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Impact of Organic, Inorganic and Bio-Fertilizers with Different Spacing on Vegetative Growth and Yield of Guava (cv. Lalit) During Summer Season

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ABSTRACT

The Field investigations were carried out know the effect of organic, inorganic and bio-fertilizers on growth and yield of guava (Psidium guajava L.) cv. Lalit was carried out at Regional Horticulture Research Station, College of Horticulture, Bengaluru. The vegetative growth and yield was significantly influenced at different spacing levels (2 x 2, 3 x 3, 6 x 3 and 6 x 6 m). In summer season the maximum plant height (2.81 m), plant spread (N-S direction) (2.85 m), plant spread (E-W direction) (2.69 m) and canopy volume (11.76 m^3) were found in 6 x 6 m spacing. Whereas, the maximum leaf area (58.13 m^2) and total chlorophyll content (2.19 mg 100 g^{-1} FW) were found in 2 x 2 m spacing. Integrated nutrient management significantly influenced vegetative growth characteristics after 8 month of growth stage the maximum plant height (2.81 m), plant spread (N-S direction) (2.74 m), plant spread (E-W direction) (2.67 m) and canopy volume (11.71 m^3) in 6 x 6 m spacing and the (2 x 2 m) spacing records, the maximum leaf area (59.12 m^2) and total chlorophyll content (2.53 mg 100 g^{-1} FW) were maximum in (T_{10}) Azotobacter @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK. The yield was significant among the different spacing of summer season. The 6 x 6 m spacing records the maximum number of fruits (171.74), fruit yield (12.63 kg $tree^{-1}$). Integrated nutrient management of (T_{10}) Azotobacter @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK wangle the maximum number of fruits (236.06), fruit yield (15.71 kg $tree^{-1}$).

Key words: *Organic, Inorganic, Bio-Fertilizers, Guava, Pruning, Summer, Lalit, Spacing*

INTRODUCTION

Guava (*Psidium guajava* L.) is a popular fruit crop in India. It belongs to the family Myrtaceae. It can be grown in tropical and subtropical climate and it adapted for diverse soil and agro climatic conditions. It is relatively precocious and prolific in fruit bearing nature, could gives highly remunerative for crop production. The fruits are highly nutritious, it has a rich source of vitamin 'C' after barbados cherry (1500 mg 100^{-1}g) and aonla (700 mg 100^{-1}g) and Vitamin 'C' content of fruits vary from 95.75 to 239.00 mg 100^{-1} g cultivars of guava[1]. Guava is the fifth important fruit crop after banana, mango, citrus and papaya with an area of 268 thousand hectares contribute to total annual production of 3668 million tons and with productivity of 13.70 million tons per hectare[2].

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Among other fruit crops, guava essentially requires nutrients for its growth and production. It gives good response for manures and fertilization for better crop production. A minimum or poor application of nutrients seems to be declining in growth and yield of a tree. Considering the above facts in view, the integrated approach of organic, inorganic and bio-fertilizers were used to know the effect on vegetative growth and its impact on yield parameters of cv. Lalit in summer season.

MATERIAL AND METHODS

The present research was carried out at the Regional Horticultural Research Experimental Centre (RHREC), UHS, Campus, Bengaluru during the year 2012-13 and 2013-14 and the research was conducted on three year old guava trees. experiment was conducted on four different plant densities included, (2 x 2 m, 3 x 3 m , 6 x 3 m and 6 x 6 m. The treatment aggregates of T_1: FYM (10 kg) + recommended NPK (50:25:75 g plant^{-1}), T_2: Vermicompost (10 kg) + recommended NPK, T_3: FYM (5 kg) + vermicompost (5 kg) + recommended NPK, T_4: FYM (10 kg) + vermicompost (10 kg) + 50% recommended NPK, T_5: *Azotobacter* (20 g) + FYM (10 kg) + 50% recommended NPK, T_6: *Azotobacter* (20 g) + vermicompost (10 kg) + 50% recommended NPK, T_7: PSB (20 g) + FYM (10 kg) + 50% recommended NPK, T_8: PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK, T_9: *Azotobacter* (20 g) + PSB (20 g) + FYM (10 kg) + 50% recommended NPK, T_{10}: *Azotobacter* (20 g) + PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK. The bio-fertilizers were procured from Department of Microbiology, UAS, Bengaluru. The experiment was statistically carried out by split plot design with ten treatments replicated thrice with two trees per replication. The observations recorded for vegetative growth, plant height (m) and plant spread (N-S & E-W), Canopy volume was calculated by using formula[3].

$$\mathrm{V} = \frac{4}{6}\pi h r^2 \quad \text{where, } \pi - 2.14, \text{ h- Height of tree (m), } r = \frac{\text{Sum of E−W and N−S directions (m)}}{4}$$

Leaf area, total chlorophyll content of leaf, number of fruits, fruit yield per tree, pruned shoots were weighed to know the biomass production. The data were statistically analyzed by adopting standard procedures and interpreted using analysis of variance.

RESULTS AND DISCUSSION

The plant height was recorded in different densities like S_1 (2 x 2 m), S_2 (3 x 3 m), S_3 (6 x 3 m) and S_4 (6 x 6 m) of summer (2014) at initial days among the different density the maximum plant height (2.58 m) recorded in 6 x 6 m which was significant over all other spacing 6 x 3 m (2.52 m), 3 x 3 m recorded (2.29 m) and 2 x 2 m (1.76 m), and after 8 months of growth period plant height (3.07 m) recorded in 6 x 6 m which was significant over all other spacing 6 x 3 m (3.00 m), 3 x 3 m recorded (2.73 m) and 2 x 2 m (2.09 m) and the integrated nutrient management method also proves that, the plants treated with T_{10} (*Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK) shows highest plant height at initial days and after 8 months (2.44 & 2.90 m respectively). The plant spread was significantly higher (N–S and E–W) was observed in unprunned treatment (6 x 6 m) than all other high density spacing (2 x 2 m), (3 x 3 m), (6 x 3 m). The maximum spread (N-S) of plant at initial days 2 x 2 m (1.53 m), 3 x 3 m (1.88 m) shows significant differences with each other but 6 x 3 m (2.31 m) was on par with 6 x 6 m (2.36 m) and after 8 months of growth period 2 x 2 m (1.82 m), 3 x 3 m (2.24 m) shows significant differences with each other but 6 x 3 m (2.75 m) was on par with 6 x 6 m (2.81 m). Where, by the application of organic and inorganic with bio-fertilizers sources were significantly influenced on plant spread (N-S) (2.19 and 2.60 m) was observed at initial days and at 8 months respectively. Similar trend was followed in the East-West spread plant spread where, the significantly maximum spread was observed in unpruned spacing S_4 (6 x 6 m) (2.39 m) which was on par with 6 x 3 m (2.32 m) but with other spacing 2 x 2 m (1.58 m) and 3 x 3 m (1.86 m) it shows significant differences were observed at initial days of growth period and the same trend was followed at 8 months growth stage S_4 (6 x 6 m) (2.84 m) which was on par with 6 x 3 m (2.76 m) but with other spacing 2 x 2 m (1.88 m) and 3 x 3 m (2.22 m) it shows significant results. Whereas, in integrated management studies, the maximum spread was observed in T_{10} (*Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK) (2.18 m and 2.60 m) at initial days and after 8th month of growth period. The maximum canopy volume was observed at (S_4) 6 x 6 m (7.60 m^3) which was on par with 6 x 3 m (7.38 m^3) but it was significant with 3 x 3 m (4.34 m^3) and 2 x 2 m (2.25 m^3) at initial days and after at 8th month (S_4) 6 x 6 m (12.84 m^3) which was on par with 6 x 3 m (12.47 m^3) but it was significant with 3 x 3 m (7.33 m^3) and 2 x 2 m (3.80 m^3) was observed. Further, T_{10} comprises with *Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK had maximum canopy volume (6.53 m^3 and 11.03 m^3 respective interval of growth stage) compared to T_9 (*Azotobacter* @ 20 g + PSB @ 20 g + FYM @ 10 kg + 50 % recommended NPK) (6.16 and 10.41 m^3 respectively) (Table 1 & 2).

The leaf area of a plant was influenced by the different spacing 2 x 2 m spaced plants shows the maximum leaf area (43.24 m^2) among all other densities, apart from the spacing treatment the integrated nutrient management resulted maximum leaf area (49.93 m^2) observed in T_{10} (*Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK. Maximum total chlorophyll content of the leaves was recorded significantly more in closer spaced (2 x 2 m) plots (2.23 mg 100 g^{-1} fresh weight). By the application of organic, inorganic and bio-fertilizers, the synthesis of total chlorophyll content of leaves was maximum in the treatment T_{10} (*Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK) (2.55 mg 100 g^{-1} fresh weight) in the summer season. The weight of pruned material was gives the additional information of plant growth in pruned trees. The significant differences were observed during summer season, the maximum weight the maximum (4.86 kg) pruned shoots weight recorded in closer spacing (2 x 2 m) and the fertilizer studies shows that the collective weight of pruned shoots was highest (4.55 kg) by the application of T_{10} (*Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK) (Table 3). The maximum number of fruits (166.25) was in summer season under wider spaced (6 x 6 m) plots. By the application of organic, inorganic and bio-fertilizers, the number of fruits was maximum (228.52) in the treatment T_{10} (*Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK) and the maximum fruit yield per tree in the higher fruit yield per tree was recorded under (6 x 6 m) spacing with the yield about (10.81 kg $tree^{-1}$). The adaptation of integrated nutrient management gives the maximum fruit yield (13.44 kg $tree^{-1}$) in the treatment (T_{10}) *Azotobacter* @ 20 g + PSB @ 20 g + vermicompost @ 10 kg + 50 % recommended NPK (Table 4).

The results of present study reveals the variations in plant height is may be due to the regular pruning was undertaken as a common practice for all high density treatment except the wider spaced plot. Thus, more or less similar dwarf plant height was observed in the entire high density plot. On the other side, the highest plant was observed in wider spacing plot. S_4 (6 x 6 m) plant growth was not restricted by adopting pruning. These results were confirmed by earlier reports of guava high density studies reported that a spacing of 6 x 6 m resulted the maximum tree height as compared to 6 x 4 and 6 x 5 m spacing[4]. The high density was coupled with the regular pruning however, some studies without pruning were recorded height of the plant was increased in the plant densities or closer spacing, and these increment in height of plant in these research find outs was mainly due to the fact that sunlight competition among the unprunned high density plants grows vertically[5,6,7&8]. The better efficiency of organic manures in combination with inorganic fertilizers might be due to the fact that organic manures would have provided the micronutrients such as zinc, iron, copper, manganese, etc., in an optimum level. These findings were supported by following scientists, the application of organic manures would have helped in the plant metabolism through the supply of such important micronutrients in the early growth phase[9].

The better efficiency of organic manures in combination with inorganic fertilizers might be due to the fact that organic manures would have provided the micronutrients such as zinc, iron, copper, manganese, etc., in an optimum level. These findings were supported by following scientists, the application of organic manures would have helped in the plant metabolism through the supply of such important micronutrients in the early growth phase[10]. The maximum plant spread was noticed in 6 x 6 m spacing. Improvement of crop growth was influenced by *Azotobacter*, the microbial inoculants, which bring about fixation of atmospheric nitrogen through free-living N_2 fixers in rhizosphere. The results of present study accordance were observed the vegetative growth of guava was improved by the application of different fertilizers, organic manure and bio-fertilizers[11]. The increasing of canopy volume might be due to the better nutritional environment, application of organic matter improve the soil health by improving physicochemical and biological activities of soil[12]. The favorable effect of vermicompost on vegetative growth might be due to the fact that in addition to improving the various aspects of soil systems (physico-chemical and biological), it also alters various enzymatic activities in plants such as peroxidase, catalase etc, which promotes cell elongation, root and shoot growth and carbohydrate metabolism[13]. The productivity of any crop depends on the process of photosynthesis, which in turn depends on the chlorophyll content of leaves in plants and the magnesium is an important constituent of chlorophyll. They help in activation of many enzymes involved in photosynthesis their by, helps in uptake and translocation of sugar in the plant. Similarly, nitrate reductase enzyme is known to be involved in assimilation of nitrogen[14]. The maximum growth increment was obtained by the application of full dose of NPK with bioincoulants followed by 75 % NPK with bioincoulants and vermicompost, it might be due to profuse supply of nutrients along with production of growth promoting hormones by bio-fertilizers and vermicompost[15]. The total chlorophyll content and photosynthetic rate of leaves were positively correlated with leaf N content[16].

The integrated use of organic manures and bio-fertilizers along with chemical fertilizers improves physico-chemical properties of soil besides improving the efficiency of applied chemical fertilizers which helps in the betterment of yield and its other components[17]. The bio-fertilizers encouraged better growth and accumulate optimum dry matter with induction of growth hormones, which stimulated cell division, cell elongation, activate the photosynthesis process, similar findings were reported in guava[18,19,20&21]. The 50 percent pruning in May produced the highest yield (25.8 kg tree^{-1}) than unpruned (7.6 kg tree^{-1}) in winter crop of guava cv. 'Sardar'[22]. The results of long-term fertilizer experiments suggested that neither organic manures alone nor exclusive application of chemical fertilizers could achieve the yield sustainability at a high order under modern farming where the nutrient turnover in the soil plant system is quite high[23]. A significant increase in yield and yield parameters in guava with integrated nutrient application may be due to vigorous vegetative growth and increased chlorophyll content, which together accelerated the photosynthetic rate and thereby increased the supply of carbohydrates to plants. The beneficial role of supplemented organic manures and bio-fertilizers in improving soil physical, chemical and biological role is well known, which in turn helps in better nutrient absorption by plants and resulting higher yield[24].

Table 1: Influence of planting density and integrated nutrient management on plant height (m) and plant spread (N-S direction) (m) of guava cv. Lalit

Summer season (2014)																				
	Plant height (m)										Plant spread (N-S)									
Treatments	Initial days				Mean	After 8 months				Mean	Initial days				Mean	After 8 months				Mean
	S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4	
T_1	1.30	2.09	2.40	2.45	2.06	1.55	2.49	2.86	2.92	2.46	1.43	1.65	2.19	2.19	1.87	1.70	1.97	2.61	2.61	2.22
T_2	1.67	2.09	2.45	2.47	2.17	1.99	2.49	2.92	2.95	2.59	1.46	1.66	2.21	2.25	1.89	1.73	1.97	2.63	2.68	2.25
T_3	1.72	2.19	2.48	2.52	2.23	2.05	2.61	2.96	3.00	2.65	1.47	1.81	2.25	2.29	1.96	1.75	2.16	2.68	2.73	2.33
T_4	1.77	2.28	2.51	2.54	2.27	2.11	2.71	2.98	3.02	2.71	1.49	1.85	2.27	2.31	1.98	1.78	2.20	2.70	2.75	2.36
T_5	1.77	2.29	2.52	2.56	2.28	2.11	2.72	3.00	3.05	2.72	1.52	1.89	2.29	2.35	2.01	1.81	2.25	2.73	2.80	2.40
T_6	1.83	2.34	2.52	2.58	2.31	2.18	2.78	3.00	3.07	2.76	1.54	1.91	2.31	2.39	2.04	1.83	2.27	2.75	2.85	2.43
T_7	1.83	2.35	2.56	2.61	2.34	2.18	2.80	3.05	3.11	2.78	1.56	1.95	2.35	2.41	2.07	1.86	2.32	2.80	2.87	2.46
T_8	1.88	2.40	2.59	2.66	2.38	2.24	2.86	3.08	3.17	2.84	1.59	1.97	2.39	2.45	2.10	1.89	2.35	2.85	2.92	2.50
T_9	1.88	2.43	2.60	2.70	2.40	2.24	2.90	3.10	3.22	2.86	1.62	1.99	2.41	2.47	2.12	1.93	2.37	2.87	2.94	2.53
T_{10}	1.93	2.48	2.61	2.72	2.44	2.30	2.96	3.11	3.24	2.90	1.64	2.15	2.45	2.51	2.19	1.95	2.56	2.92	2.99	2.60
Mean	1.76	2.29	2.52	2.58		2.09	2.73	3.00	3.07		1.53	1.88	2.31	2.36		1.82	2.24	2.75	2.81	
		S.E.m ±		CD @ 5%			S.E.m ±		CD @ 5%			S.E.m ±		CD @ 5%			S.E.m ±		CD @ 5%	
S		0.009		0.029			0.01		0.04			0.09		0.30			0.10		0.36	
T		0.001		0.004			0.00		0.00			0.00		0.01			0.00		0.01	
S x T		0.009		0.025			0.01		0.03			0.09		0.25			0.10		0.29	

T_1: FYM (10 kg) + recommended NPK (50:25:75 g plant^{-1})

T_2: Vermicompost (10 kg) + recommended NPK

T_3: FYM (5 kg) + vermicompost (5 kg) + recommended NPK

T_4: FYM (10 kg) + vermicompost (10 kg) + 50% recommended NPK

T_5: *Azotobacter* (20 g) + FYM (10 kg) + 50% recommended NPK

T_6: *Azotobacter* (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_7: PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_8: PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_9: *Azotobacter* (20 g) + PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_{10}: *Azotobacter* (20 g) + PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

S_1- 2 x 2 m S_2- 3 x 3 m S_3- 6 x 3 m S_4- 6 x 6 m

Table 2: Influence of planting density and integrated nutrient management on plant spread (E-W direction) (m) and canopy volume (m^3) of guava cv. Lalit

Treatments	Summer season (2014)																			
	Plant spread (E-W)										Canopy volume (m^3)									
	Initial days				Mean	After 8 months				Mean	Initial days				Mean	After 8 months				Mean
	S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4	
T_1	1.44	1.69	2.21	2.21	1.89	1.71	2.01	2.63	2.63	2.25	1.40	3.10	6.32	6.19	4.25	2.37	5.23	10.67	10.45	7.18
T_2	1.48	1.70	2.23	2.27	1.92	1.77	2.02	2.66	2.70	2.29	1.89	3.14	6.49	6.67	4.55	3.19	5.30	10.96	11.27	7.68
T_3	1.52	1.75	2.25	2.31	1.96	1.81	2.08	2.68	2.75	2.33	2.02	3.70	6.78	7.00	4.87	3.41	6.24	11.45	11.82	8.23
T_4	1.55	1.79	2.27	2.35	1.99	1.85	2.13	2.70	2.80	2.37	2.15	4.01	6.96	7.24	5.09	3.63	6.78	11.75	12.23	8.60
T_5	1.57	1.85	2.31	2.39	2.03	1.87	2.20	2.75	2.85	2.42	2.22	4.26	7.20	7.52	5.30	3.74	7.19	12.16	12.70	8.95
T_6	1.60	1.89	2.33	2.43	2.06	1.91	2.25	2.77	2.89	2.46	2.36	4.49	7.39	7.78	5.51	3.99	7.59	12.48	13.14	9.30
T_7	1.63	1.93	2.35	2.45	2.09	1.94	2.30	2.80	2.92	2.49	2.44	4.71	7.67	8.04	5.71	4.12	7.95	12.96	13.58	9.65
T_8	1.66	1.95	2.37	2.47	2.11	1.97	2.32	2.82	2.94	2.51	2.59	4.91	8.03	8.34	5.97	4.37	8.29	13.56	14.09	10.08
T_9	1.67	1.99	2.41	2.49	2.14	1.98	2.37	2.87	2.97	2.55	2.65	5.13	8.36	8.51	6.16	4.48	8.66	14.12	14.37	10.41
T_{10}	1.69	2.09	2.43	2.51	2.18	2.01	2.49	2.89	2.99	2.60	2.79	5.94	8.63	8.75	6.53	4.71	10.04	14.58	14.78	11.03
Mean	1.58	1.86	2.32	2.39		1.88	2.22	2.76	2.84		2.25	4.34	7.38	7.60		3.80	7.33	12.47	12.84	
	S.E.m ±		CD @ 5%			S.E.m ±		CD @ 5%			S.E.m ±		CD @ 5%			S.E.m ±		CD @ 5%		
S	0.08		0.28			0.10		0.34			0.55		1.90			0.93		3.21		
T	0.01		0.01			0.01		0.02			0.06		0.16			0.10		0.27		
S x T	0.08		0.23			0.10		0.28			0.56		1.58			0.95		2.67		

T_1: FYM (10 kg) + recommended NPK (50:25:75 g $plant^{-1}$)

T_2: Vermicompost (10 kg) + recommended NPK

T_3: FYM (5 kg) + vermicompost (5 kg) + recommended NPK

T_4: FYM (10 kg) + vermicompost (10 kg) + 50% recommended NPK

T_5: *Azotobacter* (20 g) + FYM (10 kg) + 50% recommended NPK

T_6: *Azotobacter* (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_7: PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_8: PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_9: *Azotobacter* (20 g) + PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_{10}: *Azotobacter* (20 g) + PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

S_1- 2 x 2 m S_2- 3 x 3 m S_3- 6 x 3 m S_4- 6 x 6 m

Table 3: Influence of planting density and integrated nutrient management on leaf area (m^2) and total chlorophyll content of leaf (mg 100 g^{-1} fresh weight) and weight of pruned shoots (kg) of guava cv. Lalit

Treatments	Summer season (2014)													
	Leaf area (m^2)					Total chlorophyll					Weight of pruned shoots (kg)			
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	Mean
T_1	36.84	36.85	36.29	36.66	36.66	1.82	1.79	1.77	1.55	1.73	2.19	1.30	1.02	1.13
T_2	37.02	37.75	37.43	37.89	37.52	1.85	1.82	1.77	1.58	1.76	2.30	2.05	1.05	1.35
T_3	37.11	38.08	39.25	38.51	38.24	1.95	1.92	1.89	1.69	1.86	3.48	2.74	1.30	1.88
T_4	39.42	39.66	39.84	39.57	39.62	2.00	1.98	1.92	1.70	1.90	3.55	2.13	1.41	1.77
T_5	40.75	40.73	40.41	40.10	40.50	2.25	2.20	2.16	1.91	2.13	3.76	1.94	1.52	1.80
T_6	42.28	41.59	40.42	41.78	41.52	2.34	2.35	2.20	2.01	2.22	3.91	2.56	1.57	2.01
T_7	44.04	43.53	41.27	43.00	42.96	2.44	2.41	2.34	2.09	2.32	6.47	4.12	1.63	3.06
T_8	48.59	45.02	42.87	43.45	44.98	2.45	2.44	2.37	2.12	2.35	6.86	4.64	2.07	3.39
T_9	50.95	50.33	44.93	44.13	47.59	2.48	2.52	2.43	2.18	2.40	7.10	5.17	2.38	3.66
T_{10}	55.44	54.21	45.62	44.45	49.93	2.69	2.67	2.54	2.29	2.55	8.98	6.82	2.40	4.55
Mean	43.24	42.78	40.83	40.96		2.23	2.21	2.14	1.91		4.86	3.35	1.64	
	S.E.m±			CD @ 5%		S.E.m±			CD @ 5 %		S.E.m±		CD @ 5 %	
S	0.47			1.61		0.006			0.02		0.05		0.17	
T	0.26			0.74		0.008			0.02		0.04		0.13	
S x T	0.68			1.92		0.015			0.04		0.10		0.28	

T_1: FYM (10 kg) + recommended NPK (50:25:75 g plant^{-1})

T_2: Vermicompost (10 kg) + recommended NPK

T_3: FYM (5 kg) + vermicompost (5 kg) + recommended NPK

T_4: FYM (10 kg) + vermicompost (10 kg) + 50% recommended NPK

T_5: *Azotobacter* (20 g) + FYM (10 kg) + 50% recommended NPK

T_6: *Azotobacter* (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_7: PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_8: PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_9: *Azotobacter* (20 g) + PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_{10}: *Azotobacter* (20 g) + PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

S_1- 2 x 2 m S_2- 3 x 3 m S_3- 6 x 3 m S_4- 6 x 6 m

Table 4: Influence of planting density and integrated nutrient management on number of fruits, fruit yield (kg tree^{-1}) and fruit yield (t ha^{-1}) of guava cv. Lalit

Treatments	Summer (2014)														
	Number of fruits					Fruit yield (kg tree^{-1})					Fruit yield per hectare (t ha^{-1})				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
T_1	90.24	79.62	71.13	58.39	74.85	2.33	2.71	4.00	4.08	3.28	5.83	3.01	2.22	1.13	3.05
T_2	100.86	105.10	79.62	77.50	90.77	3.46	3.50	4.75	5.31	4.25	8.65	3.89	2.64	1.47	4.16
T_3	118.90	100.86	92.36	100.86	103.25	3.45	4.31	5.68	7.16	5.15	8.63	4.79	3.15	1.98	4.64
T_4	132.71	126.34	100.86	105.10	116.25	4.50	4.86	6.81	7.95	6.03	11.24	5.40	3.78	2.20	5.66
T_5	149.69	170.93	110.41	147.57	144.65	5.50	6.15	7.48	11.23	7.59	13.74	6.83	4.15	3.11	6.96
T_6	151.82	185.79	132.71	153.94	156.06	5.61	6.90	9.39	12.10	8.50	14.01	7.67	5.21	3.35	7.56
T_7	149.69	198.53	160.31	162.43	167.74	5.64	7.41	11.98	13.14	9.54	14.10	8.23	6.65	3.64	8.16
T_8	198.53	207.02	192.16	170.93	192.16	7.23	7.78	12.86	14.06	10.48	18.07	8.64	7.14	3.90	9.44
T_9	226.13	236.75	170.93	185.79	204.90	8.74	8.16	13.89	15.68	11.62	21.85	9.07	7.71	4.34	10.74
T_{10}	246.30	251.61	209.15	207.02	228.52	10.85	9.92	15.65	17.34	13.44	27.12	11.02	8.68	4.80	12.91
Mean	131.96	136.95	156.49	166.25		5.73	6.17	9.25	10.81		14.33	6.86	5.13	2.99	
	S.E.m±		CD @ 5 %			S.E.m±		CD @ 5 %			S.E.m±		CD @ 5 %		
S	1.30		4.49			0.16		0.57			0.33		1.15		
T	2.11		5.96			0.12		0.33			0.13		0.35		
S x T	4.21		11.88			0.28		0.78			0.41		1.15		

T_1: FYM (10 kg) + recommended NPK (50:25:75 g plant^{-1})

T_2: Vermicompost (10 kg) + recommended NPK

T_3: FYM (5 kg) + vermicompost (5 kg) + recommended NPK

T_4: FYM (10 kg) + vermicompost (10 kg) + 50% recommended NPK

T_5: *Azotobacter* (20 g) + FYM (10 kg) + 50% recommended NPK

T_6: *Azotobacter* (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_7: PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_8: PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

T_9: *Azotobacter* (20 g) + PSB (20 g) + FYM (10 kg) + 50% recommended NPK

T_{10}: *Azotobacter* (20 g) + PSB (20 g) + vermicompost (10 kg) + 50% recommended NPK

S_1- 2 x 2 m S_2- 3 x 3 m S_3- 6 x 3 m S_4- 6 x 6 m

CONCLUSION

Thus application of organic manures and bio-fertilizers resulted in an overall significant increase in N, P and K nutrients in plants at lesser cost but longer in durability. The combined use of organic manures, bio-fertilizers and chemical fertilizers has been found not only in maintaining higher productivity but also in providing stable crop yields for sustainable crop production through integrated nutrient use.

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