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EFFECT OF ORGANIC AND INORGANIC FERTILIZERS ON QUALITY AND SHELF LIFE OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. SARDAR

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ABSTRACT

The two year data indicates that 25% of N tree^{-1} through FYM + 75% of N tree^{-1} through inorganic fertilizer (T_{10}) was found to be best as compared to other treatments which significantly increased the physico-chemical attributes of guava in both the years where highest fruit length (8.35 & 8.42 cm), breadth (7.92 & 7.95 cm) and fruit weight (240.85 & 247.62 g) were recorded respectively in trees receiving 25% of N tree^{-1} through FYM + 75% of N tree^{-1} through inorganic fertilizer whereas, the chemical attributes viz. TSS (12.92 & 12.97 ^{0}B), total sugars (8.56 & 8.65 per cent) and the minimum physiological loss in weight (14.29 per cent) after 10 days under ambient conditions during both the years were found to be maximum with the application of *Azotobactor* + 50% of N tree^{-1} through FYM + 50% of N tree^{-1} through inorganic fertilizer (T_9) which were at par with the treatment comprising 25% of N tree^{-1} through FYM + 75% of N tree^{-1} through inorganic fertilizers.

INTRODUCTION

Guava (*Psidium guajava* L.) is an economically important commercial fruit crop of tropical and sub-tropical climates. Its cultivation is getting popularity due to increasing international trade, better nutritional contents and processing of its value added products. This is a well known fact that increases in productivity of fruit removes large amounts of essential nutrients from the soil. Without proper management, continous fruit production reduces nutrient reserves in the soil. Another issue of great concern is the sustainability of soil productivity, as land began to be intensively exhausted depletion decreases quality fruit production and soil fertility and leads to soil degradation. On the other hand, continous use of inorganic fertilizers as source of nutrient in imbalanced proportion is also a problem, causing inefficiency, damage to the environment and in certain situations, harms the plants themselves and also to human being who consumes them. (Shanker *et al.,* 2002). Therefore, integrated nutrient management is the most appropriate approach for managing the nutrient input. This calls for moving away from chemical agriculture and embracing organic matter management, which improves all soil properties and brings nitrogen through organic manures. Organic manures like farmyard manure is bulky organic manure, which is a storehouse of major nutrients apart from containing considerable amount of macro and micronutrients, Secondly, the use of organic manures increase the organic matter content of the soil by increasing the water holding capacity.

Biofertilizers on the other hand enrich the soil with beneficial microorganisms; they have the ability to mobilize the nutritionally important elements from non-usable to usable form through biological processes resulting in enhanced production of various fruit crops (Dey *et al*., 2005). In order to meet balanced nutrient supply in guava, integrated nutrient management is the important alternative source, which is not only beneficial to maintain the soil health but also to sustain the fruit production. Keeping this in view the present investigation was carried out to study the impact of organic and inorganic fertilizers on quality and shelf life of guava cv. Sardar.

MATERIALS AND METHODS

The present studies were conducted at Experimental Orchard, Division of Fruit Science, Faculty of Agriculture, Udheywalla, SKUAST-Jammu on fifteen years old guava cv. Sardar during winter season, located in the sub-tropical zone at latitude of 32.43° North and longitude of 74.54° East. The altitude of the place is 300 meters from sea level. The mean annual maximum and minimum temperatures are 29.6° C and 16.7° C, respectively. The winter months experience mild temperature ranging from 6.5° C to 21.7° C. A total of 12 treatments replicated thrice were executed in randomized block design *viz.*, T_1 = 100% of N tree^{-1} through FYM, T_2 = 75% of N tree^{-1} through FYM + 25% of N tree^{-1} through inorganic fertilizer, T_3 = 50% of N tree^{-1} through FYM + 50% of N tree^{-1} through inorganic fertilizer, T_4 = 25% of N tree^{-1} through FYM + 75% of N tree^{-1} through inorganic fertilizer, T_5 = 100% of N/tree through inorganic fertilizer, T_6 = *Azotobacter,* T_7 = *Azotobacter* + T_1, T_8 = *Azotobacter* + T_2, T_9 = *Azotobacter* + T_3, T_{10} = *Azotobacter* + T_4, T_{11} =

Azotobacter + T_5, T_{12} = Absolute Control. Farmyard manure was applied to the trees around the trunk in the first week of July. *Azotobacter* with a uniform dose of 200 g plant^{-1} was mixed in jaggery solution prepared separately for each tree and were fed to roots. The urea was applied in two split doses; viz. first half dose before one month of flowering and the rest after fruit set. Phosphorus (P_2O_5) and potassium (K_2O) were worked out after subtracting the quantity of nutrients supplied by organics, and remaining full quantity was applied through single super phosphate (SSP) and muriate of potash (MOP) in the mid of July. Fertilizers were applied after regulating the crop for winter season crop. Regulation of cropping pattern for winter season crop of guava, 1000 ppm NAA was applied at full bloom stage in the second week of May. Observations on fruit size (length and diameter); fruit weight was based on random five fruit samples. Fruit quality parameters viz., total soluble solids and total sugars (reducing and non reducing sugar) were determined as per standard procedures given by A.O.A.C (1995). The non-reducing sugars were obtained by subtracting reducing sugars from total sugars and multiplying the difference by standard factor 0.95. Ascorbic acid was determined by using 2, 6-dichlorophenol indophenol dye (Ruck, 1969). Pectin was calculated with 'calcium pectate method' as suggested by Rangana (1995). The data generated during the course of study was subjected to statistical analysis as prescribed by Panse and Sukhatme (2000).

RESULTS AND DISCUSSION

Nutrients applied without organic manure were less effective in improving the guava productivity even at higher doses and more effective when applied with organic manure. The data presented in Table 1 on physical characteristics of guava fruit viz., fruit size and fruit weight as recorded at the time of harvest showed significant differences among the treatments where fruit length, diameter and weight (8.42 cm, 7.92 cm and 247.62 g) showed an increased over the previous year fruit length, diameter and weight (8.35 cm, 7.95 cm and 240.85g) respectively with the application of 25% of N tree^{-1} through FYM + 75% of N tree^{-1} through inorganic fertilizers. The increase in average fruit weight due to the integration of organic sources of nutrients occurred due to accelerated mobility of photosynthates from source to sink as influenced by the growth hormones, released or synthesized due to organic sources of nutrients. Similar results were also observed by Bhatia *et al*. (2001).

Persual of the data presented in Table 2 showed that maximum fruit volume (252.70 cc) and pulp weight (217.50 g) were observed with the treatment comprising 25% of N tree^{-1} through FYM + 75% of N tree^{-1} through inorganic fertilizers which has shown an increase over previous season fruit volume (243.31 cc) and pulp weight (210.73 g) while, the same treatment (T_{10}) showed minimum specific gravity (0.98) over previous season (0.99) respectively. The increase in fruit volume was attributed to the corresponding increase in length and diameter and also due to balanced availability of macro and micro-nutrients and growth promoting substances, produced by biofertilizer and organic manures, this may have lead to better metabolic activities in the tree which ultimately lead to high protein and carbohydrate synthesis Similar results are in consonance with Sharma *et al*. (2009).

With regards to chemical composition of fruits, data presented in the Table 3 and 4 showed that highest TSS (12.97° Brix), total sugar and reducing sugars (8.65 and 4.85 per cent) showed an increased trend over the previous season chemical attributes viz. TSS (12.92 ^{0}Brix), total sugars and reducing sugars (8.56 and 4.81 per cent) respectively, with the application of 50% of N tree^{-1} through FYM + 50% of N tree^{-1} through inorganic fertilizers as compared to other treatments which was at par with the treatment comprising 25% of N tree^{-1} through FYM + 75% of N tree^{-1} through inorganic fertilizers. Nitrogen stimulates the functioning of number of enzymes in the physiological processes, which might have improved the total increase in total soluble solid content of the fruits. The highest mean values for total sugars could be attributed to the involvement of nitrogen in various energy sources like amino acids and amino sugars. Improved TSS and sugar contents of guava fruit with the application of biofertilizers and organic manure was also reported by Ram and Rajput (2000) and Dey *et al*. (2005).

The data recorded in both years of study presented in Table 5 showed that ascorbic acid content of guava fruit during the first year of study revealed that the highest ascorbic acid content (212.12 mg per 100g of pulp) was recorded in fruits harvested from trees receiving cent per cent nitrogen as FYM augmented

Table 1: Effect of FYM, urea and *Azotobacter* on fruit size and fruit weight of guava cv. Sardar

Treatment	Fruit size						Fruit weight (g)		
	Length (cm)			Diameter (cm)					
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
T_1	7.71	7.74	7.73	7.43	7.44	7.44	154.12	153.18	153.65
T_2	7.79	7.81	7.80	7.46	7.48	7.47	155.45	157.87	156.66
T_3	7.95	7.98	7.97	7.59	7.61	7.60	171.94	181.25	176.60
T_4	8.12	8.19	8.16	7.71	7.72	7.72	184.86	191.93	188.40
T_5	7.85	7.88	7.87	7.51	7.53	7.52	168.17	173.65	170.91
T_6	7.57	7.55	7.56	7.21	7.19	7.20	138.16	137.76	137.96
T_7	7.78	7.81	7.80	7.48	7.49	7.49	167.84	170.25	169.05
T_8	7.98	7.97	7.98	7.63	7.64	7.64	184.19	189.86	187.06
T_9	8.24	8.29	8.27	7.79	7.81	7.80	196.18	198.62	197.40
T_{10}	8.35	8.42	8.39	7.92	7.95	7.94	240.85	247.62	244.24
T_{11}	8.31	8.33	8.32	7.85	7.87	7.86	236.15	241.85	239.00
T_{12}	7.35	7.33	7.34	7.15	7.14	7.15	128.42	127.92	128.17
CD (5%)	0.15	0.21	0.13	0.19	0.15	0.12	1.83	2.03	1.33

Table 2: Effect of FYM, urea and *Azotobacter* on volume, pulp weight and specific gravity of guava cv. Sardar

Treatment	Fruit volume (cc)			Pulp weight (g)			Specific gravity		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
T_1	152.60	151.66	152.13	121.45	120.51	120.98	1.01	1.01	1.01
T_2	153.91	156.33	155.12	122.88	125.30	124.09	1.01	1.01	1.01
T_3	171.95	181.28	176.61	139.59	148.90	144.25	1.00	1.00	1.00
T_4	184.89	191.94	188.41	152.87	159.94	156.41	1.00	1.00	1.00
T_5	166.52	171.94	169.23	136.12	141.60	138.86	1.01	1.01	1.01
T_6	136.79	136.40	136.60	105.45	105.05	105.25	1.01	1.01	1.01
T_7	166.19	168.58	167.38	135.38	137.79	136.59	1.01	1.01	1.01
T_8	184.20	189.87	187.04	151.77	157.44	154.61	1.00	1.00	1.00
T_9	196.19	198.63	197.41	164.21	166.65	165.43	1.00	1.00	1.00
T_{10}	243.31	252.70	248.00	210.73	217.50	214.12	0.99	0.98	0.99
T_{11}	236.18	244.30	240.23	204.20	209.90	207.05	1.00	0.99	1.00
T_{12}	125.90	125.41	125.66	95.57	95.07	95.32	1.02	1.02	1.02
CD (5%)	3.97	3.82	2.68	1.83	2.02	1.87	0.02	0.02	0.01

Table 3: Effect of FYM, urea and *Azotobacter* on TSS, titratable acidity and TSS/acid ratio of guava cv. Sardar

Treatment	TSS (°Brix)			Titratable acidity (%)			TSS/Acid ratio		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
T_1	11.93	11.85	11.89	0.45	0.44	0.45	26.65	27.16	26.91
T_2	12.42	12.44	12.43	0.47	0.46	0.47	24.46	27.12	26.79
T_3	12.59	12.64	12.62	0.49	0.49	0.49	25.76	25.80	25.78
T_4	12.47	12.51	12.49	0.49	0.49	0.49	25.51	25.64	25.58
T_5	12.34	12.35	12.35	0.52	0.53	0.53	23.75	23.35	23.55
T_6	11.75	11.71	11.73	0.50	0.51	0.51	23.56	23.01	23.28
T_7	12.11	12.13	12.12	0.48	0.48	0.48	25.35	25.30	25.32
T_8	12.65	12.68	12.67	0.48	0.48	0.48	26.43	26.61	26.52
T_9	12.92	12.97	12.95	0.50	0.51	0.51	25.87	25.45	25.66
T_{10}	12.84	12.88	12.86	0.50	0.51	0.51	25.79	25.79	25.72
T_{11}	12.69	12.71	12.70	0.53	0.54	0.54	23.97	23.62	23.79
T_{12}	11.62	11.54	11.58	0.51	0.51	0.51	22.81	22.65	22.73
CD (5%)	0.03	0.04	0.03	N.S	N.S	N.S	N.S	N.S	N.S

Table 4: Effect of FYM, urea and *Azotobacter* on total sugars, reducing sugars and non-reducing sugars of guava cv. Sardar

Treatment	Total sugars (%)			Reducing sugars (%)			Non-reducing sugars (%)		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
T_1	7.59	7.59	7.59	4.45	4.46	4.46	2.98	2.97	2.98
T_2	7.74	7.76	7.75	4.49	4.51	4.50	3.09	3.09	3.08
T_3	8.04	8.11	8.08	4.63	4.68	4.66	3.24	3.26	3.25
T_4	7.87	7.92	7.90	4.59	4.62	4.61	3.11	3.14	3.13
T_5	7.76	7.76	7.76	4.53	4.52	4.53	3.07	3.08	3.07
T_6	7.41	7.43	7.42	4.32	4.31	4.32	2.94	2.61	2.77
T_7	7.64	7.65	7.65	4.48	4.55	4.52	3.00	2.95	2.97
T_8	8.19	8.21	8.20	4.72	4.73	4.73	3.30	3.31	3.30
T_9	8.56	8.65	8.61	4.81	4.85	4.83	3.56	3.61	3.58
T_{10}	8.51	8.59	8.55	4.79	4.82	4.81	3.53	3.58	3.56
T_{11}	8.23	8.24	8.24	4.75	4.74	4.75	3.31	3.32	3.31
T_{12}	7.24	6.95	7.10	4.24	4.21	4.23	2.85	2.60	2.73
CD (5%)	0.10	0.11	0.10	0.03	0.04	0.02	0.09	0.11	0.07

with *Azotobacter* (T_7) as compared to other treatments whereas, in the second year, all the treatment combinations showed the lower amount of ascorbic acid content except T_7 and T_8 where highest ascorbic acid 212.56 mg per 100g of pulp (T_7) was recorded with cent per cent of nitrogen from FYM augmented with *Azotobacter* while, pectin content of guava fruit was found to be highest (0.82 per cent) over the first year of studies where pectin content (0.79 per cent) was recorded in the trees receiving 25 per cent of nitrogen through FYM + 75 per cent of nitrogen through urea augmented with *Azotobacte*r. The highest ascorbic acid may be due to catalytic activity of several enzymes, which participate in the biosynthesis of ascorbic acid. These findings are in consonance with Yadav *et al*. (2012).

The data pertaining to physiological weight loss of guava fruits after 2, 4, 6 and 10 days as affected by different treatments tried has been presented in table 6, showed significant differences among all the treatments. From the perusal of the data, post harvest life of the fruits showed that the shelf life of guava fruit was observed maximum (10 days) with the treatment comprising 50 per cent nitrogen as FYM + 50 per cent nitrogen as urea augmented with *Azotobacter* (T_9) . The minimum weight loss in the both the years 2006-07 and 2007-08 after two (1.56 and 1.49 per cent), four (3.56 and 3.54 per cent), six

Table 5: Effect of FYM, urea and *Azotobacter* on ascorbic acid, pectin and pH of guava cv. Sardar

Treatment	Ascorbic acid(mg/100g of pulp)			Pectin (%)			pH		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
T_1	209.86	208.56	209.21	0.61	0.60	0.61	4.8	4.8	4.8
T_2	209.16	207.23	208.20	0.62	0.62	0.62	4.8	4.8	4.8
T_3	205.12	204.76	205.34	0.66	0.68	0.67	4.7	4.7	4.7
T_4	204.34	202.28	203.31	0.69	0.72	0.71	4.7	4.7	4.7
T_5	195.63	193.93	194.78	0.65	0.66	0.66	4.7	4.7	4.7
T_6	191.11	190.96	191.04	0.57	0.56	0.57	4.7	4.7	4.7
T_7	212.12	212.56	212.34	0.62	0.62	0.62	4.8	4.8	4.8
T_8	211.96	212.13	212.05	0.68	0.69	0.69	4.8	4.8	4.8
T_9	208.12	206.18	207.15	0.72	0.75	0.74	4.8	4.8	4.8
T_{10}	207.11	205.12	206.12	0.79	0.82	0.81	4.8	4.8	4.8
T_{11}	198.82	198.91	198.87	0.77	0.79	0.78	4.7	4.7	4.7
T_{12}	185.93	183.94	184.94	0.51	0.48	0.50	4.7	4.7	4.7
CD (5%)	1.97	2.19	1.43	0.04	0.06	0.04	N.S	N.S	N.S

Table 6: Effect of FYM, urea and *Azotobacter* on per cent physiological loss in weight of guava cv. Sardar under ambient conditions

Treatment	After 2 days			After 4 days			After 6 days			After 8 days			After 10 days		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
T_1	1.92	1.89	1.91	7.16	7.15	7.15	13.36	13.34	13.35	18.56	18.53	18.55	23.64	23.56	23.60
T_2	1.84	1.81	1.83	4.35	4.34	4.35	8.92	8.91	8.92	15.14	15.11	15.13	20.76	20.66	20.71
T_3	1.71	1.67	1.69	4.12	4.10	4.11	8.25	8.41	8.33	14.45	14.35	14.40	19.56	19.34	19.45
T_4	1.73	1.68	1.71	4.16	4.15	4.15	8.63	8.59	8.61	14.68	14.58	14.63	19.78	19.66	19.72
T_5	1.81	1.78	1.80	4.23	4.22	4.23	8.76	8.74	8.75	14.96	14.94	14.95	19.84	19.82	19.83
T_6	2.08	2.06	2.07	7.45	7.44	7.45	13.68	13.71	13.70	18.87	18.89	18.88	24.13	23.97	24.05
T_7	1.88	1.85	1.87	6.92	6.91	6.92	13.45	13.43	13.44	18.36	18.33	18.35	20.76	20.68	20.72
T_8	1.68	1.65	1.67	3.96	3.95	3.96	6.11	6.08	6.10	10.18	9.85	10.02	15.78	15.38	15.58
T_9	1.56	1.49	1.53	3.56	3.54	3.55	5.65	5.61	5.63	9.35	9.25	9.30	14.35	14.23	14.29
T_{10}	1.59	1.52	1.56	3.68	3.66	3.67	5.85	5.81	5.83	9.78	9.68	9.73	14.74	14.66	14.70
T_{11}	1.63	1.58	1.61	3.87	3.86	3.87	5.88	5.86	5.87	10.12	10.11	10.12	15.44	15.41	15.43
T_{12}	2.15	2.18	2.17	7.45	7.47	7.46	14.11	14.17	14.14	19.46	19.48	19.47	24.76	24.81	24.79
S.Em. (±)	0.17	0.13	0.15	1.10	0.88	1.00	1.47	1.45	1.46	1.70	2.21	1.97	2.58	2.54	2.42
CD (5%)	0.35	0.27	0.21	2.28	1.82	1.42	3.04	3.01	2.08	3.52	4.58	2.81	5.36	4.67	4.88

(5.65 and 5.61 per cent), after eight (9.35 and 9.25 per cent) and after ten (14.35 and 14.23 per cent) days, respectively, was observed with the trees receiving 50 per cent nitrogen supplemented through FYM and rest of nitrogen through urea augmented with *Azotobacter* (T_9). It was observed that T_{10} was statistically at par with T_9. Similar findings were reported by Krishna and Krishnappa (2002), who reported that the use of inorganic fertilizer in which 25 per cent nitrogen substituted through FYM registered the minimum physiological loss in weight. This may be due to altered physiology and biochemistry of the fruit as influenced by both organic and inorganic fertilizers that reduced respiration and transpiration which inturn resulted in low cumulative physiological loss in weight and increased shelf life. In conclusion, our result showed that 25 per cent nitrogen in the form of FYM integrated with urea augmented with *Azotobacter* played a vital role in increasing physico-chemical attributes and shelf life of guava cv. Sardar.

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