07	39.30	46.13	52.70	62.67	66.82
T_1	100% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/ plant)	25.26	37.35	45.95	52.49	58.71	69.57	74.47
T_2	75% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	25.34	37.78	50.96	57.84	66.32	74.74	80.20
T_3	50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	25.54	38.66	52.56	60.82	68.20	76.46	81.34
T_4	100% RDF + FYM + *Azotobacter* (50 g/plant)	24.14	35.57	48.04	53.60	57.52	71.40	78.19
T_5	100% RDF + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	24.45	36.48	44.12	51.20	59.59	70.43	73.27
T_6	75% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	23.82	35.90	48.45	56.22	65.95	72.68	79.44
T_7	75% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	25.54	37.80	48.32	54.57	59.91	71.31	79.53
T_8	50% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	23.57	36.93	48.63	56.68	66.32	73.41	79.64
T_9	50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	22.78	37.70	46.86	52.87	65.17	70.36	77.42
	S.E. ±	0.73	0.83	0.69	0.51	0.76	0.55	0.33
	C.D. at 5%	NS	NS	2.21	1.48	2.19	1.57	0.96

RDF- Recommended dose of fertilizer, DAP- Days after planting, PSB- Phosphate solublising bacteria, VAM- Vesicular arbuscular mycorrhizae, NS- Non significant.

Similarly, minimum total days required (328.49 days) were recorded in the Treatment T_3, which was statistically at par with Treatment T_2 (345.25 days). It was found that, the untreated control recorded maximum total crop duration (381.12 days) as a consequence of improved vegetative growth and high photosynthetic rate and CO_2 fixation.

The shooting (flowering) process is greatly

Table 3. Effect of different treatments on number of leaves per plant of banana cv. Ardhapuri at different days after planting (Pooled).

Treatment no.	Treatment	Number of leaves per plant						
		60 DAP	90 DAP	120 DAP	150 DAP	180 DAP	210 DAP	At shooting stage
T_0	100% Recommended dose of NPK (RDF) + FYM (control)	11.87	14.13	17.07	19.93	22.27	25.63	26.90
T_1	100% RDF + FYM + *Azotobacter* (50 g/ plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	12.10	14.70	19.67	22.70	24.00	25.87	28.23
T_2	75% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	12.60	14.93	20.57	23.23	25.97	30.13	31.57
T_3	50% RDF + FYM + *Azotobacter* (50 g/ plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	13.35	15.40	20.70	23.57	25.90	30.63	32.30
T_4	100% RDF + FYM + *Azotobacter* (50 g/ plant)	11.93	14.63	17.90	21.20	23.00	25.93	27.07
T_5	100% RDF + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	12.27	14.97	20.03	22.73	24.17	25.77	27.73
T_6	75% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	12.07	14.70	19.73	22.00	25.17	26.60	29.47
T_7	75% RD of N + 100% RD of PK + FYM + PSB (50 g/ plant) + VAM *Glomus fasciculatum* (250 g/plant)	12.43	14.90	20.57	22.90	24.30	25.77	28.83
T_8	50% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	12.00	14.30	17.97	20.90	25.13	29.10	30.93
T_9	50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	12.17	15.40	20.73	23.53	24.47	26.13	28.93
	S.E. ±	0.40	0.47	0.31	0.31	0.25	0.39	0.43
	C.D. at 5%	NS	NS	0.90	0.89	0.73	1.12	1.24

RDF-Recommended dose of fertilizer, DAP-Days after planting, PSB-Phosphate solublising bacteria, VAM-Vesicular arbuscular mycorrhizae, NS-Non significant.

affected by the changed hormonal levels, that is, higher growth promoter/inhibitor ratio resulting in flower induction. Early flowering with higher number of flowers in mycorrhizal plants is dependent upon the genotype/workers through which mycorrhizal plants enter into the reproductive

Table 4. Effect of different treatments on Leaf area (m^2) of banana cv. Ardhapuri at different days after planting (Pooled).

Treatment no.	Treatment	Leaf area (m^2)						
		60 DAP	90 DAP	120 DAP	150 DAP	180 DAP	210 DAP	At shooting stage
T_0	100% recommended dose of NPK (RDF) + FYM (control)	1.88	5.69	8.22	9.93	10.98	13.86	14.06
T_1	100% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/ plant)	2.13	5.76	9.14	10.51	11.46	14.33	14.66
T_2	75% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/ plant)	2.59	7.07	9.30	11.64	13.36	17.60	17.73
T_3	50% RDF + FYM + *Azotobacter* (50 g/ plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	2.65	7.31	10.73	11.93	14.23	17.79	17.93
T_4	100% RDF + FYM + *Azotobacter* (50 g/plant)	2.19	6.18	9.85	11.27	12.04	16.08	16.13
T_5	100% RDF + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/ plant)	1.92	5.71	8.87	10.18	11.46	14.06	14.43
T_6	75% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	2.36	6.55	10.70	11.61	12.23	16.48	16.56
T_7	75% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	2.29	6.24	9.81	11.62	12.28	15.93	16.46
T_8	50% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	2.49	6.80	10.76	11.68	12.24	16.76	16.81
T_9	50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	2.18	6.13	9.76	10.75	11.70	15.13	15.24
	S.E. ±	0.03	0.05	0.17	0.15	0.17	0.15	0.14
	C.D. at 5%	0.08	0.13	0.50	0.42	0.56	0.43	0.41

RDF-Recommended dose of fertilizer, DAP-Days after planting, PSB-Phosphate solublising bacteria, VAM-Vesicular arbuscular mycorrhizae

Table 5. Effect of different treatments on crop duration of banana cv. Ardhapuri (Pooled).

Treatment no.	Treatment	Days for shooting after planting	Days to harvest after shooting	Total crop duration
T_0	100% recommended dose of NPK (RDF) + FYM (control)	246.13	134.98	381.12
T_1	100% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	243.10	124.07	367.17
T_2	75% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	224.05	121.20	345.25
T_3	50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/ plant) + VAM *Glomus fasciculatum* (250 g/ plant)	211.03	117.46	328.49
T_4	100% RDF + FYM + *Azotobacter* (50 g/plant)	240.67	122.70	363.37
T_5	100% RDF + FYM + PSB (50 g/ plant) + VAM *Glomus fasciculatum* (250 g/plant)	245.30	123.90	369.20
T_6	75% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	236.10	128.07	364.17
T_7	75% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	238.60	134.30	372.90
T_8	50% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	235.00	129.17	364.17
T_9	50% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	239.90	125.67	365.57
	S.E. ±	1.90	1.70	2.42
	C.D. at 5%	5.46	5.42	6.93

RDF-Recommended dose of fertilizer, PSB-Phosphate solublising bacteria, VAM-Vesicular arbuscular mycorrhizae.

Table 6. Effect of different treatments on yield parameters of banana cv. Ardhapuri (Pooled).

Treatment no.	Treatment	Weight of bunch (kg)	Yield (t/ha)
T_0	100% recommended dose of NPK (RDF) + FYM (control)	10.64	47.30
T_1	100% RDF + FYM + *Azotobacter* (50 g/ plant) + PSB (50 g/ plant) + VAM *Glomus fasciculatum* (250 g/plant)	13.49	59.96
T_2	75% RDF + FYM + *Azotobacter* (50 g/ plant) + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/ plant)	18.08	80.35
T_3	50% RDF + FYM + *Azotobacter* (50 g/ plant)+ PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/ plant)	19.31	85.80
T_4	100% RDF + FYM + *Azotobacter* (50 g/plant)	12.66	56.25
T_5	100% RDF + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/ plant)	12.96	57.59
T_6	75% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	12.48	55.45
T_7	75% RD of N + 100% RD of PK + FYM + PSB (50 g/plant) + VAM *Glomus fasciculatum* (250 g/plant)	15.57	69.19
T_8	50% RD of N + 100% RD of PK + FYM + *Azotobacter* (50 g/plant)	12.25	54.43
T_9	50% RD of N + 100% RD of PK + FYM + PSB (50 g/ plant) + VAM *Glomus fasciculatum* (250 g/plant)	14.18	63.03
	S.E. ±	0.47	2.08
	C.D. at 5%	1.35	5.98

RDF-Recommended dose of fertilizer, PSB-Phosphate solublising bacteria, VAM-Vesicular arbuscular mycorrhizae.

phase early because of the increased P nutrition and greater development of water conducting tissues (Chang, 1992).

Yield parameters

Weight of bunch (kg)

The highest weight of bunch (19.31 kg) was significantly recorded in (Table 6) Treatment T_3 containing 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant). This was obviously due to thevigorous 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 weight of bunch. This was in accordance with the result of Hazarika and Ansari (2010).

The applied N, P, K and biofertilizers were utilized efficiently by the plant, which resulted in producing maximum photosynthates in terms of high biomass and translocating the assimilated material to the developing sink resulting in heavier weight of bunch. N is the chief constituent of chlorophyll. Protein and amino acids, the synthesis of which is accelerated through increased supply of N (Pafli, 1965; Mahadevan, 1988).

Yield per hectare (tones)

The maximum yield (85.80 t/ha) was noticed in (Table 6) Treatment T_3 containing 50% RDF + FYM + *Azotobacter*

(50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) which may be due to the maximum weight of bunch registered in that plot. Increase in yield in Treatment (T_3) could be attributed to the increase in morphological traits and also higher nutrient uptake by the plants. This is in confirmation with the findings of Agrawal et al. (1997) and Shakila (2000). Krishnan and Shanmugavelu (1979) found that, plants with thicker pseudostem are desirable as they reflect on bunch size and other related characters. Banana being an exhaustive crop, availability of more nutrients through the inorganic source might have helped to get better weight of bunch *vis a vis* yield per hectare (Athani et al., 1999).

Conclusion

The application of 50% RDF + FYM + *Azotobacter* (50 g/plant) + PSB (50 g/plant) + VAM *G. fasciculatum* (250 g/plant) was found beneficial for growth and yield of banana cv. Ardhapuri.

REFERENCES

Agrawal S, Pandey SD, Tiwari BL (1997). Studies on the effect of high status of nitrogen and potassium on qualitative characters of in *vitro* banana fruit cv. Robusta. Orissa J. Hort. 25:67-72.

Anonymous (2004). Effect of biofertilizers on growth, yield and quality of banana cv. Rajapuri. Annual Report, All India Coordinated Research Project on Tropical Fruits, Arabhavi Centre.

Anonymous (2013). Indian Horticulture Database, N.H.B., Govt. of India.

Athani SI, Hulamani NC, Shirol AM (1999). Effect of vermicompost on maturity and yield of banana cv. Rajapuri (*Musa* AAB). South Indian Hort. 47(1-6):4-7.

Basagarahally MH (1996). Nutrition and water management for micro propagated plants. Second National Conference On Production of Healthy Planting Material in Banana. P. 55.

Chang DCN (1992). Studies and prospects of horticultural vesicular arbuscular mycorrhizae in Taiwan. Sci. Agric. 40:45-52.

Hazarika BN, Ansari S (2010). Effect of integrated nutrient management on growth and yield of banana cv. Jahaji. Indian J. Hort. 67(2):270-273.

Krishnan BM, Shanmugavelu KG (1979). Studies on Water requirements of Banana cv. Robusta, effect on Morphological characters, Crop duration, Yield and Quality of Frits. Mysore J. Agric. Sci. 13:433-441.

Mahadevan VC (1988). Effect of foliar nutrition of NPK on banana cv. Nendran (AAB). M.Sc. (Hort.) Thesis, Tamil Nadu Agric. Uni., Coimbatore.

Mohandas S (1996). In: Proc. Conference on Challenges for Banana Production and Utilization in 21st Century. National Research Centre on Banana. September 24-25:883-887.

Mustaffa MM, Kumar V, Jeyabaskeran KJ, Pandey V (2009a). Nutrition and water management for micro propagated banana plants cv. Rajapuri. Second National Conference On Production of Healthy Planting Material in Banana. Jalgaon, Souvernir and abstract. P. 58.

Pafli G (1965). Relations between abundant N supply and amino acid concentration on leaves of rice plants. Plant Soil 23:275-284.

Shakila A (2000). Studies on nutrition for in *vitro* propogated banana cv. Robusta. Ph.D. thesis submitted to, Annamalai Uni., Annamalai Nagar, Tamil Nadu.

Singh A, Singh SP (2004). Response of banana (*Musa* sp.) to vesicular arbuscular mycorrhizae and varied levels of inorganic fertilizers. Indian J. Hort. 61(2):109-113.

Subba R (1998). Biofertilizers in Agriculture. A.A. Blakema, Rotterdam/ New Delhi. pp. 128-136.