International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(5): 1073-1075

Received: 19-07-2017
Accepted: 21-08-2017

Lavkush Singh
Department of Horticulture, IAS, BHU, Varanasi, Uttar Pradesh, India

SP Singh
Department of Horticulture, IAS, BHU, Varanasi, Uttar Pradesh, India

PK Sharma
Department of Soil Science and Agricultural Chemistry, IAS, BHU, Varanasi, Uttar Pradesh, India

Avnish Pandey
Department of Fruit Science, ACHF, Navsari Agricultural University, Navsari, Gujarat, India

Correspondence
Lavkush Singh
Department of Horticulture, IAS, BHU, Varanasi, Uttar Pradesh, India

Effect of sodicity levels on nutrient status of ber (*Zizyphus mauritiana* Lam.) leaves

Lavkush Singh, SP Singh, PK Sharma and Avnish Pandey

Abstract
The present investigation entitled "Effect of sodicity levels on nutrient status of ber (*Zizyphus mauritiana* Lam.) leaves" was carried out at Nursery of Horticultural Crops, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi district of Uttar Pradesh during the year 2014-2016 in plastic pot to assess the nutrient status of six commercially ber cultivars viz., Banarasi Peondi, Banarasi Karaka, Umran, Gola, Ponda and Narendra Ber Selection-2 with different level of sodicity (Normal Soil 15%, 30%, 45% and 60%). The experiment was laid out in factorial CRD with 3 replications. The data recorded on nitrogen, phosphorus, potassium, sodium, calcium and magnesium in leaves. It was found that nitrogen, phosphorus, potassium, calcium and magnesium in leaves decreased and sodium increased with increasing levels of sodicity in all cultivars. However, the maximum nitrogen, phosphorus, potassium, calcium and magnesium recorded in leaves of Banarasi karaka and sodium in Umran.

Keywords: cultivar, nitrogen, phosphorus, potassium, sodium, calcium and magnesium.

Introduction
Ber *(Zizyphus mauritiana* Lam.) has been recognized as a useful edible fruit since antiquity in India. Jujubes are considered to be minor fruits and from research and development point of view have not received any major emphasis yet. However, the fruits are an integral part of the culture and way of life of millions of diverse peoples of India. However, if the original wild species was spread from India through Myanmar, then early domestication efforts would postdate that of the staple foods and possibly occurred when populations increased with the rise of tribal kingdoms across the Gangetic plains. *Zizyphus mauritiana* Lam. (Indian jujube) or ber belongs to the family Rhamnaceae. There is a consensus that the genus *Zizyphus* contains 86 species but others suggest there could be up to 135. The productivity of plants is greatly affected by various environmental stresses. Soil salinity affects plant growth and development by way of osmotic stress, injurious effects of toxic ions and nutrient imbalance caused by excess of Na^+ and Cl^- ions. Indications are available that ber can survive well in sodic soils, but there is little information for its tolerance limit to sodicity. There are several cultivars which are commercially grown in eastern part of Uttar Pradesh. But no systematic work has been done on the sodicity tolerance limit of these cultivars. Besides this, information pertaining to adaptability, survival, nutrient uptake and growth behavior, etc. are also lacking.

Materials and Methods
The present investigation was carried out at Nursery of Horticultural Crops, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh during the 2014-2016. The ber was growing following the recommended package and practices. The experiment was laid out in a factorial completely randomized design with 30 treatment combinations which includeed five Sodicity levels (ESP) viz., Normal Soil (S_0), 15% (S_1), 30%(S_2), 45%(S_3) and 60% (S_4) and six commercial cultivars viz., Banarasi Peondi (C_1), Banarasi Karaka (C_2), Umran (C_3), Gola (C_4), Ponda (C_5) and Narendra Ber Selection-2 (C_6), respectively which are replicated thrice. Uniform cultural operations were followed during the course of investigation. The observation was recorded on nitrogen, phosphorus, potassium, sodium, calcium and magnesium. The data collected were statistically analyzed.

Result and Discussion
Nitrogen

The data on the effect of sodicity on nitrogen content in leaves of ber cultivars showed marked variation among cultivars and sodicity levels. The highest 4.00 per cent nitrogen content was recorded in cultivar Banarasi Karaka which was statistically at par with Ponda (3.99 per cent) similarly, Narendra Ber Selection-2 (3.90 per cent) and Banarasi Peondi (3.89 per cent) did not differ significantly between themselves. The lowest 3.82 per cent nitrogen content was observed in Umran and Gola (3.82 per cent). As far as the impact of sodicity on nitrogen content is concerned, it was observed that nitrogen content in plant grown under normal soil (4.17 per cent) was significantly at par with 15 ESP soil (4.16 per cent). However, these were significantly higher than other ESP levels. The minimum 3.42 per cent nitrogen content was recorded with 60 ESP. The decrease in nitrogen content of leaf with the increase in sodicity has also been reported in aonla (Rao and Singh, 2007) [7].

Phosphorus

The comparison of data indicated that per cent phosphorus content decreased with increasing sodicity levels of soil. Data showed significant difference in the phosphorus content among ber cultivars. However, cultivars Ponda and Banarasi Karaka did not differ significantly between them. Higher phosphorus content was recorded in Ponda (0.191 per cent) and Banarasi Karaka (0.191 per cent). Similarly, Banarasi Peondi and Narendra Ber Selection-2 remained at par with themselves. The lowest 0.160 percent phosphorus content was recorded in Umran. Soil type also showed significant differences, the maximum 0.194 per cent phosphorus content was obtained in normal soil followed by 15 ESP soil level (0.190 per cent), 30 ESP soil level (0.185 per cent) and 45 ESP (0.167 per cent). The minimum 0.143 per cent phosphorus content was recorded at 60 ESP of soil. Decrease in phosphorus content of leaves with the increasing sodicity has been reported in aonla Rao and Singh, 2006b [6].

Potassium

Data showed significant difference in content of potassium in ber leaves as affected by cultivars, sodicity levels and their interaction. Potassium content in leaves of Banarasi Karaka (0.682 per cent) was statistically at par with Ponda (0.681 Per cent) and significantly higher than other cultivars. While, the minimum 0.569 per cent potassium content was recorded in Umran. Sodicity levels showed significant effect on reduction of potassium in ber leaves. The highest 0.771 per cent potassium content was observed under normal soil condition. As the ESP of soil was increased there was a deficiency in potassium content in ber leaves. The lowest 0.370 per cent potassium content was recorded at 60 ESP level of soil. This finding is supported by Valia *et al*., 2007 [9].

Sodium

A cursory glance over the data indicated a significant cultivars response with respect to sodium content. The maximum 0.55 per cent sodium content was recorded in cultivar Umran followed by Gola (0.54 per cent). Notwithstanding, Narendra Ber Selection-2 (0.48 per cent) and Banarasi Peondi (0.48 per cent) did not differ significantly between themselves. The minimum 0.43 per cent sodium content was recorded in Banarasi Karaka. The significant response was also found in sodicity level. The sodium content in plants grown under normal soil was minimum (0.38per cent) which was enhanced to 0.41 per cent at 15 ESP, 0.48 per cent at 30 ESP, 0.53 per cent at 45 ESP and 0.63 per cent at 60 ESP. In sodic soil, accumulation of sodium in ber leaves could be expected because of addition of $NaHCO_3$ to the soil in order to build up desired level of sodicity which resulted in higher Na status in the soil. In conformity to this, increased sodium was reported in ber (Rao, and Singh, 2007) [7].

Calcium

The perusal of the data revealed that some of the cultivars of ber differed significantly in calcium content of leaves. The significant higher 2.34 per cent calcium content was observed in cultivar Banarasi Karaka followed by Ponda (2.32 per cent). However, Banarasi Peondi (2.26 per cent) and Narendra Ber Selection-2 (2.26 per cent) did not differ statistically between themselves. The minimum (2.12 per cent) calcium content was recorded in both Umran and Gola. As far as the effect of sodicity is concerned, it was observed that irrespective of cultivars the higher sodicity level had adverse effect on the calcium content. It declined from 2.41 per cent in normal soil to 1.82 per cent at 60 ESP level. At 15, 30 and 45 ESP levels the Ca content were recorded to be 2.40, 2.35 and 2.19 per cent, respectively. These findings are also supported by several workers (Rao, and Singh, 2007 and Srivastava *et al*., 2007) [7, 1-8].

Magnesium

Data revealed that the highest 0.678 per cent magnesium was recorded in cultivars Banarasi Karaka which was significantly higher than those of other cultivars. All the cultivars differed statistically among themselves in calcium content. The lowest 0.541 per cent magnesium content was recorded in cultivar Umran. The magnesium content decreased considerably at higher sodicity level, showing significant difference and as a result of which the lowest 0.452 per cent magnesium content was recorded in the plant grown at 60 ESP level. The highest 0.715 per cent magnesium was noted in normal soil followed by at 15, 30 and 45 ESP. In sodic soil, reduced nitrogen, phosphorus, potassium, calcium and magnesium status of ber leaves with increasing ESP levels is attributed to the reduction in absorption of nutrient by plants under high sodicity conditions and low availability. Presence of sodium in excess amount in sodic soil has an antagonistic influence with the absorption of potassium. Absorption of Ca, Mg and K in the presence of high sodium requires more amount of energy. This energy can be derived from metabolic processes consuming oxygen. However, due to soil compaction under high sodicity condition plant roots are deprived of oxygen resulting in reduced uptake of nutrient. Interaction effect owing to cultivars and sodicity levels had significant influence. This findings are also supported by several workers Rao, and Singh, 2006b [6]; Rao, and Singh, 2007 [7]; Srivastava *et al*., 2007 [1-8]; Dubey *et al*., 2006 [2]; Dubey *et al*., 2007 [1-8]; Valia *et al*., 2007 [9]; Mahmood *et al*., 2010 [5]; Garg, 2012 [3] and Liu and Chen,

Table 1: Effect of cultivars and soil sodicity levels on nutrient content in leaves of ber

Factors and their interaction	Nitrogen (Per cent)	Phosphorus (Per cent)	Potassium (Per cent)	Sodium (Per cent)	Calcium (Per cent)	Magnesium (Per cent)
Cultivars (C)						
Banarasi Peondi(C_1)	3.89	0.176	0.609	0.48	2.26	0.618
Banarasi Karaka(C_2)	4.00	0.191	0.682	0.43	2.34	0.678
Umran(C_3)	3.82	0.160	0.569	0.55	2.12	0.541
Gola(C_4)	3.84	0.161	0.573	0.54	2.12	0.544
Ponda(C_5)	3.99	0.191	0.681	0.44	2.32	0.674
NarendraBer Selection-2(C_6)	3.90	0.175	0.611	0.48	2.25	0.593
C.D. (P=0.05)	0.012	0.001	0.001	0.007	0.007	0.001
Soil types (S) ESP						
Normal Soil(S_0)	4.17	0.194	0.771	0.38	2.41	0.715
15(S_1)	4.16	0.19	0.759	0.41	2.4	0.697
30(S_2)	4.09	0.185	0.645	0.48	2.35	0.631
45(S_3)	3.7	0.167	0.558	0.53	2.19	0.545
60(S_4)	3.42	0.143	0.37	0.63	1.82	0.452
C.D. (P=0.05)	0.011	0.002	0.001	0.007	0.006	0.001
Interaction						
S_0C_1	4.13	0.195	0.782	0.38	2.42	0.726
S_0C_2	4.26	0.212	0.852	0.34	2.54	0.774
S_0C_3	4.13	0.172	0.693	0.42	2.26	0.643
S_0C_4	4.09	0.174	0.696	0.42	2.28	0.644
S_0C_5	4.26	0.212	0.847	0.35	2.53	0.773
S_0C_6	4.13	0.197	0.754	0.38	2.43	0.731
S_1C_1	4.16	0.194	0.757	0.42	2.41	0.713
S_1C_2	4.23	0.202	0.825	0.37	2.56	0.744
S_1C_3	4.12	0.171	0.693	0.47	2.25	0.625
S_1C_4	4.13	0.173	0.693	0.45	2.24	0.625
S_1C_5	4.22	0.206	0.823	0.38	2.52	0.754
S_1C_6	4.13	0.192	0.763	0.42	2.42	0.722
S_2C_1	4.12	0.182	0.625	0.45	2.42	0.676
S_2C_2	4.17	0.202	0.677	0.41	2.47	0.712
S_2C_3	3.97	0.167	0.622	0.56	2.22	0.575
S_2C_4	4.02	0.168	0.632	0.54	2.22	0.577
S_2C_5	4.15	0.204	0.672	0.463	2.45	0.703
S_2C_6	4.10	0.183	0.641	0.45	2.36	0.541
S_3C_1	3.65	0.164	0.535	0.52	2.23	0.533
S_3C_2	3.82	0.184	0.612	0.47	2.25	0.634
S_3C_3	3.58	0.153	0.513	0.62	2.12	0.476
S_3C_4	3.64	0.153	0.522	0.62	2.12	0.467
S_3C_5	3.81	0.184	0.623	0.47	2.24	0.624
S_3C_6	3.71	0.165	0.543	0.52	2.22	0.531
S_4C_1	3.4	0.142	0.345	0.62	1.81	0.443
S_4C_2	3.54	0.153	0.442	0.57	1.91	0.525
S_4C_3	3.32	0.136	0.321	0.70	1.77	0.386
S_4C_4	3.33	0.136	0.323	0.68	1.75	0.404
S_4C_5	3.50	0.151	0.437	0.58	1.87	0.515
S_4C_6	3.41	0.136	0.352	0.65	1.83	0.438
C.D. (P=0.05)	0.027	0.003	0.002	0.016	0.016	0.003

References

1. Dubey AK, Srivastava M, Singh R, Pandey N, Deshmukh PS. Effect of soil salinity on survival, growth and chlorophyll content of 'Kurukkan' mango *(Mangifera indica)* Indian J Agril. Sci. 2007; 77(10):685-688.
2. Dubey AK, Srivastava M, Singh R, Pandey RN, Deshmukh PS. Response of mango *(Mangifera Indica)* genotypes to graded levels on salt stress. Indian J Agril. sci. 2006; 76(11):670-672.
3. Garg VK. Influence of sodicity on growth, yield, quality and ionic composition of turmeric (*Curcuma longa* L.). J Spices Aromatic Crops. 2012; 20(1):22-29.
4. Liu C, Chen J. Effects of salt stress on growth, ion concentration, and quality of pineapple fruits. Communications Soil Sci. Pt. Analysis. 2014; 45(14):1949-1960.
5. Mahmood K, Sarwar G, Schmeisky H, Hussain N, Saleem U. Effect of various sodicity levels on growth parameters of Acacia ampliceps. J Agril. Res. (Lahore). 2010; 48(3):381-390.
6. Rao VK, Singh HK. Response of sodicity and salinity levels on vegetative growth and nutrient uptake of aonla genotypes. Indian J Horti. 2006b; 63:359-364.
7. Rao VK, Singh HK. Effect of sodicity levels on growth performance of Indian gooseberry (*Emblica officinalis*) plants. Indian J Agric. Sci. 2007; 77(4):244-246.
8. Srivastava M, Dubey AK, Pandey RN, Deshmukh PS. Effect of soil salinity on survival, growth and chlorophyll content of Kurukkan (*Mangifera indica*) Indian J Agric. Sci. 2007; 77(10):685-688.
9. Valia RZ, Patil VK, Nizama JR, Patel RR. Growth, physiological parameters and nutritional status of coconut as affected by soil sodicity. Annals Plant Physiol. 2007; 21(1):119-122.