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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PHYSICO-CHEMICAL PARAMETERS OF BER UNDER MALWA PLATEAU CONDITIONS

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ABSTRACT

A field experiment was carried out with different treatment combinations of organic manures (FYM @ 53, 39.75 and 26.5kg, Vermicompost @ 26.5, 19.86 and 13.25 kg and inorganic fertilizers (100%, 50% and 25% recommended dose of fertilizer), bio-fertilizers (Azotobacter and PSB) on five-year-old ber tree cv. Gola under Malwa plateau conditions. The results revealed that the application of 50 % recommended dose of NPK as Vermicompost + 50% RDF NPK+ 50g Azotobacter + 50g PSB significantly increased the fruit length (3.58 cm) and diameter (3.31 cm), fruit volume (22.25 ml), pulp weight (20.06 g), stone weight (1.91 g), TSS (20.85 ^{0}Brix), ascorbic acid (74.04 mg/100 g pulp), reducing sugar (5.15%), non-reducing sugars (4.74%), total sugars (9.89%), TSS/Acid Ratio (160.38) and Chlorophyll content in leaves spad value (71.00) over other treatments. Treatment having (50% RDF as FYM + 50% RDF NPK + Azotobacter + PSB proved the next best and lowest values for all the parameters were recorded under control.

Key words: Ber, integrated nutrient management, physico-chemical parameters.

INTRODUCTION

Ber (*Zizyphus mauritiana* Lamk.), the poor man's apple, is an important drought hardy fruit crop, which can be grown under hostile agro-climatic conditions of the arid region. Since it is hardy and salt tolerant, the tree can be grown even in marginal lands. Its fruit contains 14-16 % sugars, 150 mg vitamin-C per 100 g of pulp, besides other minerals. Ber grows in wild and cultivated forms in India. Integrated plant nutrient 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. Vermicompost has been advocated as good source of organic manures for use in integrated nutrient management practices of fruit crops. 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. In current scenario of organic agriculture, biofertilizers, more commonly known as microbial inoculants are choice of the farmers. 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) has been well established in many fruit crops; while such studies are very meagrely available in ber. Katiyar *et al.* (2012) also reported similar suggestions. Therefore, present investigation was undertaken to evaluate the effect of integrated plant nutrient management strategies in ber.

MTERIALS AND METHODS

A field experiment was conducted during winter season of 2012-13 at Department of Fruit Science, College of Horticulture, Mandsaur (M.P.) on five year old trees of ber cv. Gola. Three levels of inorganic and organic sources of NPK i.e., 424:315:327 g NPK (100% NPK), 212:157.5:163.5 g NPK (50% NPK) and 106:78.75:81.75 g NPK (25% NPK) three levels of FYM i.e., 53 kg FYM (100% FYM), 39.75 kg FYM (75% FYM) and 26.5 kg FYM (50% FYM) and three level of vermicompost i.e., 26.5 kg vermicompost (100% vermicompost), 19.875 kg vermicompost (75% vermicompost) and 13.25 kg vermicompost (50% vermicompost) Azotobacter and PSB inoculation (50 g each) were employed in the ber tree having uniform growth and vigour while the control plants received no fertilizer, inoculation and manure treatment. The treatment combinations were *i.e.* T_0-Control, T_1-100% RDF NPK fertilizer, T_2-100% RDF as FYM, T_3-100% RDF as VC, T_4- 50% RDF as FYM + 50% RDF NPK fertilizer, T_5-50% RDF as VC + 50% RDF NPK fertilizer, T_6-50% RDF as FYM + 50% RDF NPK fertilizer + PSB + Azotobacter, T_7-50% RDF as VC + 50% RDF NPK

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fertilizer + PSB + Azotobacter, T_8-75% RDF as FYM + 25% RDF NPK fertilizer, T_9-75% RDF as VC + 25% RDF NPK fertilizer, T_{10}-75% RDF as FYM + 25% RDF NPK fertilizer + PSB + Azotobacter, T_{11}-75% RDF as VC + 25% RDF NPK fertilizer + PSB + Azotobacter. The experiment was laid out in randomized block design with three replications. The whole of the organic manure (FYM and Vermicompost) was applied as a basal dose on the onset of monsoon. Then required doses of fertilizers were applied in two split doses in the month of July and August and then bio-fertilizers were applied one week after each application of inorganic fertilizer. The observation on length and diameter of fruit, fruit volume, pulp thickness, stone weight, pulp weight, average fruit weight, yield, acidity, TSS, TSS/Acid ratio, sugars (reducing and non-reducing) (Nelson 1944), ascorbic acid (Ranganna,1977) and chlorophyll content (spad value) in leaves were determined.

RESULTS AND DISCUSSION

The physical characteristics of fruit are an expression of a plant's vegetative activity which was also significantly influenced by various integrated nutrient treatments. The results (Table 1) revealed that maximum fruit length (3.58 cm) and diameter (3.31 cm) at harvest, volume of fruit (22.25 ml), pulp thickness (1.21 cm), pulp weight (20.06 g) and stone weight (1.91 g) were recorder by the application of 50% RDF as Vermicompost + 50% RDF NPK fertilizers + Azotobacter + PSB in ber, which was significantly superior to control. The increase in fruit size (length and width), weight and volume during the investigation period might be due to the increased photosynthetic ability of plants supplied with *Azotobacter* + vermicompost which in turn might have favoured and increased the accumulation of dry matter. Fruit size, weight and volume are highly correlated with dry matter content and balanced level of hormone. Nitrogen fixers are known for accumulation of dry matter and their translocation as well as favours synthesis of different growth regulators (Awasthi *et al.* 1998). These findings are in accordance with the findings of Singh *et al.* (2012) in aonla, Katiyar *et al.* (2012) and Mishra *et al.* (2011) in ber.

Table 1: Effect of integrated nutrient treatments on physical parameters of ber

Treatments	Fruit length at harvest (cm)	Fruit diameter at harvest (cm)	Fruit volume (ml)	Pulp thickness (cm)	Stone weight (g)	Pulp weight (g)
T_0	3.26	2.91	15.83	0.90	1.29	13.74
T_1	3.50	3.17	19.83	1.10	1.48	18.03
T_2	3.38	2.91	17.21	0.93	1.34	15.06
T_3	3.38	2.93	17.58	0.95	1.37	15.35
T_4	3.51	3.21	20.17	1.13	1.57	18.31
T_5	3.55	3.22	20.83	1.14	1.59	18.94
T_6	3.55	3.23	21.83	1.17	1.65	19.75
T_7	3.58	3.31	22.25	1.21	1.91	20.06
T_8	3.39	3.02	18.33	0.99	1.40	16.36
T_9	3.41	3.04	18.54	1.01	1.42	16.71
T_{10}	3.41	3.08	19.25	1.01	1.43	17.11
T_{11}	3.42	3.08	19.58	1.06	1.45	17.75
CD (p=0.05)	0.10	0.18	1.51	0.04	0.06	1.79

The qualitative parameters of fruit were affected by different treatments (Table 2). The results revealed the minimum acidity (0.13%) and maximum TSS/acid ratio (160.38), ascorbic acid (74.04 mg), total soluble solids (20.85 0Brix), total sugars (9.89%), reducing sugar (5.15%) and non-reducing sugar (4.74%) were recorded by the application of 50% RDF as Vermicompost + 50% RDF NPK fertilizers+ Azotobacter + PSB, which were significantly superior to control. The increased fruit quality may be explained from the fact that the different sources of nutrients enhance the nutrient availability by enhancing the capability of plants for better uptake of nutrients from rhizosphere. These results are in conformity with the findings of Korwar *et al.* (2006), Singh *et al.* (2012), Athani *et al.* (2009). 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. An increase in TSS and total sugars contents with *Azotobacter* and vermicompost application may be attributed due to the quick metabolic transformation of starch and pectin into soluble compounds and rapid translocation of sugars from leaves to the developing fruits, conversion of complex polysaccharides into simple sugars. These findings are in agreement with the result of Athani *et al.* (2009) in guava. The maximum amount of ascorbic acid was recorded in fruits produced from the plants fertilized with

vermicompost + NPK + *Azotobacter* + PSB (Tripathi *et al.* 2010, Yadav *et al.* 2010). The respective increase in ascorbic acid content might be due to increased efficiency of microbial inoculants to fix atmospheric nitrogen, increase in availability of phosphorous and secretion of growth promoting substances which accelerates the physiological process like carbohydrates synthesis, (Gupta and Tripathi 2012). Based on the above results, application of 50% RDF through Vermicompost + 50% RD through fertilizer NPK + PSB + *Azotobacter* registered significantly higher physico-chemical attributes in ber.

Table 2: Effect of integrated nutrient treatments on quality of ber

Treatments	Acidity (%)	TSS (^{0}Brix)	TSS/Acid Ratio	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	Ascorbic acid (mg/100g pulp)	Chlorophyll in leaves (Spad value)
T_0	0.22	14.92	67.8	7.95	4.45	3.50	64.57	54.76
T_1	0.15	20.00	133.3	9.35	4.89	4.46	70.23	63.47
T_2	0.22	15.33	69.6	8.60	4.62	3.98	65.25	55.38
T_3	0.19	16.54	87.0	8.65	4.82	3.83	68.04	58.28
T_4	0.15	20.00	133.3	9.03	4.95	4.09	72.05	64.30
T_5	0.14	20.02	143.0	9.47	4.99	4.48	72.29	65.01
T_6	0.14	20.17	144.0	9.56	5.06	4.49	73.32	68.29
T_7	0.13	20.85	160.3	9.89	5.15	4.74	74.04	71.00
T_8	0.17	16.88	99.2	8.69	4.71	3.98	68.99	58.23
T_9	0.16	18.00	112.5	8.79	4.79	3.99	69.48	60.97
T_{10}	0.16	18.83	117.6	8.99	4.99	4.00	69.99	61.45
T_{11}	0.16	19.50	121.8	9.16	4.86	4.31	70.10	62.12
CD (p=0.05)	0.04	2.02	9.68	0.29	0.37	0.34	3.73	4.84

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