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COMPARATIVE SUTDY OF ORGANIC AND INTEGARATED NUTRIENT MANAGEMENT SYSTEM ON YIELD ATTRUIBUTES AND QUALITY OF PAPAYA UNDER SOUTH GUJARAT CONDITION

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ABSTRACT
A field experiment was conducted at Organic Farm, F-block, NAU, Navsari in FRBD with three replications during 2009-10 and 2010-11 along with one control outside the organic farm. Pool data showed that yield attributes like number of fruits per plant (22.33), average fruit weight (0.956 kg), fruit yield per plant (21.68 kg) and fruit yield (68.83 t/ha) were significantly highest in treatment O_4 which was at par with treatment O_3. However, application of banana pseudostem sap (S_1) was significantly superior over no application of sap (S_0) for yield attributes. Similarly, quality parameters of papaya fruit like shelf life, TSS, acidity, ascorbic acid, reducing as well as total sugar were significantly affected due to application of different proportion of organics as well as pseudostem sap. However, mean of INM was significantly superior over mean of organic treatments in yield attributes except quality parameters.

INTRODUCTION

Papaya (*Carica papaya Linn*.) is native to tropical America. It belongs to the family *Caricaceae* and is believed to have originated in Southern Mexico. Papaya is one of the important fruit crop of India. It gives higher production of fruits per hectare and have an income next to banana (Singh, 1990). The excess use of inorganic fertilizer and other chemicals leading to environmental pollution, residual effects and higher pest infestation. Sustainable farming depends upon the successful management of available resources in agricultural production. Organic farming is recognized as the best known alternative to the conventional agriculture. The number of studies conducted on organic farming indicated that the quality of agriculture produce is better than inorganically grown produce. Based on the global survey on organic farming carried out in 2007/2008 (Willer, 2008) by the Research Institute of Organic Agriculture (FiBL, BioFach, Germany), organic agriculture is now followed in more than 130 countries with a total area of 30.4 million hectares in 0.7 million number of organic farms. Asia, Latin America and Australasia are important producers and exporters of organic foods (Sahota, 2008). In India, about 528,171 hectare area is under organic farming (this includes certified and area under organic conversion) with 44,926 number of certified organic farms. This accounts for about 0.3 per cent of total agricultural land. Indian organic farming industry is estimated at US$ 78 million and is almost entirely export oriented. According to Agricultural and Processed Food Products Export Development Authority (APEDA), a nodal agency involved in promoting Indian organic agriculture, about 585,970 tonnes of organic products worth of Rs. 301 million are being exported from India. Growing awareness, increasing market demand, increasing inclination of farmers to go organic and growing institutional support have resulted in more than 200 per cent growth in certified area during the last two years (Ramesh *et al*., 2010). The work done in India is predominately related to INM and very scanty literature is available on nutrient management in pure organic farming. Scrutinizing literature available on organic farming showed that in general people are using single bulky source of organic manure (Reddy *et al*., 2010). The papaya was used as test crop because of its multifarious uses and high nutritive values. For this purpose, three organics were selected, (I) Bio compost: it is available in ample quantity in South Gujarat as a by-product of sugar industry which is concentrated in South Gujarat. Further, it is the rich source of C, Mn, S, N along with some bioinoculants, (II) Banana pseudostem based vermi compost (VC): this is a byproduct obtained during the process of fibre extraction from banana pseudostem. This is rich source of Fe and K along with some growth promoting substance (Anon., 2011) and (III) castor cake(CC): it is also liberally available in Gujarat as it is one of the major crops of Gujarat. It was taken as concentrate organic manure. Due to the organic farming not only the

quality of agriculture produce is improved but the health of soil is also sustained rather improved in comparison to conventional farming. Therefore the study was planned to assess the effect of different proportion of organics with and without sap on yield and quality of papaya grown on organic farm. Papaya crop being heavy feeder and the fruit are harvested fresh, the nutrient requirement of this crop is also very high. Information regarding these aspect is very scanty under South Gujarat and more so under organic farming situation. Hence, present study was planned to assess the effect of different proportion of organics with and without sap on yield and quality of papaya grown on organic farm.

MATERIALS AND METHODS

A field experiment consisting of eight treatment combinations involving different proportion of three organics on N equivalent basis [O_1: 50 % RDN through bio compost (BC) + 50 % RDN through castor cake (CC), O_2: 50 % RDN through bio compost + 50 % RDN through vermi compost (VC), O_3: 50 % RDN through bio compost + 25 % RDN through vermi compost + 25 % through castor cake and O_4: 33.3 % RDN through bio compost + 33.3 % RDN through vermi compost + 33.4 % RDN through castor cake] and two levels of banana pseudostem sap application (S_0: without sap and S_1: with sap @ 8 l/plant) along with one INM controls outside the organic farm were conducted in FRBD with three replications at Organic Farm, F-block, NAU, Navsari during 2009-10 and 2010-11.On the basis of maturity indices, the mature fruits per plant were harvested and mean number of fruits per plant were calculated after all picking. Mature fruits having yellow colored strips were harvested from each plant of net plot and weighed separately. Total weight of fruits of all pickings was considered as fruit yield and was divided by number of tagged plants. The data of yield per net plot was recorded and multiplied by multiple factor computed on area basis to give the final data for total yield in tonnes per hectare. The shelf-life of fruit was noted by keeping two fruits from each treatment at room temperature from third and fourth picking. The shelf-life of fruits was recorded as the day taken from harvesting to optimum rippening stage. The total soluble solids (TSS) of the ripped fruit pulp extract were determined using a hand refractometer (Erma Japan) having a scale in the range of 0 -32. The methods describe by Ranganna (1979) was adopted for estimation of acidity, ascorbic acid and reducing sugar of papaya fruit.

RESULTS AND DISCUSSION

Yield and Yield attributes

The number of fruits per plant, average fruit weight, fruit yield per plant and fruit yield was recorded at harvest and the results are reported in table 1. The results indicated that only the effect of organics treatment was significant on yield attributes and yield. Among the organics treatments, treatment O_4 recorded significantly highest number of fruits per plant, average fruit weight, fruit yield per plant and fruit yield with values of 22.33, 0.956 kg, 21.68 kg and 68.83 kg, respectively over O_1 and O_2 and at par with O_3. Similar variation in papaya fruit yield due to different sources of organics viz., FYM, urban compost, rural compost, sun hemp green manure and Vermi compost have also been reported by Reddy *et al*. (2010). Similar beneficial effect of application of reduced dose of chemical fertilizers along with combination of two or three organic manures was found by Damse *et al*. (2014) for garlic in rabi season.An increase observed in yield parameters of papaya with INM control over organics treatments mean could be attributed to the fact that under INM system combination of inorganic, organic and biological sources are involved. Combined application of these sources results in improved soil physical, chemical and biological properties of soil in comparison to inorganic sources alone.Application of sap was significantly highest in number of fruits per plant (22.10), fruit yield per plant (20.21 kg) and fruit yield (64.13 t/ha) over no application of sap (S0). Apart from essential plant nutrients, pseudostem sap also contains the growth promoting substances like cytokinin, GA3 etc., which might have exerted beneficial effects on plant growth and ultimately reflected on the yield of papaya. Similar beneficial effect of sap application on yields of banana (3 l/plant), sugarcane (5000 l/ha) and onion (1500 l/ha) have also been observed with INM system under South Gujarat conditions (Anon., 2012).

In control v/s rest analysis, INM control significantly superior over mean of organic treatments. The result indicate that INM control recorded the number of fruit per plant, average fruit

Table 1: Effect of different treatments on number of fruits per plant, average fruit weight, fruit yield per plant and fruit yield of papaya

Treatments	Number of fruits per plant		Average fruit weight (Kg)		Fruit yield per plant (Kg)		Fruit yield (t/ha)	
O_1	20.26		0.813		16.47		52.26	
O_2	21.04		0.86		18.12		57.5	
O_3	21.96		0.933		20.47		64.97	
O_4	22.33		0.956		21.68		68.83	
S_0	20.69		0.875		18.16		57.65	
S_1	22.1		0.906		20.21		64.13	
Mean of Organic	21.4		0.89		19.18		60.89	
Mean of Control	23.35		1.08		25.23		80.07	
Source	SEm±	CD at 5%	SEm±	CD at 5%	SEm±	CD at 5%	SEm±	CD at 5%
O	0.26	0.75	0.016	0.047	0.22	0.64	0.99	2.86
S	0.37	1.06	0.011	NS	0.31	0.9	0.7	2.02
O x S	0.52	NS	0.023	NS	0.44	NS	1.4	NS
Cont. v/s rest	0.35	1.01	0.015	0.045	0.31	0.89	0.98	2.82
CV %	6		6		6		6	

Table 2: Effect of different treatments on shelf life, TSS and acidity of papaya fruit

Treatments	Shelf life (Days)		TSS (°Brix)		Acidity (%)	
O_1	6.31		6.87		0.023	
O_2	6.30		7.07		0.026	
O_3	6.63		7.15		0.027	
O_4	6.91		7.22		0.024	
S_0	6.33		6.92		0.030	
S_1	6.74		7.23		0.020	
Mean of Organic	6.53		7.08		0.025	
Mean of Control	5.43		6.45		0.036	
Source	SEm±	CD at 5%	SEm±	CD at 5%	SEm±	CD at 5%
O	0.11	0.31	0.10	NS	0.001	0.003
S	0.07	0.22	0.07	0.21	0.001	0.002
O x S	0.15	NS	0.15	NS	0.001	NS
Cont. v/s rest	0.10	0.29	0.10	0.30	0.001	0.003
CV %	6	5	13			

Table 3: Effect of different treatments on ascorbic acid, reducing and total sugar of papaya fruit

Treatments	Ascorbic acid (mg/100g)		Reducing sugar(%)		Non reducing sugar(%)	
O_1	21.50		5.23		6.78	
O_2	21.74		5.30		6.87	
O_3	21.92		5.58		7.16	
O_4	23.10		5.71		7.41	
S_0	21.08		5.31		6.87	
S_1	23.04		5.59		7.24	
Mean of Organic	22.06		5.45		7.06	
Mean of Control	19.65		4.95		6.23	
Source	SEm±	CD at 5%	SEm±	CD at 5%	SEm±	CD at 5%
O	0.40	1.15	0.08	0.23	0.11	0.31
S	0.28	0.81	0.06	0.16	0.08	0.22
O x S	0.56	NS	0.11	NS	0.15	NS
Cont. v/s rest	0.42	1.21	0.08	0.22	0.10	0.30
CV %	6	5	5			

weight, fruit yield per plant and fruit yield values of 23.35, 1.080, 25.23 and 80.07 , respectively which was significantly more than means of organics treatments. The work related to organic nutrient management done by Reddy *et al*. (2010) on red loam soil (pH 6.12, Organic carbon 0.73%) of IIHR, Bangalore using papaya (cv. Surya) also reported about 30 per cent reduction in fruit yield with treatments receiving nutrients only through organic sources (20 kg sun hemp + 150 g rock phosphate per plant per year) over treatment wherein recommended doses of fertilizers were applied. However, from the data base generated through survey related to status of organic farming in India, Ramesh *et al*. (2010) have also reported that on an average the crop yield is decreased by 9.2 per cent. An increase observed in yield parameters of papaya with INM control over organics treatments mean could be attributed to the fact that under INM system combination of inorganic, organic and biological sources are involved. Combined application of these sources results in improved soil physical, chemical and biological properties of soil in comparison to inorganic sources alone. Similar results were also found by Kumar *et al*. (2011) by the study of effect of organic and inorganic sources of nutrient on yield, yield attributes and nutrient uptake of rice cv. prh-10.

Quality parameters

The shelf life, titratable acidity, ascorbic acid, reducing as well as total sugar significantly affected due to application of different organics (Table 2 and 3). The result indicated that the shelf life, ascorbic acid, reducing as well as total sugar of papaya fruit significantly higher in O_4 treatment with a tune value of 6.91, 23.10 (mg/100g), 5.71 and 7.41(%), respectively over O_2 and O_1, however, it was at par with O_3 (Table 2). Similarly, application of banana pseudostem sap could also enhance the shelf life (6.74 days), TSS (7.23 ^{0}brix), ascorbic acid (23.04 mg/100g), reducing as well as total sugar (5.59 and 7.24 %, respectively) of papaya fruit significantly in comparison to its no application. In case of acidity, it was significantly highest in O_3 (0.027%) and S_0 (0.030 %) over rest of the organic treatments. Between the two nutrient management systems, organic nutrient management showed superiority over INM by recording significantly higher values of shelf life, TSS, ascorbic acid, total sugar and reducing sugar. Contrarily to this, titratable acidity was higher with INM as compared to organics mean. The magnitude of increase in shelf life, TSS, ascorbic acid, total sugar and reducing sugar with organics was 16, 9, 11, 12 and 9 per cent over INM system. Similarly improvement in quality parameters of papaya with organic nutrient management has also been reported by *Ravishanker et al.,* 2010b and Singh *et al.,* 2010**.**

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