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Effect of Integrated Nutrient Management to Reduce the Cost of Cultivation of Amrapali Mango (*Mangifera indica* L.) by Minimizing the Indiscriminate use of Chemical Fertilizers under High Density Planting

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ABSTRACT

A field experiment was carried out to evaluate the response of organic manures (FYM, Vermicompost), inorganic fertilizers (NPK), biofertilizers (Azotobacter and PSB) on the cost of cultivation of mango cv. Amrapali under high density orcharding. The economics of integrated nutrient management was concerned, application of 75% RDF + 20 kg Vermicompost + 250g Azotobacter + 250g PSB/plant registered maximum gross income (Rs1090410 and Rs1308346 ha^{-1}), net return (Rs.874872 and Rs.1036240 ha^{-1}), and cost : benefit ratio (1: 4.06 and 1: 3.08) as compared to other treatments. The minimum gross income (Rs. 387200 and Rs. 59832 ha^{-1}), net return (Rs. 237493 and Rs. 407091 ha^{-1}) and cost: benefit ratio (1: 1.59 and 1: 2.13) were estimated with recommended dose of fertilizers during 2010-11 and 2011-12.

Key word: *Mango, NPK, PSB, Azotobacter, Vermicompost.*

INTRODUCTION

Mango (*Mangifera indica* L.) is a premier fruit crop of India considering its acreage, production and popularity among the people and therefore it is designated as the 'National Fruit of India'. The fruit is excellent source of vitamin A, C and nutrients as well as carbohydrates Singh, 2007. No other fruits are so intimately connected with the history and literature of India as mango. This premium fruit has been in cultivation in Indian sub continent for well over 4000 years.

Indiscriminate use of chemical fertilizers, pesticide and herbicides in horticultural crops over four decades has adversely affected the soil fertility, biodiversity, ground water pollution and human health. Owing to these limiting factors, conventional (chemical based) farming has became non-sustainable.

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There are sufficient evidences that the intensive agriculture system has also caused decline in vitamin and mineral contents of fresh fruit. A poor supply of nutrient seems to be one of the main causes for tree decline, low yield and poor fruit quality. Since mangoes are mostly consumed as fresh, they should be devoid of fertilizer and pesticide residue. An economically attractive and potential source of plant nutrients in a balanced proportion is the need of the day in maintaining the fertility and productivity of agricultural soil.

The integrated nutrient management refers to "a system which aims at improving and maintaining the soil fertility for sustaining increase in crop productivity and involves the use of inorganic fertilizers in conjunction with organic manures/wastes with inputs through biological processes". Therefore, it is a holistic approach, where we first know what is exactly required by the plant for an optimum level of production, in what different forms these nutrients should be applied in soil, at what different timings in the best possible method, and how best these forms should be integrated to obtain the highest productive efficiency on the economically acceptable limits in an environment friendly manner. The management of nutrients through organic and biological sources would be more beneficial and eco-friendly to improve the health of soils and quality of fruit produce.

The current trend is to explore the possibility of supplementing chemical fertilizers with organic fertilizers, especially bio-fertilizers of microbial origin Patil *et al*[3]. Among the commercially grown mango cultivars, Amrapali being a dwarf and regular bearer has responded well to different cultural practices in high-density orcharding. Very little efforts have been made so for to study the response of organic, inorganic and biofertilizers on the sustainable production and fruit quality of Amrapali mango under high density planting Ahmad *et. al*.,[2] and Yadav *et.al.*[9]. Recommendation is also not available for the integrated nutrient management system of crop production in Amarpali mango under the climatic conditions of western UP which has been recognised as Agri. export zone of mango by the government of India.

It was therefore realised that the investigation on the balanced use of nutrients through different sources in dwarf mango cultivar under high density planting would be useful for sustainable production of quality mango and reduced cost of cultivation.

Keeping in view of above facts and the bearing potential of Amrapali mango in high density orcharding, the present investigation were undertaken to find out the combined effect of organic manures, inorganic manures and biofertilizers on total cost of production and reduced cost of cultivation mango fruits .

MATERIAL AND METHODS

The field investigations were laid out on 13 years old "Amrapali' mango trees which were planted at a distance of 2.5×2.5 m in an orchard of HRC, at Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.) during the year 2010-11 and 2011-12. All the trees of uniform growth and vigour were selected for the study and they were maintained healthy following timely and uniformly application of appropriate pesticides. The experiment was laid out in Randomized Block Design (RBD), replicated thrice with the treatment combination of T_1 (RDF 1000, 500, 1000 g NPK + 100 kg FYM)), T_2 (100 % RDF + 250g Azotobacter), T_3 (100 % RDF + 250g PSB), T_4 (100 % RDF + 250g Azotobacter + 250g PSB), T_5 (100 % RDF + 20 kg Vermicompost), T_6 (100 % RDF + 40 kg Vermicompost), T_7 (75 % RDF + 20 kg Vermicompost), T_8 (75 % RDF + 40 kg Vermicompost), T_9 (75 % RDF + 20 kg Vermicompost + 250 Azotobacter), T_{10} (75 % RDF + 40 kg Vermicompost + 250 Azotobacter), T_{11} (75 % RDF + 20 kg Vermicompost + 250 PSB), T_{12} (75 % RDF + 40 kg Vermicompost + 250 PSB) T_{13} (75 % RDF + 20 kg Vermicompost + 250 Azotobacter +250g PSB), T_{14} (75 % RDF + 40 kg Vermicompost + 250 Azotobacter+ 250g PSB).

The organic sources of nutrients, i.e. FYM,(100 Kg/plant) and vermicompost two type dose 20Kg and 40 Kg/plant were applied around tree basin during first week of September. The biofertilizers, *Azotobacter* and PSB @ 250 g per tree each were applied in first week of October at a depth of 30 cm around the tree trunk in respective treatment. The RDF of NPK (1000, 500, 1000g/tree) was applied to two type different dose (100%, 75%, RDF). The observations were recorded quality was analysed as per AOAC(1990) and different economic parameters including gross income, net return and cost benefit ratio were calculated in cost of cultivation.

RESULTS AND DISCUSSION

The findings based on two years of study revealed the highest gross income (Rs.1090410 and Rs 1308346 ha^{-1}) was obtained with treatment comprising 75 % RDF + 20 kg Vermicompost + 250g Azatobacter + 250g PSB/plant (T_{13}) followed by 75 % RDF + 40 kg Vermicompost + 250g Azatobacter + 250g PSB/plant (T_{14}) (Rs.1031040 and Rs. 1284266 ha^{-1}) during the year 2010-11 and 2011-12. However, the treatment containing only recommended dose of fertilizers (T_1) had registered lowest gross income (Rs.387200 and Rs.598320 ha^{-1}) during both the years of study. Maximum gross income recorded in the present study with the treatments 'T_{13}' and 'T_{14}' might be due to significant improvement observed in yield and quality with treatments having both the biofertilizers and vermicompost. As a results, the gross income under these treatments was found to be maximum incomparison to treatments containing single or no biofertilizers and vermicompost. The beneficial effect of organic manure and inorganic fertilizers have also been reported by Singh[5], Yadav *et al.*[7] and Yadav *et al*[8]. The findings of present investigation further revealed that the treatment T_{13} resulted in maximum net return of Rs.874872 and Rs 1036240 ha^{-1} followed by treatment T_{14} (Rs. 751302 and Rs. 931920 ha^{-1}) during both the years of study. The minimum net return (Rs. 237493 and Rs. 407091 ha^{-1}) was recorded with treatment having only recommended dose of fertilizer (T_1). It might due to minimum yield recorded with this treatment. Similar trend in net return due to INM treatments was also reported by Yadav *et al.*[9] and Singh *et al*[4].

The highest cost of cultivation (Rs.279738 and Rs 352346 ha^{-1}) was observed in treatment having 75 % RDF + 40 kg Vermicompost + 250g Azotobacter + 250g PSB/plant followed by treatment containing 100% RDF + 40 kg Vermicompost/plant (Rs.278307 and Rs.271709 ha^{-1}) during both the years of study. The increase in the cost of cultivation with these treatments might be due to higher cost of organic manures, namely, vermicompost & FYM since this treatment contained highest amount of vermicompost (40 kg) and 100 % recommended dose of FYM. The lowest cost of cultivation (Rs. 160000 and Rs.42000 ha^{-1}) in the present study was recorded with recommended dose of fertilizer during both the years of experimentation. In the only RDF. Since no vermicompost and biofertilizers were incorporated in this treatment, therefore the cost of cultivation was found to be comparatively less with this treatment than other treatments. The findings of this study also confirmed the results of Tiwari *et al*.[6] who had also observed lowest cost of cultivation when only recommended dose of fertilizers were applied. The higher cost : benefit ratio (1:4.06 and 1:3.81) was recorded with current study under T_{13} followed by T_5 (1:3.28 and 1:2.50) during both the years of study, while lowest cost : benefit ratio (1:1.59 and 1:2.13) was obtained with treatment containing only recommended dose of fertilizers. The higher yield and better quality fruits obtained in treatment 'T_{13}' might have improved the cost: benefit ratio. The higher cost: benefit ratio was also observed by Yadav *et al.*[7] and Singh *et al.*[4] with the application of 75% N + biofertilizers.

SUMMARY

As far as the economics of integrated nutrient management was concerned, application of

75% RDF + 20 kg Vermicompost + 250g Azotobacter + 250g PSB/plant registered maximum gross income (Rs1090410 and Rs1308346 ha^{-1}), net return (Rs.874872 and Rs.1036240 ha^{-1}), and cost : benefit ratio (1: 4.06 and 1: 3.08) as compared to other treatments. The minimum gross income (Rs. 387200 and Rs. 59832 ha^{-1}), net return (Rs237493 and Rs. 407091 ha^{-1}) and cost: benefit ratio (1: 1.59 and 1: 2.13) were estimated with recommended dose of fertilizers during 2010-11 and 2011-12.

Table 1: Effect of organic and inorganic sources of nutrient on net return in Amrapali mango

Treatments	Total cost of production (Rs/ha)		Gross income (Rs/ha)		Net return (Rs/ha)		Cost : Benefit Ratio	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
T_1	149707	191229	387200	598320	237493	407091	1:1.59	1:2.13
T_2	164307	209469	502125	684720	337818	475251	1:2.06	1:2.27
T_3	164307	209469	445200	691488	280893	482019	1:1.71	1:2.30
T_4	164507	227709	649290	770880	484783	543171	1:2.95	1:2.39
T_5	214107	271709	916800	952000	702693	680291	1:3.28	1:2.50
T_6	278307	351949	971190	1028800	692883	676851	1:2.49	1:1.92
T_7	186338	235628	672810	713920	486472	478292	1:2.61	1:2.03
T_8	250238	315866	744330	819200	494092	503334	1:1.97	1:1.59
T_9	200938	253866	861750	869493	660812	615627	1:3.29	1:2.43
T_{10}	265138	334106	894090	1033573	628952	699467	1:2.37	1:2.09
T_{11}	200938	253866	769770	878453	568832	624587	1:2.83	1:2.46
T_{12}	265138	334106	846090	1052800	580952	718694	1:2.19	1:2.15
T_{13}	215538	272106	1090410	1308346	874872	1036240	1:4.06	1:3.81
T_{14}	279738	352346	1031040	1284266	751302	931920	1:2.69	1:2.64

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