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Impact of Integrated Nutrient Management on Physico-chemical Attributes of Ber (*Zizyphus mauritiana* Lamk.) cv. Umran under Bundelkhand Region

ANAND SINGH, SHARAD KUMAR SINGH, BIJENDRA KUMAR SINGH AND PUSHPENDRA*
Banda University of Agriculture and Technology, Banda
**Corresponding author- pushpendra770404@gmail.com*

Abstract

A field experiment was carried out at Department of Fruit Science, College of Horticulture, Banda University of Agriculture and Technology, Banda (Uttar Pradesh) using various treatment combinations of inorganic fertilizers (100%, 75%, 50%, and 25% NPK recommended dose of fertilizer), organic manures (FYM, Vermicompost, Mushroom waste) and bio-fertilizers (Azotobacter and PSB). The maximum fruit length, fruit diameter, pulp thickness, stone weight and pulp weight were recorded by the application of 75% NPK +VC + Azotobacter + PSB and total soluble solid (20.14 ^{0}Brix), TSS/acid ratio (118.46%), total sugars (9.48%), reducing sugar (5.24%) and non-reducing sugar (4.23%) were all significantly increased and titratable acidity (0.15%), ascorbic acid (62.17 mg/100g of pulp) by the application of 50% NPK + VC+ Azotobacter + PSB according to the results.

Keywords: Vermicompost, Mushroom, Azotobacter, bio-fertilizers, PSB

Introduction

The Rhamnaceae family includes the highly significant dryland fruit crop known as ber (*Zizyphus mauritiana* Lamk.). It is sometimes referred to as poor man's fruit and is also known as Chinese date or Chinese fig. This fruit probably originates from India. Other countries including Iran, Syria, Australia, the United States, France, and some regions of Italy, Spain, and Africa have been reported to grow it. It is seen to grow particularly in the Mediterranean and other tropical and subtropical regions of the world. India is a major state that is growing, including Gujarat, Maharashtra, Punjab, Haryana, Uttar Pradesh, and Madhya Pradesh. It is widely grown due to its ability to survive in any kind of soil and climate conditions, including drought. Ber orchards are commonly observed in the districts of Raibareilly, Agra, Aligarh, Banda, Hamirpur, Mahoba, Varanasi, Faizabad, and Aligarh in Uttar Pradesh. Ber is a one of the nutritional fruit, it's a high source of vitamins A, B, and C. Ber fruits are richer than apple in proteins, phosphorus, calcium, carotene and ascorbic acid. Reducing the requirement for inorganic fertilizer, increasing the proportion of organic matter in the soil, improving nutrient use efficiency, maintaining the physical, chemical, and biological qualities of the soil, maintaining the balance between nutrients supplied to and removed by plants, and enhancing soil health and productivity throughout the years are the objectives of integrated plant nutrient management. Farmers choose to use biofertilizers, sometimes referred to as microbial inoculants, in the current organic agricultural environment. These are cultures of particular soil microorganisms that have been artificially developed in order to increase agricultural yield and soil fertility. By improving the plant's ability to absorb nutrients, biofertilizers not only help plants grow rapidly but also protect them against diseases that are carried by the soil. Additionally, biofertilizers assist in the effective utilization of solid waste and composting, both of which increase soil health. Thus, with improved soil quality and increased plant production, biofertilizers

serve an ecologically friendly and need-based alternative to chemical fertilizers. In many fruit crops, the role of nutrient elements, either by itself or in together with other sources (organic manures/ fertilizers), has been well established; however, there are only a few investigations of this type in Ber. Similar recommendations were also given by Bohane *et al*. (2014). Therefore, present investigation was undertaken to evaluate the impact of integrated nutrient management of ber in Bundelkhand region.

Materials and Methods

A field experiment was conducted during winter season of 2022-23 at Department of Fruit Science, College of Horticulture, Banda University of Agriculture and Technology, Banda (U.P.) on five year old trees of ber cv. Umran. The experiment was laid out in Randomized Block Design (RBD) with following 11 treatments were replicated three times. T_0-Control, T_1-100% NPK, T_2- 75% NPK + FYM+ Azotobacter + PSB, T_3-75% NPK +VC + Azotobacter + PSB, T_4- 75% NPK + Mushroom waste + Azotobacter + PSB, T_5-50% NPK + FYM + Azotobacter + PSB, T_6-50% NPK + VC+ Azotobacter + PSB, T_7-50% NPK + Mushroom waste + Azotobacter + PSB, T_8-25% NPK + FYM + Azotobacter + PSB, T_9-25% NPK + VC + Azotobacter + PSB, T_{10}-25% NPK + Mushroom waste + Azotobacter + PSB. 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 two week after each application of inorganic fertilizer. The observation on length and diameter of fruit, pulp thickness, stone weight, pulp weight, average fruit weight, yield, acidity, TSS, TSS/Acid ratio, sugars (reducing and non-reducing) (Bohane *et al*. (2014)

Results and Discussion

Fruit's physical attributes reveal a plant's vegetative activity, which has been significantly influenced by several of integrated nutrient treatments. The application of 75% NPK +VC + Azotobacter + PSB in Umran ber produced maximum fruit length (3.71 cm) and fruit diameter (3.38 cm) at harvest, pulp thickness (1.22 cm), pulp weight (20.61 g), and stone weight (1.86 g), which was significantly greater than the control. The results (Table 1) showed this. The increase in fruit size (length and width) and weight 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 and weight 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. These findings are in accordance with the findings of Lesha Bohane

Table 1: Impact of Integrated Nutrient Management on Physical Properties of Ber

Treatments	Fruit length (cm)	Fruit diameter (cm)	Pulp thickness (cm)	Stone weight (g)	Pulp weight (g)
T_0	3.38	2.96	0.92	1.21	14.12
T_1	3.40	2.98	0.96	1.24	14.97
T_2	3.68	3.35	1.18	1.74	18.44
T_3	3.71	3.38	1.22	1.86	20.61
T_4	3.64	3.33	1.16	1.65	17.56
T_5	3.53	3.23	1.14	1.56	16.45
T_6	3.67	3.26	1.15	1.63	17.04
T_7	3.42	3.22	1.05	1.45	16.15
T_8	3.48	3.21	0.97	1.38	16.12
T_9	3.51	3.22	1.02	1.41	16.20
T_{10}	3.41	3.12	0.95	1.32	15.68
CD (p=0.05)	0.006	0.088	0.008	0.010	0.299

Table 2: Impact of Integrated Nutrient Management on Chemical Attributes of Ber

Treatments	Acidity (%)	TSS (^{0}Brix)	TSS/Acid ratio (%)	Total Sugars (%)	Reducing Sugar (%)	Non-reducing sugar (%)	Ascorbic acid (mg/100g pulp)
T_0	0.26	13.81	53.15	7.11	4.24	2.88	71.53
T_1	0.22	14.32	79.55	8.09	4.06	4.01	69.48
T_2	0.17	16.75	97.04	8.53	4.66	3.87	63.23
T_3	0.17	17.24	97.55	8.62	4.85	3.76	63.15
T_4	0.18	15.62	88.11	8.42	4.63	3.78	64.28
T_5	0.15	18.44	111.85	9.24	5.09	4.15	62.86
T_6	0.15	20.14	118.46	9.48	5.24	4.23	62.17
T_7	0.16	18.43	103.05	8.74	4.95	3.78	63.08
T_8	0.19	15.12	82.19	8.13	4.32	3.80	67.31
T_9	0.19	15.44	83.86	8.27	4.66	3.60	65.14
T_{10}	0.20	14.97	79.56	8.13	4.23	3.89	68.96
CD (p=0.05)	0.009	0.033	0.026	0.009	0.012	0.013	0.011

and Rajesh Tiwari (2014) in ber, Singh *et al*. (2012) in Aonla, Katiyar *et al.* (2012) and Mishra *et al*. (2011) in Ber.

The qualitative parameters of fruit were affected by different treatments (Table 2). The results revealed the maximum total soluble solids (20.14 ^{0}Brix), TSS/acid ratio (118.46), total sugars (9.48%), reducing sugar (5.24%), non-reducing sugar (4.23%) and minimum ascorbic acid (62.17 mg/100g), acidity (0.15%) were recorded by the application of 50% NPK + VC+ 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 Bhattacharjee *et al.* (2024) Korwar *et al.* (2006), Singh *et al.* (2012), Athani *et al.* (2009) and Abdel-Sattar *et al.* (2021) in Indian jujube. 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 and Kumar *et al*. (2023) in aonla. The maximum amount of ascorbic acid was recorded in fruits produced from the plants fertilized with vermicompost + NPK + Azotobacter + PSB (Tripathi *et al*., and 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.

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