Indian J. Hort. 69(2), June 2012: 151-155

Effect of integrated nutrient management in mango cv. Sunderja

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ABSTRACT

A field experiment was conducted to study the effect on integrated plant nutrient management in mango cv. Sunderja during 2009-10. Different vegetative growth parameters, *viz.* plant height, canopy height, plant spread (N-S) and (E-W) as well as tree volume were not influenced significantly. However, the treatment T_8 comprising 500:250:250 g N:P:K/tree + 50 kg FYM + 10 kg vermicompost registered the maximum plant height, canopy height, plant spread (N-S) and (E-W) as well as tree volume. On the other hand, full dose of NPK alone (T_1) resulted in the lowest vegetative growth. As regards with the fruiting parameters, the treatment T_8 resulted in maximum number of fruits/ panicle, longer length and width, fruit weight, pulp weight, number of fruits and fruit yield. All the fruit quality parameters were found non-significant except TSS due to integrated plant nutrient management treatments. The total soluble solid was found highest (22.81°Brix) in T_7 treatment, followed by T_4 (22.63°Brix). The acidity was found lowest in T_1 and T_7 treatments and highest in T_3, T_5, T_6 and T_8 treatments, however the differences among the acidity values were non-significant. The pulp: stone and pulp: peel did not differ significantly due to integrated plant nutrient management treatments. However, the treatment T_8 recorded the highest pulp: stone, whereas pulp: peel was highest in case of T_4. Whereas, the second best pulp: stone was in T_5 and pulp: peel in T_8. On the other hand, the treatments T_3 and T_7 recorded lowest pulp: stone and pulp: peel. The shelf-life of mango fruits was influenced significantly due to integrated plant nutrient management treatments. The treatments T_2, T_6, T_7 and T_9 resulted in the maximum period of storage (>15 days) at room temperature. On the other hand, the control treatment having full dose of NPK only (T_1) reduced the storage or shelf-life (9.9 days) of fruits.

Key words: Integrated nutrient management, mango, bio-fertilizers, organic mulching.

INTRODUCTION

Mango (*Mangifera indica* L), is grown in all the districts of Madhya Pradesh, while Jabalpur. Rewa, Satna and Panna occupy the maximum area and production. In Rewa region, it is grown in 1,541.5 ha area with a production 7,707.50 tonnes and productivity 5.0 tonnes/ha, which is quite low. Integrated nutrient plant management refers to maintenance of soil fertility and plant nutrient supply to optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. Integrated nutrient management envisages the use of chemical fertilizers in conjunction with organic manures, green manures, crop residues, legumes in a cropping system and locally available resources with the objectives of sustaining high yield and ensuring environmental safety. Objectives of integrated plant nutrient management are to reduce inorganic fertilizer requirement, to restore the organic matter in soil and to increase nutrient use efficiency, to maintain quality in terms of physical, chemical and biological properties of soil, to maintain the nutrient balance between the supplied nutrient and nutrient removed by plant and to improve soil health and productivity on sustainable basis.

Heavy application of nitrogenous fertilizers has resulted in accumulation of high quantities of nitrates in water bodies near orchards making it unfit for cultivation and also for human consumption. In current scenario of organic agriculture, biofertilizers, more commonly known as microbial inoculants are choice of the farmers (Kumar *et al.*, 5; Srivastava *et al.*, 12). These are artificially multiplied cultures of certain soil microorganisms that can improve soil fertility and crop productivity. Bio-fertilizers not only provide growth promoting activity to the plant by enhancing the nutrient uptake but also provide strength against soil-borne diseases. Bio-fertilizers also help in composting and effective recycling of solid waste which results in improved soil health. Therefore, biofertilizers provide an eco-friendly and need based use of chemical fertilizers with enhanced soil quality and higher yield of plant. The role of nutrient elements either alone or in combination with other sources (organic manures/ fertilizers) have been well established in many fruit crops; while such studies are very meagerly available in mango. Therefore, present investigation was undertaken to evaluate the effect of integrated plant nutrient management strategies in mango.

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MATERIALS AND METHODS

The study was undertaken at the Fruit Research Station, Kuthulia, College of Agriculture, Rewa under Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during the year 2009-10 on 38-year-old trees of mango cv. Sunderja, planted at a distance of 10 m × 10 m in square system. The investigation was carried out in ten treatments which consisted of T_1 = 1000:500:500 g N:P:K/tree (control), T_2 = 1000:500:500 g N:P:K/tree + 0.57% Zn + 0.2% boron + 1% Mn +0.6% Ca as foliar application twice (August and October), T_3 = 1000:500:500 g N:P:K/tree + organic mulching (10 cm thick), T_4 = 1000:500:500 g + 0.57% Zn + 0.2% boron + 1% Mn + 0.6% Ca + organic mulching (10 cm thick), T_5 = Half dose of T_1 + 50 kg FYM + *Trichoderma* 250 g, T_6 = Half dose of T_1 + 50 kg FYM + *Azospirillum* 250 g, T_7 = Half dose of T_1 + 50 kg FYM + *Azotobacter* 250 g, T_8 = Half dose of T_1 + 50 kg FYM + 10 kg vermicompost, T_9 = Half dose of T_1 + 50 kg FYM + *Pseudomonas fluorescens* 250 g, T_{10} = Half dose of T_1 + 50 kg FYM + *Trichoderma* 250 g and *Pseudomonas fluorescens* 250 g. All the treatments were replicated thrice in randomized block design having two trees per treatment per replication. The trees were maintained under uniform cultural practices. The vegetative growth parameters like plant height (m), canopy height (m), (E-W) plant spread (m) and (N-S) plant spread (m), tree volume (m^3) and yield (kg/tree) were recorded by standard methods.

Data were also recorded for fruit qualities parameters like number of fruits/panicle, fruit drop (%), fruit weight (g), fruit length (cm), fruit width (cm), peel, stone and pulp content, number of fruits/tree, fruit yield (kg/ha), TSS, acid, pulp:stone, pulp: peel and shelf-life of fruits at room temperature (days). Acidity was analyzed by using standard methods AOAC (1). The TSS of fruit pulp was determined with the help of Zeiss hand refractometer. Shelf-life of fruit at room temperature was recorded by keeping ten mature fruits per treatment in three replicates for each treatment at room temperature for repining without deterioration of fruits. For yield parameters average number of fruits per tree, average yield per tree (kg), and average weight of fruit (g) were recorded. The yield was recorded by weighing the fruits at the time of each picking. Fifty uniform mature fruits from each tree were used for recording of various fruit quality parameters. The present data were angularly transformed before statistical analysis.

RESULTS AND DISCUSSION

All the vegetative parameters, *viz*. plant height, canopy height, plant spread (N-S) and (E-W) as well as tree volume were not significantly influenced due to the applied integrated nutrient plant management treatments (Table 1). However, the treatment T_8 comprising of half dose of recommended NPK + 50 kg FYM + 10 kg vermicompost registered the maximum plant height (6.72 m), canopy height (5.98 m), plant spread N-S (10.12 m) and E-W (10.24 m) as well as tree volume (780.09 m^3). On the other hand, full dose of NPK alone (T_1) resulted in the lowest values for all these vegetative growth parameters except N-S plant spread, which was minimum in T_9 (7.73 m). The maximum vegetative growth parameters of mango as a result of applied 50 kg FYM and 10 kg vermicompost per tree along with the 50% NPK chemical fertilizers (T_8) may be due to increased photosynthetic rate and carbohydrate accumulation as a result of multifarious role of FYM and vermicompost to allow most favorable conditions of the soil with increased availability of plant nutrients responsible for better plant growth (Sharma and Bhutani, 10; Tiwari *et al.*, 13; Dutta *et al.*, 4).

With respect to fruiting parameters, none of them were significantly influenced due to integrated plant nutrient management treatments. However, the treatment T_8 (half dose of NPK + 50 kg FYM + 10 kg vermicompost) resulted in maximum number of fruits/ panicle (0.81). The same treatment also recorded the highest fruit weight (225.03 g), number of fruits/tree (409.60) and fruit yield (124.67 kg/tree). Maximum fruit length (11.10 cm) and width (7.04 cm) was recorded in T_2 where T_1 was amended with zinc, boron, manganese and calcium. Minimum fruit length (10.11 cm) and fruit width (6.37 cm) was recorded in T_3 where it was supplemented along with organic mulching. In T_8 treatment, FYM + vermicompost played their multifarious effect to encourage these fruiting parameters. Similarly, T_4 treatment having full dose of NPK with micronutrients (Zn + B + Mn) + Ca and mulching also found effective. Minimum fruit drop (97.79%) was recorded in treatment T_2 (T_1 + Zn + B + Mn + Ca), while maximum fruit drop was recorded in T_3 (98.52%) (T_1 along with organic mulch) (Table 2). Similar results were reported by Ahmad *et al.* (2), Sharma *et al.* (12), Naik and Babu (7), Athani *et al.* (3), Dutta *et al*. (4), and Patel *et al*. (8).

All the fruit quality parameters were found non-significant except TSS due to integrated plant nutrient management treatments. Data has been presented in Table 3. The total soluble solids was found highest (22.81°Brix) in T_7 treatment having half NPK + FYM + *Azotobacter* 250 g, followed by T_4 having full dose of NPK + Zn + Bn + Mn + Ca + organic mulch (22.63°Brix) (Table 3). These results showed the effect of integrated nutrient application

Table 1. Influence of integrated nutrient management on vegetative growth parameters.

Treatment		Plant height (m)	Canopy height (m)	Plant spread [N-S] (m)	Plant spread [E-W] (m)	Tree volume (m^3)
T_1	1000:500:500 g NPK/tree	5.59	4.92	7.89	7.99	370.93
T_2	T_1 + Zn + boron + Mn + Ca	6.46	5.72	9.31	9.4	575.17
T_3	T_1 + Organic mulching	6.59	5.41	9.88	10.09	705.58
T_4	T_1 + Zn + boron + Mn + Ca + Organic mulching	6.17	5.66	9.15	9.55	762.16
T_5	Half of T_1 + 50 kg FYM + *Trichoderma* 250 g	6.36	5.56	8.03	8.84	469.42
T_6	Half of T_1 + 50 kg FYM + *Azospirillum* 250 g	6.2	5.98	8.94	9.27	594.03
T_7	Half of T_1 + FYM + *Azotobacter* 250 g	6.35	5.76	8.89	9.33	557.7
T_8	Half of T_1 + 50 kg FYM + 10 kg vermicompost	6.72	5.98	10.12	10.24	780.09
T_9	Half of T_1 + 50 kg FYM + *Pseudomonas fluorescens* 250 g	6.12	5.47	7.73	8.47	433.6
T_{10}	Half of T_1 + 50 kg FYM + *Trichoderma* 250 g + *P. fluorescens* 250 g	6.07	5.61	8.44	8.72	500.5
	CD at 5%	NS	NS	NS	NS	NS

Table 2. Influence of integrated nutrient management on fruiting parameters.

Treatment		No. of fruits/ panicle	Fruit wt. (g)	Fruit length (cm)	Fruit width (cm)	No. of fruits/ tree	Fruit yield (kg/ha)	Fruit drop (%)
T_1	1000:500:500 g NPK/tree	0.61	182.87	10.99	6.64	229.73	75.9	98.04
T_2	T_1 + Zn + boron + Mn + Ca	0.67	197.3	11.1	7.04	271.13	86.27	97.79
T_3	T_1 + Organic mulching	0.71	196.97	10.11	6.37	320.23	98	98.52
T_4	T_1 + Zn + boron + Mn + Ca + Organic mulching	0.73	211.47	10.2	6.56	328.97	106	98.47
T_5	Half of T_1 + 50 kg FYM + *Trichoderma* 250 g	0.62	205	10.33	6.6	287.67	91.9	97.94
T_6	Half of T_1 + 50 kg FYM + *Azospirillum* 250 g	0.67	211.6	10.76	6.69	282.43	95.67	97.99
T_7	Half of T_1 + FYM + *Azotobacter* 250 g	0.6	186.5	10.23	6.44	273.87	96.1	98.17
T_8	Half of T_1 + 50 kg FYM + 10 kg vermicompost	0.81	225.03	10.98	6.68	409.6	124.67	98.19
T_9	Half of T_1 + 50 kg FYM + *Pseudomonas fluorescens* 250 g	0.67	198.63	10.75	6.58	307.17	97.33	97.96
T_{10}	Half of T_1 + 50 kg FYM + *Trichoderma* 250 g + *P. fluorescens* 250 g	0.67	204.97	10.92	6.62	286.33	95	98.04
	CD at 5%	NS	NS	NS	NS	67.14	19.25	NS

Table 3. Influence of integrated nutrient management on fruit quality parameters.

Treatment		Peel (%)	Stone (%)	Pulp (%)	TSS (°Brix)	Acidity (%)	Pulp: stone	Pulp: peel	Shelf-life (days)
T_1	1000:500:500 g NPK/tree	15.1	12.15	72.75	21.56	0.3	3.83	3.23	9.9
T_2	T_1 + Zn + boron + Mn + Ca	15.38	12.69	71.93	22.33	0.35	3.97	3.28	15.1
T_3	T_1+ Organic mulching	14.99	12.00	73.01	22.28	0.39	3.59	2.98	12.3
T_4	T_1 + Zn + boron + Mn+ Ca + Organic mulching	14.29	11.89	73.82	22.63	0.32	4.44	3.8	12.4
T_5	Half of T_1 + 50 kg FYM + *Trichoderma* 250 g	15.41	13.1	71.49	21.13	0.39	4.02	3.29	12.3
T_6	Half of T_1 + 50 kg FYM + *Azospirillum* 250 g	15.8	12.41	71.79	21.4	0.39	4.51	3.38	15.3
T_7	Half of T_1 + 50 kg FYM + *Azotobacter* 250 g	14.34	12.74	72.92	22.81	0.3	3.59	3	15.4
T_8	Half of T_1 + 50 kg FYM + vermicompost	14.68	11.34	73.98	21.33	0.39	4.68	3.55	13.1
T_9	Half of T_1 + 50 kg FYM + *Pseudomonas fluorescens* 250 g	15.34	12.79	71.87	22.06	0.38	4.16	3.13	14.9
T_{10}	Half of T_1 + 50 kg FYM + *Trichoderma* 250 g + *P. fluorescens* 250 g	15.47	12.41	72.12	22.46	0.36	4.26	3.52	13.3
	CD at 5%	NS	NS	NS	0.92	NS	NS	NS	1.34

in T_4 and T_7, which enhanced the conversion of complex polysaccharides into simple sugars. The present findings have also been supported by Mitra *et al.* (6), and Athani *et al.* (3).

The acidity was found lowest (0.30%) in T_1 (full NPK) and T_7 (half NPK + FYM + *Azotobacter* 250 g) treatments and highest (0.39%) in T_3, T_5, T_6 and T_8 treatments, though they were non-significant. The decrease in acidity of fruits may be attributed to their conversion into sugars and their derivatives by the reactions involving reversal of glycolytic pathway or might be used in respiration or both. Similar results have also been reported by (Dutta *et al.*, 4) in guava. The pulp: stone and pulp: peel ratios did not differ significantly due to integrated plant nutrient management treatments. However, the treatment T_8 (half dose of NPK + 50 kg FYM + 10 kg vermicompost) recorded the highest (4.68) pulp: stone, whereas pulp: peel was highest (3.80) in case of T_4 (full NPK + Zn + B + Mn + Ca + organic mulch).

The shelf-life of mango fruits was influenced significantly due to integrated nutrient management treatments. The treatments T_2, T_6, T_7 and T_9 resulted in the maximum period of storage or shelf-life (14.90 to 15.43 days) at room temperature. On the other hand, the control treatment having full dose of NPK only (T_1) reduced the storage or shelf-life of mango fruits, *i.e.* only upto 9.94 days.

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Received: January, 2012; Revised: April, 2012;
Accepted: May, 2012