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Short communication

Effect of organic practices on fruit quality in papaya cv. Surya

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ABSTRACT

A field experiment was conducted during 2009-10 at Indian Institute of Horticultural Research, Bangalore using papaya cv. 'Surya'. Ten organic nutrient treatments along with recommended dose of fertilizers and control (no manure/fertilizer) were used totaling twelve treatment combinations of FYM, biofertilizers and vermicompost. Fruit quality parameters such as total carotenoids, lycopene, TSS, average fruit weight and ascorbic acid content were analyzed. Among the treatments, application of 50% recommended dose of fertilizers in the form of farm yard manure (FYM) applied as *Azospirillum*+Phosphate solubilizing bacteria+Mycorrhiza+Vermicompost showed high level of carotenoids, lycopene and low levels of ascorbic acid. TSS and average fruit weight were not affected by various organic nutrient treatments.

Key words: Papaya, organic, cv. Surya, quality parameters, FYM, biofertilizers, vermicompost

Papaya is native to Central America and is grown in tropical and warmer subtropical areas worldwide. This popular tropical fruit was reputedly called "fruit of the angels". Organic farming is becoming increasingly popular, with a rapidly growing global demand for organic products. It offers considerable benefits over conventional farming system, particularly, with respect to sustainable yield, better quality and hazard-free produce. In fact, organic farming has been the outcome of concerns relating to increased contamination of food and consequent negative effects on human health. Organic production system emphasizes use of cultural, mechanical and biological management practices, instead of external inputs such as synthetic pesticides or fertilizers. Production is based on management practices for site-specific conditions that enhance ecological balance of a natural system.

In India, area under papaya is increasing and, limited information is available on the effect of organic production systems on fruit quality parameters especially, antioxidants and ascorbic acid content. Organic practices are important in crops like papaya that are short in duration and bear fruits continuously. Papaya is a good source of ascorbic acid too with its content ranging from 60 to100mg/ 100g compared to guava juice (a watery extract of cooked guavas) ranging from 60 to 90mg/100ml (Hartzler, 1945).

Carotenoids being the main group of coloring substances in nature are responsible for red, orange and yellow colors in fruits and vegetables. This has attracted many researches as carotenoids possess commercially important properties such as a natural origin, nil toxicity and high versatility, providing both lipo- and hydro-soluble colorants and Provitamin A. In recent years, importance of lycopene is rapidly increasing due to its pharmacological and anti-cancerous properties (Livny *et al*, 2002) and antioxidant activity (Sies and Stahl, 1998; Di Mascio *et al*, 2002; Heber and Lu, 2002).

Antioxidant attributes of carotenoids have been reported to play an important role in their anti-cancerous properties (Stahl and Sies, 1996; Rao *et al*, 1998). *In vitro* studies indicated that lycopene was the most efficient carotenoid-scavenger of free-radicals. In papaya, information on effect of organic practices on fruit quality and antioxidant content is scanty. Hence, the present study was initiated.

A field trial on organic practices of papaya cv. Surya was conducted during 2009-2010 at the experimental farm of Indian Institute of Horticultural Research, Bangalore. Twelve treatments were applied as follows:

T_1 – 100% Recommended dose of fertilizers applied as FYM + Vermicompost,

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T_2 – 75% Recommended dose of fertilizers applied as FYM + Vermicompost,

T_3 – 50% Recommended dose of fertilizers applied as FYM + Vermicompost,

T_4– 100% Recommended dose of fertilizers applied as FYM + Vermicompost + *Azospirillum* + Mycorrhiza,

T_5– 100% Recommended dose of fertilizers applied as FYM + Vermicompost + *Azospirillum* + Phosphate solubilizing bacteria,

T_6 – 75% Recommended dose of fertilizers applied as FYM + Vermicompost + *Azospirillum* + Mycorrhiza,

T_7 – 75% Recommended dose of fertilizers applied as FYM + Vermicompost + *Azospirillum* + Phosphate solubilizing bacteria,

T_8– 50% Recommended dose of fertilizers applied as FYM + Vermicompost + *Azospirillum* + Mycorrhiza,

T_9– 50% Recommended dose of fertilizer applied as FYM + Vermicompost + *Azospirillum* + Phosphate solubilizing bacteria + Mycorrhiza,

T_{10}- 100% Recommended dose of fertilizers,

T_{11}- 50% Recommended dose of fertilizer applied as FYM+ *Azospirillum* + Phosphate solubilizing bacteria + Mycorrhiza + Vermicompost, and

T_{12} - No manure/ fertilizer

Plants were spaced at 2m×2m. Vermicompost @ 2 kg/plant/year was applied to all treatments except T_{10} and T_{12}. The trial was laid out in Randomized Block Design, with four replications. Six plants were used per treatment. Plants were under drip irrigation and the soil (red loam) had available N 100.5 kg/ha, P_2O_5 36.8 kg/ha, K_2O 205.0 kg/ha, with initial pH of 6.8. Biofertilizers, *viz.*, *Azospirillum*, Mycorrhiza and Phosphate solubilizing bacteria (PSB) were applied @ 50 g/plant/year. Fertilizer dosage was split into 4 times/year for treatment T_{10} (100% recommended dose of fertilizers). Nutrient content of organic manures used in this experiment is as follows:

FYM**:** N-0.91%, P-0.166% and K-0.88%; Vermicompost**:** N-1.41%, P-0.299% and K-0.55%.

In each treatment, five fruits were selected randomly and a sample of 20 gram pulp was used for quality analysis. Carotenoids were extracted from the pulp using the solvent acetone, and lycopene was extracted with petroleum ether, dried using sodium sulphate (anhydrous) to eliminate traces of water and rough impurities. These were analyzed by using UV-spectrophotometer at 450nm and 503nm wavelengths, for estimating carotenoids and lycopene, respectively. All samples were analyzed in triplicate for carotenoids, lycopene and ascorbic acid estimation as per Ranganna, 1976 and Jensen, 1978. TSS of fruits was recorded with a hand-held refractometer.

Effect of organic practices on TSS and fruit weight is presented in Table 1. These parameters were found to be non-significant among treatments. However, maximum fruit weight (589.2g) and TSS (12^0Brix) were recorded in T_1 (100% Recommended dose of fertilizers, applied as FYM + Vermicompost) and T_6 (75% Recommended dose of fertilizers applied as FYM + Vermicompost + *Azospirillum* + Mycorrhiza). On the contrary, Ravishankar *et al* (2008) reported increased TSS due to organic practices in 'Coorg Honey Dew' papaya grown in the hilly regions of Coorg. The variation content may be due to growth conditions, variety and climate. Similar results were reported by Ray *et al* (2008). Results on carotenoids, lycopene and ascorbic acid content influenced by different organic treatments are presented in Table 2. Highest total carotenoids (7.54mg/100g) and lycopene content (5.03mg/100g) were recorded in treatment T_{11} (50% Recommended dose of fertilizer applied as FYM + *Azospirillum* + Phosphate solubilizing bacteria + Mycorrhiza + Vermicompost), and lowest total carotenoids (3.17mg/100g) and lycopene (2.04mg/100g) were observed in treatment T_1 (100% Recommended dose of fertilizers applied as FYM + Vermicompost). Higher content of lycopene and carotenoids was due to high

Table 1. Fruit quality in papaya cv. Surya as influenced by various organic practices

Treatment	Average fruit weight (g/fruit)	TSS (^{o}Brix)
T_1 - 100% RDF FYM + Vermicompost	589.2	11.0
T_2 - 75% RDF FYM + Vermicompost	583.7	10.5
T_3 - 50% RDF FYM + Vermicompost	480.7	10.3
T_4 - T_1+AZO+Mycorrhiza	385.7	9.7
T_5 - T_1+AZO+PSB	395.5	10.0
T_6 - T_2+AZO+Mycorrhiza	565.7	12.0
T - T_{2+} AZO+PSB	532.7	9.6
T_8 - T_3+AZO+Mycorrhiza	538.0	10.7
T_9 - T_3+AZO+PSB+Mycorrhiza	483.0	10.4
T_{10} - 100% RDF	499.2	9.3
T_{11} - 50% RDF FYM applied as AZO+ PSB + Mycorrhiza + Vermicompost	489.7	10.8
T_{12}- No manure (Control)	423.5	9.5
F-test	NS	NS
S.Em±	28.5	0.28

NS: Non-significant

Table 2. Total carotenoids, lycopene and ascorbic acid content in papaya as influenced by various organic practices

Treatment	Total carotenoids (mg/100g)	Lycopene (mg/100g)	Ascorbic acid (mg/100g)
T_1 - 100% RDF FYM + Vermicompost	3.17	2.04	170.00
T_2 -75% RDF FYM + Vermicompost	4.45	2.43	150.00
T_3 -50% RDF FYM + Vermicompost	3.21	2.06	1190.33
T_4 - T_1+AZO+Myco	7.11	2.34	209.67
T_5 - T_1+AZO+PSB	4.13	2.87	140.00
T_6 - T_2+AZO+Myco	4.54	2.21	199.67
T_7 -T_{2+} AZO+PSB	4.61	2.56	180.00
T_8 -T_3+AZO+Myco	3.58	2.71	230.00
T_9-T_3+AZO+PSB+Myco	3.73	3.41	249.67
T_{10}-100% RDF	4.06	2.84	190.00
T_{11}-50% RDF FYM applied as AZO+ PSB + Myco + Vermicompost	7.54	5.03	280.67
T_{12}- No manure (Control)	6.06	3.76	110.00
F-test	*	*	*
S.Em±	0.28	0.02	1.43
C.D. (P=0.05)	0.85	0.06	4.29

*Significant @5%

nutritional content in organic treatments involving biofertilizers and VAM. Anonymous (2012) reported that VAM + PSB + *Azotobacter* + *Azospirillum* were very effective in papaya, citrus, mango, pomegranate and grape. These enhanced nutrient availability, uptake, imparted bio-control properties, improved yield and fruit quality. Lower content of lycopene and carotenoids were due to non-availability of nutrient elements sufficient for growth and development of papaya fruits. Ascorbic acid content in ripe papaya ranged from 110.0 to 1190.33 mg/100g. Treatment T_3 (50% Recommended dose of fertilizers applied as FYM + Vermicompost) recorded highest (1190.33mg/100g) ascorbic acid content, and lowest (110.00mg/100g) was seen in T_{12} (No manure). Similarly, Dutta *et al* (2010) reported that application of *Azotobacter* + *Azospirillum* + VAM + 2kg FYM showed maximum total soluble solids-TSS (6.20°Brix), total sugars (5.18%) and β- carotene (2320µ/ 100g pulp) content, with minimum acidity, in papaya cv. Ranchi. Effects of Vermicompost may depend not only on chemical compounds in it and physiological its properties, but also its effects on physical properties of the soil. These findings need to be corroborated by further research under laboratory and field conditions.

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