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INTEGRATED NUTRITIONAL MANAGEMENT AFFECTS THE GROWTH, FLOWERING AND FRUITING OF REJUVENATED BER

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ABSTRACT: The experiment was carried out in the Horticulture Garden of C.S. Azad University of Agriculture & Technology, Kanpur during 2009-11 to investigate integrated nutritional management effects on the growth, flowering, fruiting yield and quality of rejuvenated ber (*Zizyphus mauritiana* Lamk.) cv. Banarasi Karaka. The 35 years old ber plants were headed back with the help of hand saw after leaf fall during mid of May of 2009. There were six treatments of NPK (g) viz., T_1 (200:100:50), T_2 (400:200:100), T_3 (600:300:150), T_4 (800:400:200), T_5 (1000: 500:250), T_6 (Control – No fertilizer and manure) replicated four times in a RBD. Tree under all the treatments barring T6 were supplemented with 50 kg FYM. Fertilizer application through DAP, Urea and MoP was done just after pruning the trees. Application of T_5 promoted vegetative growth but blossoming, fruit set were maximized under T_4 where as the percentage of fruit drop was noted minimum under the lowest level of NPK i.e. T_1. The size and weight of fruit were noted greater under T_4 and smallest size and lesser weight were noted control. The fruit quality was augmented superior in respect of T.S.S., ascorbic acid and lower titratable acidity when the trees were supplemented with 800gN + 400g P + 200gK + 50Kg FYM. The same treatment gave significantly better harvest during first year (30.08 Kg fruits).

Keywords : *Ber, rejuvenation, NPK nutrition, yield, quality.*

Indian jujube (*Zizyphus mauritiana* Lamk.) is an important fruit crop of hot arid ecosystem due to less water requirement, wider adaptability, hardy nature and its ability to flourish well even in inferior soil. So it is known as "King of Arid Fruits". Ber fruit is within the reach of poor people, it is therefore, rightly known as a poor man's fruits. Besides providing the nutritive fruits, various parts of the ber tree possess medicinal value. Ber timber is utilized in the manufacturing of various farm implements and the leaves are good source of cattle feed particularly goats.

Pruning is essential component for the production of quality and quantity fruits, particularly in those fruit crops where fruiting takes place on current season growth. It is also done to avoid tip bearing and making balance between vegetative and reproductive growth. Fruiting in ber occurs in the axil of shoots of current year. Thus the quantum of production depends upon the number and vigour of shoots during current year. The age old ber orchards become heavily infested with weeds, diseases and insect pest and their branches become unproductive, which needs rejuvenation.

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MATERIALS AND METHODS

The experiment was carried out in the Horticulture Garden of C.S. Azad University of Agriculture & Technology, Kanpur during 2009-11 to investigate integrated nutritional management effects on the growth, flowering, fruiting, yield and quality of rejuvenated ber (*Zizyphus* mauritiana Lamk.) cv. Banarasi Karaka. Experimental trees were 35 years old, received uniform cultural operations throughout the experiment. The soil of the field is sandy loam with average fertility having pH of 7.5. Uneconomic ber trees were headed back with the help of hand saw after leaf fall during mid of May of 2009. There were six treatments of NPK (g) viz., T_1 (200:100:50), T_2 (400:200:100), T_3 (600:300:150), T_4 (800:400:200), T_5 (1000: 500:250), T_6 (Control–No fertilizer and manure) replicated four times in a RBD. Tree under all the treatments barring T_6 were supplemented with 50 kg FYM. Fertilizer application through DAP, Urea and MoP was done just after pruning of plants.

Observations regarding growth, flowering, fruiting, yield and quality of fruit were recorded periodically. The diameter and length of fruits and shoots were recorded with the help of vernier calipers and meter scale, fresh fruit weight with the help of electronic balance. Sugar, acidity and ascorbic acid contents of fruit were estimated as per A.O.A.C. (1).

RESULTS AND DISCUSSION

Growth parameters

From the perusal of data (Table 1), it is clear that the growth of shoots influenced significantly by various integrated nutritional management treatments. After pruning ber trees, number of sprouts emerged profusely under each treatment which varied significantly. Treatment T_5 supplied with 1000g N + 500g P + 250g K + 50 kg FYM produced significantly highest number of sprouts-shoots i.e. 56.50 sprouts remaining at par with T_4 (55.50 sprout). Well spaced and vigorous 10 shoots were retained on each tree. Their growth measured in terms of length were recorded 70, 90 and 110 days after heading back indicated that increasing level of fertilizers gave increased length of shoot significantly at all the stages of observations and it was 165, 312 and 512 cm under the maximum level of fertilizer closely followed by its respective lower level (T_4) being significantly at par with T_5. The trees under control obviously expressed poor shoot growth. The diameters of shoots recorded at periodical stages were also noted maximum under T_5. The numbers of secondary and tertiary branches were found significantly greater less than 1000 g N + 500 g P + 250 g K + 50kg FYM (10.5 and 10.9) treatment. All the above vegetative growth parameters of ber sprouts was recorded significantly poor under control.

Nitrogen (N) in optimal dose increased chlorophyll content imparting dark green colour to foliage as it governs to a considerable degree, the utilization of P, K and other elements. Phosphorus (P) closely related with cell multiplication and development, participates in the metabolism of carbohydrate and fat. Similarly potassium (K) might have accelerated enzymes action helping formation of protein and chlorophyll ultimately improving vegetative parameters. Organic manure (FYM) is universally known to improve physical properties of soil by increasing water holding capacity. Similar improvement through fertilizer schedule has been reported in fruit plants (Athani *et al.* 2; Chaudhary and Singh, 3; and Chaudhary *et al.* 4).

Floral and fruiting parameters

Integrated nutritional management after rejuvenation significantly influenced the floral parameters (Table 2). The flower initiation was hastened under control taking 129.55 days after heading back whereas, it was delayed by all the fertilizer treatment in increasing levels with a maximum of 137.80 days. The duration of blossom was longest in T_5 (1000 g N + 500 g P + 250 g K + 50kg FYM) of 11.55 days against the smallest duration (10.45 days) was recorded under control.

Fruit set under the influence of integrated manuring schedule (T_4) indicated 7.65% set followed by its respective higher (7.05%) and lower (6.40%) levels. However, the treatment causing higher fruit set failed to give higher retention and it was maximum under the lowest level (T_1) of fertilization (16.0%). Observations of Athani *et al.* (2) and Singh (8) are in line with the present findings. The size in terms of length and weight of fruit was recorded significantly greater under T_4 (3.99cm, 22.20 g) followed by its respective higher and lower levels. Lighter fruits of smaller size were harvested from control trees (17.90 g and 3.35 cm, respectively). The improvement in size and weight of fruit is obviously due to the optimal integrated nutritional schedule. The findings are in agreement with the reports of Kumar and Kumar (6) and Shyamal (9).

Fruit yield and quality

Yield and quality of fruits are ultimate aim of producer as in the present investigation of

Table 1: Effect of integrated nutritional management on the vegetative growth of rejuvenated ber cv. Banarasi Karaka.

Treatments	No. of sprouts	Retained shoots	Length of shoots(cm) Days after heading back			Diameter of shoots (cm) days after heading back			No. of the branches	
			70	90	110	70	90	110	Secondary	Tertiary
T_1 : 200g N+100g P + 50gK + 50kg FYM	52.5	10	159	282	505	2.34	3.35	4.41	9.15	7.25
T_2 : 400g N+200g P + 100gK+50kg FYM	54.26	10	161	283	459	2.40	3.39	4.45	9.45	7.65
T_3 : 600g N+300g P + 150gK+50kg FYM	54.50	10	164	285	662	2.43	3.40	4.46	9.65	7.75
T_4 : 800g N+400g P + 200gK+50kg FYM	55.5	10	164	302	508	2.56	3.76	4.64	9.75	9.70
T_5 : 1000g N+500g P + 250gK+50kg FYM	56.50	10	165	312	512	2.62	3.93	5.07	10.50	10.90
T_6 : Control	48	10	150	264	443	2.12	3.39	4.44	9.05	7.05
C.D. (P=0.05)	1.76	-	9.26	15.82	35.38	0.07	0.09	0.01	0.5	0.57

Table 2. Effect of integrated nutritional management on the flowering, fruiting, yield and quality of rejuvenated ber cv. Banarasi Karaka.

Treatments	Blossoming after heading back (days)	Duration of blossom	Fruit set (%)	Fruit retention (%)	Size of fruit length (cm)	Weight of fruit (g)	Yield (kg/plant)	T.S.S. (0 Brix)	Ascorbic acid (mg/ 100g)
T_1 : 200g N+100g P + 50gK + 50kg FYM	130.55	11.10	5.70	16.00	3.62	18.35	24.35	14.60	75.45
T_2 : 400g N+200g P + 100gK+50kg FYM	132.15	11.05	6.05	14.00	3.67	19.35	26.45	15.15	78.35
T_3 : 600g N+300g P +150gK+50kg FYM	130.65	11.20	6.40	13.50	3.63	19.10	27.32	15.75	81.50
T_4 : 800g N+400g P +200gK+50kg FYM	133.50	10.50	7.65	14.30	3.99	22.20	30.08	16.41	87.15
T_5 : 1000g N+500g P +250gK+50kg FYM	137.80	11.55	7.05	13.20	3.65	21.30	29.50	15.75	79.25
T_6 : Control	129.55	10.45	6.05	11.15	3.35	17.90	17.75	15.05	74.30
C.D.(P=0.05)	2.31	0.54	0.15	1.19	0.12	1.33	2.42	0.62	1.45

rejuvenation, ber trees yield was improved to the maximum (30.08 Kg/plant) when 800 g N +400g P + 200 g K + 50 kg FYM was applied (Table 2). A decrease in the yield was marked when the doses of NPK were increased. The yield under T_4 and T_5 were increased by 69.46 and 66.19% over control, respectively.

Chemical composition of fruits is also one of the most important parameters deciding their quality and marketability. During present investigation, application of 800g N+400g P + 200g K along with 50 kg FYM per tree enhanced the T.S.S. content to the tune of 16.41°Brix, lowering the acidity contents (0.21%) in fruits and increasing vit C contents (87.15 mg). Results are in consonance with Ghosh (5) and Pereira and Mitra (7).

Therefore, most superior fruits could be harvested when 800g N+ 400g P+ 200g K+50kg FYM tree was applied. An increase in N, P & K dose i.e. 1000g N+500g P+250g K in association with 50kg FYM brought about a slight deterioration in the quality traits i.e. 15.75°Brix T.S.S. and 81.50 mg/100 mg vit-C content. The fruits produced under lowest levels of N, P & K nutrients along with 50 kg FYM (200g N+100g P+50g K +50 Kg FYM), exhibited lesser T.S.S. and ascorbic acid, which were comparable to control. Thus, T_4 (800 g N+400 g P+200g K+50 kg FYM) proved optimal treatment for improving fruit quality as it improved T.S.S. and vit. C contents by 9.10% and 17.29% over control and reduced acidity at the same time by 0.22%.

Improvement in yield and quality of ber fruits may be attributed due to the optimal amount of NPK under agro-climatic conditions prevailing in North Gangetic Plains of the Country. Findings are in accordance with Chaudhary and Singh (3), Chaudhary *et al.* (4), Kumar and Kumar (6) and Shyamal (9).

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