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Performance of nitrogen and zinc on yield and physico-chemical composition of ber (*Zizyphus mauritiana* Lamk) fruits cv. Gola

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Abstract

A field experiment was carried out to study the influence of different levels of nitrogen (250, 500 and 750g plant^{-1} year^{-1}) and zinc sulphate (0.4, 0.6 and 0.8 per cent plant^{-1} year^{-1}) on yield and physico-chemical composition of ber fruits. Applications of 500g nitrogen and 0.6% zinc sulphate plant^{-1} exhibited highest fruit yield with maximum dry matter, pulp, pulp: seed ratio, TSS, ascorbic acid, reducing sugar, non reducing sugar, total sugars and minimum moisture and seed content.

Key words: *Ber, nitrogen, zinc, yield, physico-chemical quality parameters.*

Introduction

The ber (*Zizyphus mauritiana* Lamk) is hardy fruit plant, regular bearing habit and adaptability to adverse climatic condition. It can give better income on marginal lands where other fruit plant and crops can not survive. Since the ber crops is mainly grown in arid and semi-arid region where major and minor nutrients are lacking, the need for fertilizer application becomes essential. Among the major nutrients, nitrogen is considered to be the vital in case of ber and its requirement, depends on agro climatic situation where crop is grown.

In arid and semi-arid region, one of the factors which can ensure lucrative income from ber growing area continuously over number of years is proper feeding and judicious use of nutrients for plants. In case of ber nutrition, increase the fruit plant nutrient, nitrogen is major nutrient and zinc is minor nutrient, which are already deficient in Rajasthan soil (Akbary *et al.* 1995). Doses of these nutrients affect the quantity and quality of ber fruits. With this observation that present investigation was undertaken to carried out the application of nitrogen in soil in split and zinc as foliar spray on the performance of yield and quality of ber fruits.

Material and methods

The investigation was carried out on productive, healthy and vigorous ber trees cv. Gola at Central Arid Zone Research Institute, Krishi Vigyan Kendra Pali, during 2004-05 and 2005-06. The location was latitude 25^{0} 47'13" north altitudes and 73^{0} 18' 42" east longitudes. The experimental soil was silty loam with available nitrogen (135.9kg ha^{-1}), available phosphorus (18.2kg ha^{-1}), potassium (256.1 kg ha^{-1}), Zinc (0.18 ppm) and p^{H} 8.3. The area received annual rainfall of 325.9 and 645.6mm and average minimum 3.2^{0}C and maximum 43.4^{0}C temperature. Of the total precipitation 90 per cent was received during July to September. The relative humidity ranged from 25 to 95 per cent during the experimental span. The treatments composed of three levels of nitrogen viz 250, 500 and 750g plant^{-1} year^{-1} and three levels of zinc sulphate 0.4, 0.6 and 0.8 per cent plant^{-1} year^{-1}. In all, there were ten treatment combinations including control. The experiment was laid out in RBD with factorial approach having three replications. Half dose was applied in month of July and remaining dose of nitrogen was applied in month of November. The zinc sulphate was sprayed thrice along with equal dose of lime for neutralization and teepol as a sticking agent in the Ist week of August, September and October.

All the common cultural practices were adopted and the ber trees were maintained under uniform conditions of orchard management. At the time ber fruit green colour turned light yellow colour (ripening stage), fruits were harvested and the yield was recorded accordingly. In all, there were 5 pickings. A sample of 500g fruits was collected randomly from 2nd picking from each treatment under all the replications to estimate the physico-chemical characteristics viz; moisture (%), dry matter (%), pulp

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content (%), seed content (%), pulp: seed ratio, TSS (%), ascorbic acid (mg 100g^{-1} pulp), reducing sugar (%), non-reducing sugar (%) and total sugars (%). Pulp of the fruits was separated after removing the seeds and weight of pulp and seed was recorded and pulp: seed ratio was calculated accordingly. Fruit pulp was dehydrated at 60°C up to constant weight and total dry matter and moisture content was recorded. Total soluble solids (TSS) of the fruits were measured with the help of 'Erma' hand refractometer and corrected at 20°C temperature. Ascorbic acid, reducing sugar, non- reducing sugar and total sugar contents were determined with the help of methods suggested by A.O.A.C. (1990). The data for both the years were pooled and statistically analyzed with the help of method suggested by Gomez and Gomez (1984).

Result and discussion

The application of nitrogen significantly increased the dry matter, pulp, pulp: seed ratio, TSS, ascorbic acid, reducing sugar, total sugar and yield of fruit. However, non reducing sugar was not influenced significantly by the application of nitrogen. The maximum pulp content (91.27%), pulp: seed ratio (10.80), TSS (16.75%), ascorbic acid content (87.53mg100g^{-1}), reducing sugar (5.30%), total sugar (10.71%) and yield of fruits (37.82kg tree^{-1}) were recorded at N_2 (500g N tree^{-1}) treatment as compared to minimum (85.40%, 5.86, 14.41%, 65.39mg 100g^{-1}, 3.75%, 8.56% and 26.81 kg tree^{-1}, respectively) under control, while the dry matter content (21.36%) was the highest with 750g N tree^{-1} treatment and lowest (17.79%) under control. On other hand the moisture and seed content decreased significantly with the increasing rate of nitrogen from unfertilized control to 750g N tree^{-1} treatment. The lowest moisture (78.56%) content was recorded at 750g N tree^{-1}, while the minimum seed content (8.73%) was recorded at 500g N tree^{-1} treatment as compared to the maximum values of these parameters (82.21% and 14.60%, respectively) under control (Table 1 and 2).

The useful effect of nitrogen is attributed to increased efficiency of metabolic and physiological processes of plants, which encouraged the growth of trees and consequently increased size and weight of fruits. The size of fruit depends mainly upon the photosynthetic activity of plants and hence the healthy plants produced the fruits with maximum length, diameter, weight and volume (Singh *et al.*, 1996). The probable reason for the improvement in size may be due to the beneficial effect of N in cell division and cell enlargement, and increased activities of living tissues such as parenchyma. These changes altogether produced ultimately higher yield of ber in this investigation. Unsurprisingly, similar results had been reported by Lal *et al.* (2001 and 2003), Prasad and Bankar (2002), Prasad and Vashishtha (2004), and Prasad. (2004) in ber.

The foliar application of zinc significantly influenced the, dry matter, pulp, pulp: seed ratio, ascorbic acid, reducing sugar, total sugar and yield of fruits, while moisture and seed content significantly decreased with the foliar application of zinc. The maximum dry matter content (21.25%), pulp (91.28%), pulp: seed ratio (10.77), ascorbic acid (87.30mg 100g^{-1}), reducing sugar (5.33%), total sugars (10.66%) and fruit yield (37.42 kg tree^{-1}) were recorded at Zn_2 (0.6% $ZnSO_4$) as compared to minimum (17.79%, 85.40%, 5.86, 65.39 mg 100g^{-1}, 3.75%, 8.56% and 26.81 kg tree^{-1}, respectively) under control, while TSS content in fruit (16.65%) was maximum at Zn_3 (0.8% $ZnSO_4$) treatment as compared to minimum (14.41%) under control. However, the lowest moisture (78.74%), and seed content (8.72%) were recorded at Zn_2 (0.6% $ZnSO_4$) treatment as compared to highest (82.21% and 14.60%, respectively) under control (Table 1 and 2).

The improvement in quality of fruits with the application of zinc might also be due to improved auxin content and at zinc acting as a catalyst in oxidation-reduction process. Besides, zinc helps the enzymatic reaction like hexokinase and formation of cellulose. Change

Table 1. Effect of N and Zn on moisture, dry matter, pulp and seed content of ber fruits.

Treatment	*Moisture(%)*	*Dry matter(%)*	*Pulp(%)*	*Seed content(%)*	*Pulp seedratio*
Unfertilized control	82.21	17.79	85.40	14.60	5.86
250g N tree^{-1} (N_1)	79.68	20.31	90.34	9.64	9.58
500g N tree^{-1} (N_2)	78.71	21.26	91.27	8.73	10.80
750g N tree^{-1} (N_3)	78.56	21.36	91.20	8.77	10.56
SEm±	0.16	0.16	0.15	0.15	0.20
0.4% $ZnSO_4$ (Z_1)	79.46	20.48	90.46	9.50	9.73
0.6% $ZnSO_4$ (Z_2)	78.74	21.25	91.28	8.72	10.77
0.8% $ZnSO_4$ (Z_3)	78.76	21.19	91.08	8.92	10.43
SEm±	0.16	0.16	0.15	0.15	0.20
C D 5%	0.46	0.45	0.43	0.42	0.56

Table 2. Effect of N and Zn on yield, TSS, ascorbic acid sugars content of ber fruits.

Treatment	TSS (%)	Ascorbic acid (mg100g^{-1} pulp)	Reducing (Sugar %)	Non- reducing (Sugar %)	Total Sugar (%)	Yieldkg/tree^{-1}
Unfertilized control	14.41	65.39	3.75	4.55	8.56	26.81
250g N tree $^{-1}$ (N_1)	15.82	80.50	4.85	5.23	10.23	34.48
500g N tree $^{-1}$ (N_2)	16.75	87.53	5.30	5.49	10.71	37.82
750g N tree $^{-1}$ (N_3)	16.67	86.38	5.17	5.21	10.15	37.62
SEm±	0.09	1.03	0.08	0.11	0.09	0.27
C D 5%	0.25	2.89	0.21	NS	0.26	0.76
0.4% $ZnSO_4$ (Z_1)	16.14	81.73	4.88	5.28	10.16	35.63
0.6% $ZnSO_4$ (Z_2)	16.45	87.30	5.33	5.39	10.66	37.42
0.8% $ZnSO_4$ (Z_3)	16.65	85.38	5.10	5.26	10.27	36.88
SEm±	0.09	1.03	0.08	0.11	0.09	0.27
C D 5%	0.25	2.89	0.21	NS	0.26	0.76

in sugar content of fruit may be attributed to the action of zinc on zymohexose, a metal protein in blocked by formation of complex cystein. The blocked enzyme is reactivated with zinc. Its presence however, is of great importance of sugar metabolism (Levitt, 1972). These findings are similar to the findings of Hoda *et al.* (1975) and Babu and Yadav (2005) who reported similar pattern in Khasi mandarin.

Hence, it is concluded that the application of 500g N per tree along with 0.6% $ZnSO_4$ as foliar application was found highest yield and good quality fruit of ber.

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