J Krishi Vigyan 2020, 9 (1) : 250-253 DOI : 10.5958/2349-4433.2020.00169.5

Nutrient Dynamics: Effect on Growth, Yield and Quality Attributes of Plum (*Prunus saliciana*) under Rainfed Agroclimatic Conditions in Poonch District of Jammu & Kashmir

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ABSTRACT

To make out the response of plum to integrated nutrient management, an on farm trial was conducted at five different locations in district Poonch for three successive years. The treatments were T_1: Farmers' Practice (Urea (500 g) + 10 kg FYM), T_2: Recommended dose (N (735g/tree), DAP (280g/ tree), MOP (1050g/tree) and T_3: Intervention ($N_{40\%}$ +$VC_{50\%}$ + $FYM_{10\%}$, $P_{50\%}$ + $VC_{45\%}$ + $FYM_{5\%}$ and $K_{50\%}$+$VC_{40\%}$+$FYM_{10\%}$). The experiment was laid out in randomized block design (RBD) comprised of three treatments having various combinations of inorganic fertilizers (urea, SSP and MOP), FYM and vermicompost. Among the treatments, T_3**:** Intervention ($N_{40\%}$ +$VC_{50\%}$ + $FYM_{10\%}$, $P_{50\%}$ + $VC_{45\%}$ + $FYM_{5\%}$ and $K_{50\%}$+$VC_{40\%}$+$FYM_{10\%}$), performed best where highest annual shoot growth (50.39cm), tree height (4.97), trunk girth (80.27), fruit set (61.03%), fruit yield (38.89 kg/ tree), TSS (18.20^o Brix), highest gross income (Rs. 507173/-), net income (Rs. 311112/-) and benefit cost ratio (1: 58) was obtained.

Key Words: Plum, INM, Yield, Quality.

INTRODUCTION

Plum (*Prunus saliciana Lindl*.) is one of the most important stone fruits grown in temperate and subtropical areas of north India. Most of the plum is grown in the states of Jammu and Kashmir, Himachal Pradesh, and Uttarakhand. Santa Rosa plum has been found to be prolific and regular bearer and is the most important table variety cultivated successfully in the mid hills of district Poonch of Jammu and Kashmir. If proper care is taken in nutrient management by using organic manures and inorganic fertilizers, the proper growth and yield of plum trees is assured. Application of inorganic nutrients plays an important role on the yield attributes as well as uptake of nutrients at the same time. Further, the inorganic fertilizers are expensive and continuous use of these chemical fertilizers leads to the problem of soil deterioration. Organic manures alone are not able to supply all nutrients required for plant growth. However, use of proper proportion of organics along with inorganic nutrients not only helps in increasing the yield of the crop but also act as store house of nutrients besides it improves physical condition of soil Tayade et al. (2012). Keeping in view the above facts, an On Farm Trial (OFT) was conducted to find out the response of plum trees in terms of growth, yield & quality to conjoint application of organic and inorganic sources of nutrients.

MATERIALS AND METHODS

An on farm trial was conducted at different locations in district Poonch for three successive years. Nine apple plants of 12 years of age were selected in each trial at five different locations and total numbers of plants selected were forty five.

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The experiment was laid out in randomized block design (RBD) comprised of three treatments having three replications each. The treatments were **T_1**: Farmers' practice (Urea (500 g) + 10 kg FYM), **T_2**: Recommended dose (N (735g/tree), DAP (280g/ tree), MOP (1050g/ tree) and **T_3:** Intervention ($N_{40\%}$ +$VC_{50\%}$ + $FYM_{10\%}$, $P_{50\%}$ + $VC_{45\%}$ + $FYM_{5\%}$ and $K_{50\%}$+$VC_{40\%}$+$FYM_{10\%}$). Under intervention treatment, to meet out the 100 per cent dose of nutrients through the application of different organic and inorganic resources were (20 kg of Vermicompost and 20 kg of FYM) and remaining was applied by inorganic sources which was calculated on the basis of nutrient content percentage of manures and fertilizers. The chemical fertilizers (SSP and MOP) along with FYM were applied at the mid of December except N (urea) which was applied in two split dozes *i.e.,* first during before flowering and remaining half one month after first application. Vermicompost was used one month after chemical fertilizers application. Observations on annual shoot growth, trunk girth, tree height, fruit set, fruit yield and TSS were recorded. The data of three years were pooled and analyzed statistically as per Cochran and Cox (1963) for interpretation of results and drawing conclusions. Regarding economics of different treatments, cost incurred per tree on each treatment was worked out by calculating expenditures on variable as well as fixed inputs of each treatment. Simultaneously, gross return was also calculated by existing market rate of produce and unit fruit production of each treatment. Benefit was calculated by deducting expenditure from the gross return. Ratio of cost and benefit was then calculated for each treatment.

RESULTS AND DISCUSSION

Effect on growth parameters

The results of (Table 1), pooled data revealed that integrated nutrient management (INM) increased the growth parameters of plum trees. The highest annual shoot growth (50.39 cm), trunk girth (80.27 cm) and tree height (4.97m) were observed with the application of T_3: (($N_{40\%}$ +$VC_{50\%}$ + $FYM_{10\%}$, $P_{50\%}$ + $VC_{45\%}$ + $FYM_{5\%}$ and $K_{50\%}$+$VC_{40\%}$+$FYM_{10\%}$), Similar results were obtained by Thakur and Thakur (2014) who reported maximum vegetative growth with application of FYM and vermicompost along with chemical fertilizers. This might be due to the increased photosynthetic rate and carbohydrate accumulation as a result of multifarious role of FYM and vermicompost to allow most favourable conditions of soil with increased availability of plant nutrients responsible for better plant growth (Dutta *et al.* 2009); Goswami *et al*, 2012, Mir *et al*, 2015 and Khachi *et al*, 2015. Pathak and Ram (2005) also observed improved vegetative growth in guava with the application of different fertilizers, organic manures and biofertilizers. This increase in tree height, spread, volume, shoot length and number of shoot emergence per branch might be attributed to the simulative activity of microflora in the rhizosphere leading to increased nutrient availability and hence, vigorous plant growth (Singh *et al*, 2000).

Effect on fruit set, yield and quality

Increased percentage fruit set has been observed in T_3 (61.03%) and can be ascribed to increased availability of nutrients in the rhizosphere with conjoint application which have increased the translocation of metabolites from roots to flower to enhance pollen germination and pollen tube growth and hence increased fruit set (Singh *et al,* 2010). The highest fruit yield (38.89 kg/tree) (Table 2) was recorded with the application of T_3: (($N_{40\%}$ +$VC_{50\%}$ + $FYM_{10\%}$, $P_{50\%}$ + $VC_{45\%}$ + $FYM_{5\%}$ and $K_{50\%}$+$VC_{40\%}$+$FYM_{10\%}$). These findings indicated that integrated application of inorganic fertilizers, FYM and vermicompost was successful in maintaining higher levels of plum productivity. The present findings of increasing fruit yield by combined application of organic manures with inorganic fertilizers were in similarity with the findings of Mir *et al* (2015) who reported maximum fruit yield per plant of Pomegranate with the application of VC_{20} +B_{80} + FYM_{20} + GM + NPK_{75}. The increase in the yield was mainly attributed to relative increase in

Table 1. Effect of conjoint bio-organic and inorganic nutrient sources on annual shoot extension growth parameters of plum .

Treatment	Annual shoot growth (cm)				Trunk girth (cm)				Tree height (m)			
	2017	2018	2019	Pooled	2017	2018	2019	Pooled	2017	2018	2019	Pooled
T_1	37.12	40.25	45.85	41.07	77.15	78.20	78.85	78.06	3.15	3.40	3.85	3.46
T_2	38.20	42.55	48.33	43.02	78.15	79.10	80.30	79.18	4.20	4.56	4.65	4.47
T_3	45.84	49.20	56.15	50.39	79.16	80.45	81.22	80.27	4.57	4.90	5.45	4.97
CD (P=0.05)	1.47	1.98	2.56	2.05	1.49	0.92	1.73	0.73	0.11	0.15	0.09	0.05

Table 2. Effect of conjoint bio-organic and inorganic nutrient sources on yield and quality parameters of plum .

Treatment	Fruit set (%)				Fruit yield (kg/tree)				TSS (%)			
	2017	2018	2019	Pooled	2017	2018	2019	Pooled	2017	2018	2019	Pooled
T_1	45.65	47.56	49.25	47.48	22.25	23.45	25.15	23.61	15.15	15.65	15.50	15.43
T_2	52.44	55.78	58.25	55.49	32.10	34.25	35.86	34.07	17.10	17.35	17.55	17.33
T_3	55.65	62.10	65.35	61.03	36.14	39.20	41.35	38.89	18.15	18.25	18.20	18.20
CD (P=0.05)	2.56	1.54	2.27	2.11	1.28	3.58	5.88	3.69	1.63	1.88	1.11	1.05

Table 3. Economics of conjoint bio-organic and inorganic nutrient sources.

Treatment	Gross cost (lakh/ha)				Gross return (lakh/ha)				Net return (lakh/ha)				Benefit cost ratio			
	2017	2018	2019	Pooled	2017	2018	2019	Pooled	2017	2018	2019	Pooled	2017	2018	2019	Pooled
T_1	1.90	1.93	1.96	1.93	2.47	3.25	3.49	3.07	5.68	1.32	1.52	1.14	0.30	0.68	0.78	0.58
T_2	1.99	2.01	2.03	2.01	3.56	4.76	4.98	4.44	1.57	2.75	2.95	2.42	0.79	1.36	1.45	1.20
T_3	1.93	1.95	1.99	1.96	4.01	5.45	5.75	5.07	2.08	3.50	3.75	3.11	1.07	1.79	1.88	1.58
CD (P=0.05)	0.277	0.191	0.309	0.259	0.154	0.218	0.225	0.199	1.51	2.17	2.22	1.97	0.52	0.86	0.85	0.75

the availability of nutrients and better solute uptake by the plants. These results were in line with the findings of Thakur and Thakur (2013) and Khachi et al, (2015). The effectiveness of inorganic fertilizers was greatly enhanced when it was applied along with FYM, this might have resulted due to better retention of urea in root zone and better availability of phosphate and potash to the plants by organic matter.

It was also evident from the data that fruit quality parameter like TSS (18.20 ºBrix), was markedly improved by different conjoint application of organic and inorganic fertilizer nutrient sources due to action of joint application of organic sources and chemical fertilizers. The conjoint nutrient treatments might have acted complementary and supplementary to each other and resulted into adequate supply of nutrients (Pilani *et al,* 2010), enhanced photosynthesis activities which led to the accumulation of more carbohydrates, starch and other metabolites and ultimately translocation towards the fruit. These results were also in line with the findings of Fawzi *et al* (2010) and Singh *et al* (2010 a).

Cost benefit ratio

The data (Table 3) revealed that the per hectare highest gross income (Rs. 5.07 lakh), net income (Rs. 3.11 lakh) and benefit cost ratio (1.58) was observed with the treatment T_3 which was followed by treatment T_2 having gross income Rs. 443827, net income Rs. 242550 and benefit cost ratio Rs. 1.20. Hence, the treatment T_3: (($N_{40\%}$ +$VC_{50\%}$ + $FYM_{10\%}$, $P_{50\%}$ + $VC_{45\%}$ + $FYM_{5\%}$ and $K_{50\%}$+$VC_{40\%}$+$FYM_{10\%}$), was the best for improving the tree growth, fruit yield and quality and was also economic with more benefit cost ratio.

CONCLUSION

Based on the present investigation it may be concluded that the use of integrated nutrient management may played a vital role to enhance the growth, yield and quality attributes in plum and also economic with more benefit cost ratio.

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Received on 09/08/2020 *Accepted on 05/11/2020*