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EFFECT OF ORGANIC AND INORGANIC SOURCES OF NITROGEN ON GROWTH, YIELD AND QUALITY OF MANGO

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ABSTRACT

The present investigation was carried out at the Agriculture Experimental Station, Paria, Navsari Agriculture University, Navsari during three years (2008-09 to 2010-11) to study the effect of nitrogen fertilization by organic and inorganic means on growth, yield and quality of mango 'Kesar'. The experiment was laid out with eleven treatments having different replacement levels of RDN (recommended dose of nitrogen) by vermicompost and composted press mud in randomized block design with three replications. The plant height and plant spread were not influenced by various treatments significantly. However, the tallest plants (3.67m) and maximum plant spread (4.11m) were recorded under 25% RDM as vermicompost + remaining RDF by fertilizers (T_5). Fruits/tree (199.98) and yield of fruit/tree (65.37 kg/tree) were recorded under T_9 (25% RDN as composted pressmud + remaining RDF as fertilizers) and minimum with T_{11} (100% RDN as comported pressmud). Treatment T_{10} (100% RDN as vermicompost) resulted in maximum value (18.44 brix) of TSS in mango fruits. The minimum acidity (0.19%) was recorded with T_{10} and T_{11} treatments. The maximum amount of reducing sugar (3.97%) in mango fruits was recorded under 100% RDN as vermicompost (T_{11}) treatment. The results indicated that 25% of nitrogen can be applied organically through composted press mud to obtain higher production. Providing nitrogen to plants organically helps in improving the quality characteristics of fruits.

Keywords: Mango, nitrogen, vermicompost, composted press mud

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important fruits of India and referred to as the king of fruits. Besides delicious taste, excellent flavor and attractive fragrance, it is rich in vitamins A and C. India is the largest producer of mango accounting for nearly 50 % of the total world production, 34.9% of the area under fruit crops in India and 20.7% of the total fruit production of the country (NHB, 2015). In Indian context, it is an important fruit crop ruling both domestic and export markets. Providing adequate nutrition to fruit trees is the utmost concern among farmers for enhancing growth, yield and quality of mango which is mandatory for sustainable production. Inorganic fertilizers are one of the most expensive inputs in orchard management. Besides, continuous application of huge amount of chemical fertilizers hampers the quality, soil health and soil productivity. As such, it is necessary that fertilizer application should be made through inorganic, organic sources and micronutrients (Yadav *et al.,* 2011). Generally, the enzyme activities in the soil are closely related to the organic matter content and strongly influenced by the hydrothermal regimes. Furthermore, there have been many reports that organic fertilizers can increase soil microbiological activity (Bulluck *et al.,* 2002) and many enzymatic activities have been reported to be correlated with total organic C, soil moisture, temperature and organic sources (Bell *et al.,* 2008). The vermicompost and composted press mud has almost equal nitrogen percentage but differ in C:N and C:P ratios which are equal to 18.25 and 15.28 in composted press mud and 8.78 and 4.07 in vermicompost, respectively (Joshi and Sharma, 2010). Mostly, mango orchard soils are very poor in organic matter owing to high temperature and intense microbial activities, addition of different kinds of organic substrates as organic sources of nutrition through FYM, composting, vermicomposting, organic mulching, bioinoculants, *etc.* may be a viable option for maintaining soil health and orchard sustainability (Singha *et al.,* 2014). The fertilizer schedule should be holistic in nature as fertilizer is one of the costliest inputs in agriculture and the use of right amount of fertilizer is fundamental for farm profitability and environmental protection (Kimetu *et al.,* 2004). Keeping this in view, the present study was conducted to assess the effect of applying the recommended dose of nitrogen (RDN) through organic sources or in combination with chemical fertilizers on growth yield and quality of mango.

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MATERIAL AND METHODS

The experiment was conducted at Agriculture Experimental Station, Paria, during three years (2008-09 to 2010-11). Paria is situated at 22°44' N latitude and 72°94' E longitude at an altitude of 10 m above the mean sea level. The climate of the region is humid, with an average annual rainfall of about 2207 mm distributed from June to September. The minimum and maximum temperature ranges from 9.6 °C to 27°C and 27.2°C to 41.8°C, respectively while relative humidity varies from 57.1 to 92 % during the year. The soils of the area are fine-textured heavy soils classified as Vertic Ustrochrepts. The studies were conducted in 15 years old mango orchard cv. Kesar with eleven treatments *viz.* T_1 – Recommended dose of fertilizer (RDF) 100kg FYM + 750-160-750 g NPK/plant, T_2 - 100 % recommended dose of nitrogen (RDN) through vermicompost + remaining RDF by fertilizers, T_3- 75 % RDN through vermicompost + remaining RDF by fertilizers, T_4- 50 % RDN through vermicompost + remaining RDF by fertilizers, T_5- 25 % RDN through vermicompost + remaining RDF by fertilizers, T_6- 100 % RDN through composted press mud + remaining RDF by fertilizers, T_7- 75 % RDN through composted press mud + remaining RDF by fertilizers, T_8- 50 % RDN through composted press mud + remaining RDF by fertilizers, T_9- 25 % RDN through composted press mud + remaining RDF by fertilizers, T_{10}- 100 % RDN through vermicompost, T_{11}- 100 % RDN through composted press mud. The experiment was laid out in randomized block design with three replications. All the selected trees were almost uniform in growth, vigour and were managed with uniform cultural operations during the course of investigation. The treatments were applied on the onset of rains during first week of June during all the years as recommended in this area which is rain fed. The data on tree height, plant spread were recorded using meter scale while mature fruits were harvested from each treatment separately and weighed on single pan balance. The biochemical constituents like total soluble solids (TSS), reducing sugars and fruit acidity were estimated as suggested by (AOAC, (1995) and Ranganna, (1986). The data obtained on various characters were subjected to statical analysis and interpretation of the data was carried out in accordance to Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The pooled data (Table 1) revealed that the different treatments had a non significant effect on plant height and spread, however maximum plant height (3.67 m) and widest canopy spread (4.11 m) was observed under T_5 (25 % RDN as vermicompost along with the remaining RDF as chemical fertilizers). Moyin-Jesu and Adeofun (2008) reported that the incorporation of organic sources like ash from oil palm trees, straw, and turkey and other farm bird manure, and their interactions (8 kg ha^{-1}) together with the formula 15-15-15 NPK (400 kg ha^{-1}), affected plant height and foliar area, it being statistically greater than those found in unfertilized trees. The reasons for better growth under fertilizer and organic manure combination may be due to increased availability of nutrients to plants initially through fertilizers and than by organic manure. The treatments differed significantly in attaining number of fruits per tree and fruit yield and maximum number of fruits per tree (199.98) and yield (65.37 kg/tree) were obtained with T_9 (25 % RDN composted press mud along with the remaining RDF through chemical fertilizers). The results are in accordance with those reported by Sarker and Rahim (2012) who realized edaphic applications with mineral fertilizers and these workers also reported a higher quantity of fruits on fertilized trees, compared with the un-fertilized trees. Corrales *et al.* (2003) emphasized that individual application of mineral and organic fertilizers were statistically inferiors to the combination of organic and mineral fertilizers but superior to control. Higher contents of N, P and K in bulky manures are directly related with flowering and fruit yield (Reddy *et al.* 2001). Fruit quality parameters were influenced significantly by the application of different treatments and maximum TSS (18.44 ^{o}Brix) was recorded in T_{10} (100 % RDN as vermicompost) which was at par with T_{11} (100 % RDN as composted press mud).

Table 1: Effect of nitrogen fertilization through organic and chemical sources on growth, Yield and quality of mango cv. Kesar (pooled three years)

Treatment	Plant height (m)	Plant spread (m)	Number of Fruits/tree	Yield (kg/tree)	TSS (^{0}Brix)	Reducing sugars (%)	Fruit acidity (%)
T_1	3.61	4.02	160.73	52.62	17.92	3.50	0.21
T_2	3.05	3.71	123.45	40.24	17.83	3.48	0.21
T_3	3.46	3.99	130.12	42.63	17.89	3.41	0.21
T_4	3.56	3.84	113.98	37.39	17.92	3.61	0.20
T_5	3.67	4.11	147.03	48.31	17.80	3.75	0.20
T_6	3.48	3.63	117.63	38.60	17.49	3.60	0.20
T_7	3.55	3.82	128.44	42.06	18.18	3.58	0.20
T_8	3.40	3.62	156.39	51.23	18.10	3.66	0.20
T_9	3.66	3.83	199.98	65.37	18.04	3.72	0.20
T_{10}	3.51	3.47	105.89	34.62	18.44	3.90	0.19
T_{11}	3.52	3.59	102.86	33.66	18.38	3.97	0.19
SEm±	0.11	0.12	4.87	1.60	0.06	0.05	0.004
CD P=00.05	NS	NS	13.73	4.52	0.17	0.15	0.01
CV %	10.33	11.11	15.05	15.05	1.08	4.86	5.44

The amount of reducing sugars was maximum (3.97 %) in T_{11} followed by T_{10}. Fruit acidity was also influenced significantly and the minimum acidity (0.19 %) was recorded in treatments T_{10} and T_{11} where only RDN was applied organically without remaining RDF. Ram and Nagar (2003) stated that maximum TSS, titrable acidity and ascorbic acid was obtained from vermicompost applied plants in guava. Our results are also in agreement with the findings of Athani and Hulamani (2000) as they found that plants treated with vermicompost gave higher TSS, titrable acidity and ascorbic acid in banana. Shirol *et al.* (2003) reported highest reducing sugars in the fruits of sapota with application of vermicompost plants. The organic amendments increased the availability of nutrients, improve the soil aeration (Prakash *et al.,* 2010) and the quality improvement in fruits may be due to proper supply of nutrients and induction of growth hormones, which stimulated cell division, cell elongation, increase in number and weight of the fruits, better root development and better translocation of water uptake and deposition of nutrients. This may be attributed to the improved fertilizer use efficiency with the application of organic and inorganic sources of nutrients apart from nutrient supply and availability. These results are in accordance with the findings of Singh *et al.* (2007) in aonla, Mahendra *et al.* (2009) in ber and Robertse and Stassen (2004) in mango.

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