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Effect of integrated nutrient management on physico-chemical attributes of ber fruit cv. Banarasi Karaka

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Abstract

An experiment was conducted during 2016-17 at Main Experiment Station, N.D. University of Agriculture & Technology, Kumarganj, Faizabad (U.P,) to study the physico-chemical attributes of ber fruit cv. Banarasi Karaka. The experiment comprised of three replications with seven treatments in RBD *viz*. T_1 (Control), T_2 (100% RDF through NPK),T_3 (100% FYM), T_4 (50% FYM + 50% RDF through NPK), T_5 (50% FYM + 50% (PSB + Azotobacter), T_6 (75% FYM + 25% RDF through NPK), T_7 (75% FYM + 25% RDF through NPK + 25% (PSB + Azotobacter). Therefore, it may be recommended application of treatment T_7 is (75% FYM + 25% RDF through NPK + each 25% PSB + Azotobacter) to ber growers for obtaining larger and heavier ber fruit followed by application of 50% RDF through FYM + 50% RDF through NPK.

Key words: Ber, nutrient management, bio-fertilizers

Introduction

Ber (*Zizyphus mauritiana* Lamk.) is one of the most ancient and common fruit indigenous to India and belong to family Rhamnaceae. It is also known as Chinese date or Chinese fig and commonly consider as poor man's fruit. It is reported to grow in other countries like Iran, Syria, Australia, USA, France and certain parts of Italy, Spain, and Africa *etc*. Precisely, it is seen to grow under tropical and sub-tropical as well as mediterranean region of the world. The ber tree is drought hardy and can grow under the most hazardous condition of soil, water and climate. Ripe ber fruits are eaten fresh. Fruits are also dried and used as dessert purpose. It gives an excellent product when candied. Other processed products made are ber butter, ber juice or squash, ready to serve (RTS), beverage, jam, murabba and ber pickles. Besides fruit different part of tree like root bark, leaves, flower and seed are being used in Ayurvedic and Unani medicines for treatment of headache, bleeding, gums and asthma. The powder and decoction prepared from the roots are effective in case of fever, ulcers and old wounds. The stem bark is considered to be a remedy for diarrhoea; it is also blood purifier and appetizer. The leaves are used as fodder for the animal (Bakshi and Singh, 1974) and it became hardy nature and prolific bearer. The stem gives a quality wood which is used for making various agricultural implements.

It is one of the most nutritious fruit and good source of vitamin A, B and C. The ripe ber fruits have high nutritive values and conventionally. The ber fruit is richer than apple in protein, phosphorus, calcium and vitamin 'C' (Bakshi and Singh, 1974) and one hundred gram of edible ber fruit contains moisture (85.9%), protein (0.8g), fat (0.1g), carbohydrate (12.88%), calcium (0.03g), phosphorus (0.03g), iron (0.8g), carotene (70 IU) and vitamin 'C' (50-100 mg), TSS (°Brix) 12.21, total sugars 3.1-14.5%, reducing sugars 1.4-2.4%, non reducing sugar 4.3-9.7%, pH 4.2-4.8% acidity 0.13-1.42%, total ash 0.34-0.45% and ascorbic acid 73-103 mg/100g of pulp. The farm yard manure (FYM) seems to be directly responsible in increasing crop yields either by accelerating the respiratory process by increasing cell permeability by hormone growth action or by combination of all these processes. The farm yard manure contains 0.5-1.5% nitrogen, 0.4-0.8% phosphorus and 0.5-0.9% potassium. Biofertilizers are substance which contains living micro-organisms, which when applied to soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. Biofertilizers are also able to fix 20200 kg N/ha/year, solubilize P in the range of 3050 kg P_2O_5 ha/year and mobilizes P, Zn, Fe, Mo to varying extent and help to build up the lost micro-flora and play important role in increasing crop productivity (Hazarika and Ansari, 2007). *Azotobacter* is an aerobic, free living nitrogen fixer. When applied to soil, they multiply rapidly and develop a thick population in rhizosphere. PSB is the effective strain of phosphate solubilizing bacteria used in increasing the level of available P in the soil. It is a phosphate solubilizing bio-fertilizer. The present investigation was, undertaken to evaluate the "Studies on integrated nutrient management on physico-chemical attributes of ber fruit (*Zizyphus mauritiana* L.) cv. Banarasi Karaka".

Material and Methods

In the investigation, 27 years old plants of ber cv. Banarasi Karaka having uniform vigour and productivity were selected as experimental material to find out yield and quality

of ber fruits. The present investigation was carried out at the main experimental station, Department of Horticulture, A.N.D.U.A.&T, Ayodhya (U.P.) during the year 2016-2017. The experiment was laid out in Factorial Randomized Block Design with 12 treatments and 3 replications. There were seven treatment combinations *viz*. T_1 (Control), T_2 (100% RDF through NPK), T_3 (100% FYM), T_4 (50% FYM + 50% RDF through NPK), T_5 (50% FYM + 50% (PSB + *Azotobacter*), T_6 (75% FYM + 25% RDF through NPK) and T_7 (75% FYM + 25% RDF through NPK + 25% (PSB + *Azotobacter*).

Results and Discussion

The important results obtained have been discussed in the light of available literature in succeeding heads.

Physical parameters

Result showed that maximum fruit length (4.18 cm), fruit width (3.8 cm) and fruit weight (20.27) at harvest with the application of T_7 (75% FYM + 25% RDF through NPK + 25% (PSB + *Azotobacter*) was significantly superior to T_1, T_2, T_3, T_5, and T_6. The increase in fruit length and width by the application of integrated nutrient treatments might be due to optimum supply of plant nutrients and growth hormones in right amount during the entire crop period causing vigorous vegetative development of the plants and ultimately production of more photosynthetic material. Improvement in physical character of fruits on account of FYM application might have been attributed to the translocation of nutrients from soil to the plants and enhanced supply of macro and micro-nutrients during entire growing season. The various positive effects of biofertilizers on physical parameter like fruit length and diameter may be due to the fact that biofertilizers encouraged better growth and accumulates optimum dry matter with induction of growth hormones, which stimulated cell division, cell elongation, activate the photosynthesis process, enhances translocation of water and nutrients, growth and development of roots as well as energy transformation which in turn causes increase in number and weight of the fruits and other physical characters. The maximum average fruit weight (20.27 g) was recorded in application of T_7 (75% FYM + 25% RDF through NPK + 25% (PSB + *Azotobacter*) which is followed by T_4 (78.13 kg) were significantly superior to control, T_2, T_3, T_5, and T_6 (Table 1). The enhancement in yield by these treatments was mainly 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.

Chemical parameters

Application of organics and chemical fertilizers along with biofertilizers not only increased the yield but also improved the fruit quality (Table 2). Their application significantly influenced the chemical constituents' *viz*. TSS, reducing, non-reducing and total sugars, ascorbic acid of the

Table 1. Effect of intergrated nutrient management on physical attributes of ber fruits

Treatments	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)
T_1	3.26	2.60	16.18
T_2	3.94	2.92	18.26
T_3	3.56	2.76	17.12
T_4	4.07	3.02	18.84
T_5	3.72	2.78	17.28
T_6	3.83	2.87	17.85
T_7	4.18	3.78	20.27
SEm±	0.13	0.10	0.75
CD at 5%	0.39	0.30	2.08

Table 2. Effect of intergrated nutrient management on bio-chemical attributes of ber fruits

Treatments	T.S.S. (^{0}Brix)	Titrable acidity (%)	Ascorbic acid (mg/100g pulp)	Reducing sugars (%)	Non reducing sugars (%)	Total sugars (%)
T_1	13.32	0.24	65.20	3.25	4.26	7.51
T_2	15.19	0.20	70.18	4.38	4.56	8.94
T_3	14.04	0.22	65.95	4.17	4.38	8.55
T_4	16.09	0.18	72.45	4.33	4.54	8.87
T_5	16.61	0.18	68.41	4.21	4.45	8.66
T_6	15.19	0.21	71.53	4.57	4.68	9.25
T_7	17.40	0.17	74.63	4.70	4.81	9.51
SEm±	0.70	0.01	1.13	0.09	0.07	0.12
CD at 5%	2.16	0.03	3.48	0.29	0.21	0.37

fruit over the control. The minimum acidity (0.17%) and maximum ascorbic acid (74.63 mg), total soluble solids (17.40 ^{0}Brix), reducing sugars (4.70%) and non-reducing sugar (4.81%) total sugars (9.51) were recorded in application of T_7 (75% FYM + 25% RDF through NPK + 25% (PSB + *Azotobacter*) which were significantly superior to control. The improvement in various chemical characteristics by application of optimum dose of NPK may be explained by the fact that phosphorus enters into the composition of phospholipids and nucleic acids, the latter combines with proteins and result in the formation of nucleus proteins which are important constituents of the nuclei of the cells. Potassium acts as a catalyst in the formation of more complex substances and in the acceleration of enzyme activity. These carbohydrates and coenzymes are beneficial in the improvement of fruit quality and nitrogen enhances the uptake of phosphorus and potassium. The chain reactions in these components might have possibly been reasons for the improvement in quality of the fruit. Similar results have also been reported by Yadav *et al.* (2007) in aonla and Bohne & Tiwari (2014).

Azotobacter and PSB inoculation resulted in overall increase in plant growth, fruit yield and quality which can be explained in a way that *Azotobacter* and PSB contribute up to 20-30% N and 25-50% P_2O_5 in soil, respectively. Ber responds well to the application of manures and fertilizers, hence biofertilizers application improved plant growth, fruit yield and chemical composition through rapid mineralization and transformation of plant nutrients in soil and also through the exertion of plant growth promoting substances mainly IAA, gibberellic acid and cytokinins like substances, vitamins and amino acid by microorganism. These results are in accordance with the findings of Shukla *et al.* (2009) in guava, Singh *et al.* (2011) in mango, Lesha *et al.* (2016) in ber and Singh *et al.* (2017) in strawberry.

Results of present study indicated that the application of 75% FYM + 25% RDF through NPK + each 25% PSB + *Azotobacter* gave better quantitative and qualitative trades *viz*., fruit length (cm), fruit weight (g), fruit width (cm), TSS (°Brix), acidity (%), ascorbic acid, Total sugar (%), reducing and non- reducing sugar (%) of ber fruit followed by application of 50% RDF through FYM + 50% RDF through NPK. Therefore, the application of 75% FYM + 25% RDF through NPK + each 25% PSB + *Azotobactor* may be recommended to ber growers for obtaining better yield and quality of ber fruit.

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