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EXTENDED ABSTRACT

Feasibility Study of Saline Water Usage by Determining of Salinity Production Function on Ber (*Ziziphus Spina-Christi*)

M. Alihouri

Assistant Professor, Date Palm and Tropical Fruits Research Center, Horticultural Sciences Research Institute, Agricultural Research, Education and Extension Organization (AREEO), Ahvaz, Iran.(*alihouri_m@hotmail.com*).

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Introduction

Non-saline water resources are scarce, especially in arid and semi-arid regions. Therefore, the consumption of saline water is inevitable in agricultural usage. Iran has large saline water sources that have different levels of salinity. The use of these resources requires special management practices for the reduction of their negative environmental impacts. The usage of saline drainage waters, generated by irrigated agriculture, seems inevitable for plants irrigation.

Salinity stress reduces the osmotic potential, as well as all major processes of plant including growth, photosynthesis, protein synthesis, and lipid and energy metabolism. Of course, the response of plants and tolerance of different species of plants are different to salinity. The rapid reduction of leaf area and number of leaves, decreasing biomass (dry matter) of the shoot and root, as well as reducing the plant height and active root level in the soil are among the plant responses to salinity stress. Salinity induced changes in photosynthesis, stomatal behavior, chlorophyll content and accumulation of metabolites at growth various stages of ber (Hooda et al, 1990; Ramoliya and Pandey, 2007). Investigating the applicability of agricultural lands drainage in irrigation of juvenile ber plantation and determining the production function of water salinity-shoot dry matter of juvenile ber were overall objectives of this research.

Methodology

This research was carried out in a randomized complete block design with four treatments and three replications on *Ziziphus spina-christi* seedlings. The treatments of irrigation water salinity (EC) were 0.3, 3, 6 and 9 dS/m (Table 1). The 12 polyethylene pots of 40 cm diameter and 60 cm depth were installed for the performance this experiment. The waters of 3, 6 and 9 dS/m were obtained by mixing the Karun river water and agricultural lands drainage.

The salinity of soil saturation extract, leaf number, wet and dry matter of root and shoot, ratio of shoot to root and shoot relative water content were measured. The production functions of water salinity-shoot dry matter were estimated in five equations of linear, quadratic, cubic, logarithmic and exponential. Five statistical indices of adjusted coefficient of determination (R^2_{adj}), modeling efficiency (EF), maximum error (ME), normalized root mean square error (nRMSE) and coefficient of residual mass (CRM) were used in evaluation of models.

Table 1-Irrigation water composition

EC ($dS\ m^{-1}$)	SAR	pH	Cation (meq/L)				Anion (meq/L)		
			Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	HCO_3^-	SO_4^{2-}
0.3	6.5	7.3	2.5	-	0.2	0.1	2.5	0.3	-
3.0	7.0	8.0	21.0	-	7.5	10.5	27.0	5.5	-
6.0	14.6	7.9	45.1	-	9.0	14.5	43.0	6.2	-
9.0	18.8	8.0	74.3	-	11.2	29.0	72.0	6.7	-

Results and Discussion

The irrigation water salinity had significant effect on soil salinity and root and shoot characteristics of ber seedlings at 1% level of probability (Table 2). By increasing the irrigation water salinity from 3 to 6 dS/m, wet and dry matter of root decreased by 34.4 and 30.5 percent, respectively. The wet and dry matter of shoot decreased by 9.7 and 3.6 percent, respectively. Total root and shoot characteristics of plant decreased at 1% level of probability, significantly by increasing of the irrigation water salinity from 6 to 9 dS/m. The wet and dry matter of root in water salinity of 9 dS/m decreased by 47.5 and 40.9 percent, respectively. Also, wet and dry matter of shoot in water salinity of 9 dS/m decreased by 31.5 and 19.6 percent, respectively.

Table 2- Effect of water salinity on soil salinity and vegetative characteristics of ber seedlings*.

Water salinity (dS/m)	Soil salinity (dS/m)	Number of leaves	Root wet matter (g)	Root dry matter (g)	Shoot wet matter (g)	Shoot dry matter (g)	Shoot/Root (dry matter)
0.3	5.4 ^{c}	1162 ^{a}	135.0 ^{a}	62.9 ^{a}	187.4 ^{a}	88.9 ^{a}	1.4 ^{b}
3.0	6.4 ^{bc}	886 ^{b}	122.5 ^{a}	56.0 ^{a}	135.0 ^{b}	64.7 ^{b}	1.2 ^{b}
6.0	10.4 ^{ab}	852 ^{b}	80.4 ^{b}	38.9 ^{b}	121.9 ^{b}	62.4 ^{b}	1.6 ^{b}
9.0	11.4 ^{a}	664 ^{c}	42.2 ^{c}	23.0 ^{c}	83.5 ^{c}	50.2 ^{c}	2.2 ^{a}

* Means followed by same letter in column are not significantly different at level 1%.

Conclusions

The juvenile ber can be irrigated with saline water up to 6.0 dS/m for one year after the establishment period. The cubic equation had more accuracy than the other equations due to implementing of the maximum adjusted coefficient of determination (R^2_{adj}) and modeling efficiency (EF,) and minimum maximum error (ME), normalized root mean square error (nRMSE) and coefficient of residual mass (CRM).

References

1- Agrawal, R., Gupta, S., Gupta, N.K., Khandelwal, S.K. and Bhargava, R., 2013. Effect of sodium chloride on gas exchange, antioxidative defense mechanism and ion accumulation in different cultivars of Indian jujube (*Ziziphus mauritiana* L.). *Photosynthetica*, 51(1): 95-101.

2- Arndt, S.K., Clifford, S.C., Wanek, W., Jones, H.G. and Popp, M., 2001. Physiological and morphological adaptations of the fruit tree *Ziziphus rotundifolia* in response to progressive drought stress. *Tree Physiology*, 21(11): 705-715.

3- Hooda, P.S., S.S. Sindhu, P.K. Mehta and Ahlawat, V.P., 1990. Growth, yield and quality of ber (*Zizuphus mauritiana* Lamk.) as effected by soil salinity. *Journal of Horticultural Science*, 65(5): 589-593.

4- Motamedi, H., A. Safary, S. Maleki and Seyyednejad, S.M., 2009. Ziziphus spina-christi, a native plant from Khuzestan, Iran, as a potential source for discovery new antimicrobial agents. *Asian Journal of Plant Sciences*, 8(2): 187-190.

5- Nejat, N. and Sadeghi, H., 2012. Response of ziziphus spina-christi (L.) willd seedlings to NaCl - induced salinity. *Agricultural Science Digest*, 32 (1): 61- 65.

6- Pareek, O.P., 2001. *Ber*. International Center for Underutilised Crops, Southampton, UK.

7- Ramoliya, P.J. and Pandey, A.N., 2007. Soil salinity and water status effect on growth of seedlings of *Zizyphus mauritiana* (Rhamnaceae). *Indian Forester*, 133(7): 951-962.

8- Tomar, O.S., Minhas, P.S., Sharma, V.K., Singh, Y.P. and Gupta, R.K., 2003. Performance of 31 tree species and soil conditions in a plantation established with saline irrigation. *Forest Ecology and Management*, 177(1): 333-346.