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Short communication

Influence of organic practices on growth and fruit yield in papaya cv. Surya

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ABSTRACT

A field trial on organic practices in papaya cv. Surya was conducted during 2009-2011 with 10 nutrient combinations involving farm yard manure, biofertilizers and VAM along with 100% recommended dose of fertilizers and no manure/ fertilizer treatment. Vegetative parameters were recorded periodically. At 18 months after planting, plant height, plant girth and number of leaves were found to be significant. Results indicated that, crop growth was better with organic treatments compared to no manure/fertilizer treatment. Fruit yield and quality parameters were also recorded. Fruit yield and average fruit weight were found to be significant. Maximum fruit yield of 32kg/plant (80 t/ ha) was recorded under 75% recommended dose of fertilizer applied as farm yard manure+vermicompost, which was significantly superior to that in 100% recommended dose of fertilizer for the 18-month cropping period.

Key words: Papaya, organic practices, fruit yield

Organic farming is becoming increasingly popular, with a rapidly growing global demand for organic products. These offer considerable benefits over the conventional farming systems, particularly, with respect to sustainable yield, better quality and hazard-free produce. Organic practices, in the long run, improve organic carbon content and, thereby, sustainable yields in addition to improvement in quality. Shiva Kumar *et al* (2012) reported papaya yield to increase by 10.2% in organic practices, compared to that under 100% recommended dose of fertilizers. Organic farming has been an outcome of the concerns over increasing contamination of food and consequent negative effects on human health. In general, excess use of fertilizers causes environmental hazards with deleterious effects on soil structure, soil microflora and quality of water besides crop productivity in the long run (Anon., 1995). Fruits, often eaten raw, are more vulnerable to contamination with chemicals due to their residual toxicity compared to cereals and pulses. Thus, organic production of fruits is becoming particularly popular. However, in India, data on the exact area of fruit crops under organic cultivation is not available. Papaya farming has attained great popularity owing to the quick returns, easy cultivation, adaptability to adverse soil and climatic conditions and above all, delicious taste of its wholesome fruit having multifarious uses. India ranks fourth among papaya producing countries of the world by growing the fruit crop in an area of 1.06 lakh hectares, with production of 41.96 lakh tons (National Horticultural Board, 2011). Nutritional requirement of the papaya plant is typical bacause of a continuous growth behavior like vegetative, flowering and fruiting habit. Papaya demands nutrients continuously and in large amounts. Use of chemical fertilizers alone is not feasible besides being costly to poor farmers. Since, papaya bears fruits and flowers round the year, organic production of papaya plays an important role. Papaya also responds well to such production systems compared to other perennial fruit crops. Being shallow rooted, papaya readily benefits from organic amendment and soil microflora which play a major role in growth, and productivity and soil health. Although use of insecticides and fungicides is relatively low in papaya, nutrition management is important in this crop due to its continuous growth and fruiting. In almost all the states of India, area under papaya is increasing while limited information is available on organic production. Therefore, the present investigation assumes importance for adequately marketing of organic papaya.

A field trial was conducted during 2009-2011 at the experimental farm of Indian Institute of Horticultural Research, Bangalore, located at a latitude of 13^0-58'N and longitude of 78^oE. The trial was laid out in land kept fallow for three years. There were 12 treatments as follows: T_1–100% recommended dose of fertilizers applied as farm

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yard manure+Vermicompost, T_2–75% recommended dose of fertilizers applied as farm yard manure+Vermicompost, T_3–50% recommended dose of fertilizers applied as farm yard manure+Vermicompost, T_4–100% recommended dose of fertilizers applied as farm yard manure+Vermicompost +*Azospirillum*+Mycorrhiza, T_5–100% recommended dose of fertilizers applied as farm yard manure+Vermicompost +*Azospirillum*+Phosphate Solubalizing Bacteria, T_6–75% recommended dose of fertilizers applied as farm yard manure+Vermicompost+*Azospirillum*+Mycorrhiza, T_7-75% recommended dose of fertilizers applied as farm yard manure+Vermicompost+*Azospirillum*+Phosphate Solubalizing Bacteria, T_8–50% recommended dose of fertilizers applied as farm yard manure+Vermicompost+ *Azospirillum*+Mycorrhiza, T_9-50% recommended dose of fertilizer applied as farm yard manure+Vermicompost+ *Azospirillum*+Phosphate Solubalizing Bacteria+Mycorrhiza, T_{10}-100% recommended dose of fertilizers, T_{11}-50% recommended dose of fertilizer applied as farmyard manure+*Azospirillum*+Phosphate Solubalizing Bacteria+ Mycorrhiza+Vermicompost and T_{12}-No manure/ fertilizer. The 100% RDF is 250g N+ 250g P_2O_5 and 500g K_2O/ plant/ year. Plants were spaced at 2m×2m with a planting density of 2500/ha. Vermicompost was applied at the rate of 2kg/ plant/year in all the treatments before planting and again after one year (except in no manure/fertilizer and 100% recommended dose of fertilizers treatments). Vermicompost contained 1.41% N, 0.299% P and 1.55% K. The trial was laid out in Randomized Block Design, with four replications. There were six plants/treatment and the plants were under drip irrigation. The soil (red loam) had available N 100.5 kg/ ha, P_2O_5 36.8 kg/ha, K_2O 205 kg/ha, at pH 6.8. Biofertilizers, viz., *Azospirullum*, Mycorrhiza and Phosphate Solubalizing Bacteria were applied at the rate of 50g/plant/year before planting and again, after one year. The fertilizers were applied four times a year for the treatment 100% recommended dose of fertilizers. Nutrient content of organic manures used in this experiment was: FYM with N 0.91%, P 0.166% and K 0.88%, and, Vermicompost had N 1.41%, P 0.299% and K 0.55%. Vegetative parameters were recorded at six monthly intervals. Data in this study pertains to 18 months after planting. Fruit yield was recorded in different pickings of six plants/plot, and the mean fruit yield was calculated.

Vegetative parameters

Different vegetative parameters such as plant height, plant girth and number of leaves after 18 months of planting were influenced by various nutrient treatments (Table 1).

Table 1. Vegetative parameters in papaya cv. Surya as influenced by various organic treatments

Treatment	Plant height (m)	Plant girth (cm)	No. of leaves /plant
T_1-100% RDF FYM + Vermicompost	3.53	51.0	45.0
T_2 -75% RDF FYM + Vermicompost	3.38	53.7	49.9
T_3 -50% RDF FYM + Vermicompost	3.54	54.5	43.5
T_4 - T_1+AZO+Myco	3.15	54.1	43.0
T_5 - T_1+AZO+PSB	3.20	49.5	39.8
T_6 -T_2+AZO+Myco	3.13	52.3	32.9
T_7 -T_{2+} AZO+PSB	3.15	52.9	31.5
T_8-T_3+AZO+Myco	3.22	50.3	30.9
T_9-T_3+AZO+PSB+Myco	3.47	45.9	26.6
T_{10}-100% RDF	3.42	48.7	26.8
T_{11}-50% RDF applied as FYM+ AZO+ PSB+ Myco + Vermicompost	3.51	52.1	49.0
T_{12}- No manure/fertilizer	3.00	42.3	24.4
S.Em.±	0.14	2.1	2.5
CD *(P=0.05)*	0.41	6.2	7.4

*Significant at 5% level; AZO= Azospirillum sps.; Myco= Mycorrhiza; PSB = Phosphate Sobubilizing Bacteria

Maximum plant height, plant girth and number of leaves was recorded in treatment T_3 (50% Recommended dose of fertilizers applied as FYM), whereas (T-$_{12}$: no manure or fertilizer treatment) recorded minimum values for these parameters. Shivakumar *et al* (2012), Ravishankar *et al* (2008), Jaizma Vega *et al* (2006) and Pire and Aceveda (2005) also reported increased growth in organic amendment treatments which was attributed to enhanced physical, chemical and biological characters of soil, creating a favorable environment for development, would have which resulted in better plant growth. Shardakhade and Rodrigues (2009) reported that, in papaya cv. Surya, inoculation with *Arbuscular Mycorrhizal* fungi significantly increased all the growth parameters viz., plant height, stem girth, leaf area and root length.

Fruit yield

Fruit yield was found to be significantly influenced by different treatments (Table 2). Maximum fruit yield (31.9kg/plant and 79.7t/ha) was recorded in treatment T_6 (75% RDF applied as FYM+Vermicompost+ *Azospirillum*+Mycorrhiza), and the least was recorded in T-$_{12}$: no manure/fertilizer treatment. All organic amendment treatments along with 100% RDF increased fruit yield compared to no manure/ fertilizer treatment. This can be attributed to better plant growth in organic treatment amendments. This treatment also induced better plant

Table 2. Fruit yield as influenced by various organic treatments in papaya cv. Surya

Treatment	No. of fruits/plant	Fruit yield (kg/plant)	Fruit yield (t/ha)
T_1-100% RDF FYM + Vermicompost	60.9	22.2	55.5
T_2 -75% RDF FYM + Vermicompost	68.3	23.0	57.5
T_3 -50% RDF FYM + Vermicompost	64.4	21.5	53.7
T_4 - T_1+AZO+Myco	59.3	18.9	47.2
T_5 - T_1+AZO+PSB	53.5	18.4	46.0
T_6 -T_2+AZO+Myco	68.4	31.9	79.7
T_7 -T_{2+} AZO+PSB	64.5	24.1	60.2
T_8-T_3+AZO+Myco	65.6	21.8	54.5
T_9-T_3+AZO+PSB+Myco	62.3	20.0	50.0
T_{10}-100% RDF	53.7	18.7	46.7
T_{11}-50% RDF applied as FYM+AZO+PSB+Myco+ Vermicompost	51.3	18.3	45.7
T_{12}- No manure/fertilizer	49.2	13.6	34.0
S.Em.±	11.1	3.0	8.1
CD *(P=0.05)*	NS	9.1	24.2

*Significant at 5% level; NS- Non-significant; AZO= Azospirillum sps.; Myco= Mycorrhiza; PSB = Phosphate Sobubilizing Bacteria

growth in terms of plant height and plant girth with resultant increase in fruit yield, thereby being significantly superior to 100% RDF. Similar results were reported by Ravishankar *et al* (2008) and Shivakumar *et al* (2012) in papaya cvs. Coorg Honey Dew and Surya respectively.

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