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Original article

Evaluation of salinity tolerance threshold and some quantity and physiological characteristics of Chicory (*Cichorium intybus* L.)

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Extended abstract

Introduction

Soil salinity and associated problems constitute one of the major abiotic constraints in global production and are particularly critical in semi-arid and arid areas. In areas faced with water scarcity, it is common practice to utilize saline groundwater in irrigated agriculture. Chicory is a flowering plant in the dandelion family that is characterized by a tough, hairy stem, light purple flowers and leaves that are commonly used in salads. Chicory coffee tastes similar to coffee but has a flavor that's often described as slightly woody and nutty. Hence, the present research was aimed to evaluate the effects of salinity stress on some of chicory of quantity and physiological characteristics.

Matherial and Method

In order to evaluate the salinity tolerance of Chicory, an experiment was conducted in a completely randomized design with 3 replications in a pot in the greenhouse of the National Salinity Research Center during 2019-20. Experimental treatment includes 5 levels 0.44 (control), 3, 6, 9 and 12 dS m^{-1}. In the present study, some growth traits, height of plant, leaf area, shoot dry weight, root dry weight, number of aken per plant, relative water content, ion leakage, potassium, sodium and ratio of K/Na were measured.

Results and discussion

The results showed that the application of salinity levels significantly reduced all the studied traits. Regarding increasing salinity from control to salinity of 12 dS m^{-1} reduced plant height by 50%, shoot dry weight by 59%, root dry weight by 76% and number of aken per plant by 72%. Also, with increasing salinity level from 0 to 9 dS m^{-1} caused decreasing relative water content by 9.68% and increasing ion leakage by 37.47%. Increasing salinity levels from control to 12 dS m^{-1} was affected as significantly on decreasing ratio of potassium to sodium (96%). Also, 50% and 100% reduction in root yield was obtained at salinity of 5.91 and 14.66 dS m^{-1}, respectively. In general, according to the results, it seems that Chicory does not have high tolerance to salinity. The results showed that the application of salinity levels significantly reduced all the studied traits. Regarding increasing salinity from control to salinity of 12 dS m^{-1} reduced plant height by 50%, shoot dry weight by 59%, root dry weight by 76% and number of aken per plant by 72%. Also, with increasing salinity level from 0 to 9 dS m^{-1} caused decreasing relative water

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content by 9.68% and increasing ion leakage by 37.47%. Increasing salinity levels from control to 12 dS m^{-1} was affected as significantly on decreasing ratio of potassium to sodium (96%). Also, 50% and 100% reduction in root yield was obtained at salinity of 5.91 and 14.66 dS m^{-1}, respectively. In general, according to the results, it seems that Chicory does not have high tolerance to salinity. Also, 50% and 100% reduction in root yield was obtained at salinity of 5.91 and 14.66 dS m^{-1}, respectively. In general, according to the results, it seems that Chicory does not have high tolerance to salinity. The results showed that the application of salinity levels significantly reduced all the studied traits. Regarding increasing salinity from control to salinity of 12 dS m^{-1} reduced plant height by 50%, shoot dry weight by 59%, root dry weight by 76% and number of aken per plant by 72%. Also, with increasing salinity level from 0 to 9 dS m^{-1} caused decreasing relative water content by 9.68% and increasing ion leakage by 37.47%. Increasing salinity levels from control to 12 dS m^{-1} was affected as significantly on decreasing ratio of potassium to sodium (96%). Also, 50% and 100% reduction in root yield was obtained at salinity of 5.91 and 14.66 dS m^{-1}, respectively. In general, according to the results, it seems that Chicory does not have high tolerance to salinity.

***Keywords*:** Ion leakage, Potassium, Ratio of potassium to sodium, Relative water content, Root dry weight

Table 1. Soil physico chemical characteristics of experimental location

EC	pH	Organic carbon	Phosphorus ava.	Potassium ava.	Sand	Silt	Clay
dS m^{-1}		%	----------mg.kg^{-1}----------		----------%----------		
4.50	7.36	0.04	4.9	85	44.16	35.62	20.22

Table 2- chemical properties of irrigation water

Treatment	EC	pH	Ca^{2+}	Mg^{2+}	CO_3^{2-}	HCO_3^-	Na^+	K^+	Cl^-	SO_4^{2-}	SAR
	dS m^{-1}		----------meq l^{-1}----------								
Non-saline water resource	3	8.05	9.7	8.42	0	2.89	11.74	0.1	17.31	9.75	3.9
Diluted saline water resource $\frac{1}{50}$	10	8.00	3.26	12.88	0	2.77	80.73	0.21	86.48	7.82	28.83

Table 3. Analysis of variance of the effect of salinity stress on some studied characteristics in *Cichorium intybus* L.

S.O.V	Salinity treatments	Error	CV (%)
df	4	10	
Plant height	793.90**	19.36	7.41
Leaf area	15251.05**	165.08	13.83
Shoot dry weight	0.58**	0.00	5.63
Root dry weight	0.02**	0.00	9.81
Number of aken per plant	91.96**	2.87	13.42
Relative water content	3290.94**	1.77	2.24
Ion leakage	1548.16**	8.00	9.15
Potassium	2.21**	0.07	10.50
Sodium	27.49**	0.39	16.21
K/Na	15.89**	1.37	-

** Significant at the level of 0.01

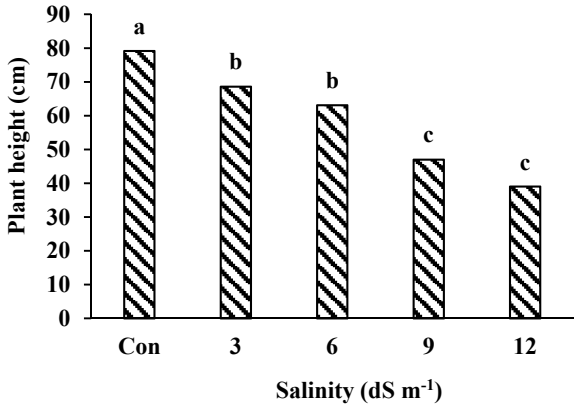

Fig. 1. The effects of different levels of EC_{iw} on height of Chicory

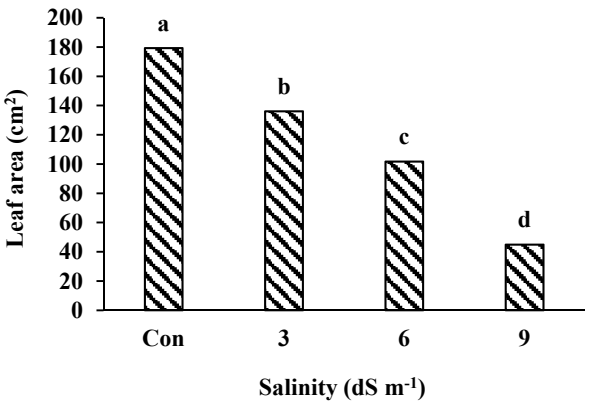

Fig. 2. The effects of different levels of EC_{iw} on leaf area of Chicory

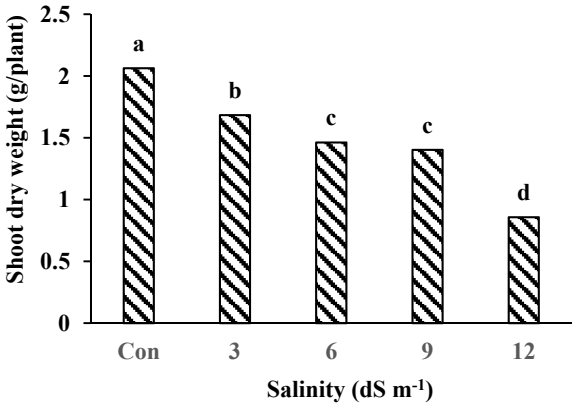

Fig. 3. The effects of different levels of EC_{iw} on Shoot dry weight of Chicory

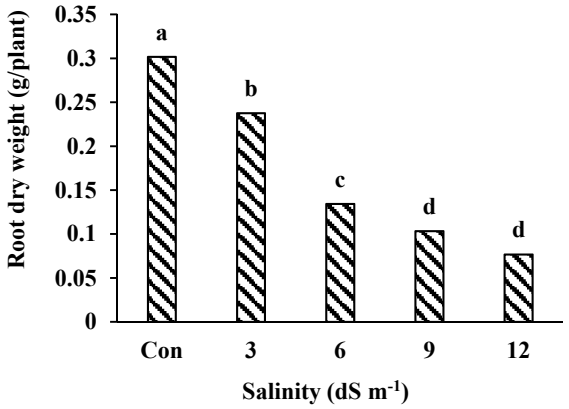

Fig 4. The effects of different levels of EC_{iw} on Root dry weight of Chicory

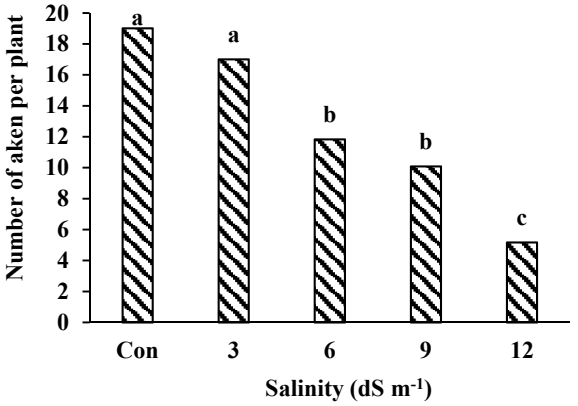

Fig. 5. The effects of different levels of EC_{iw} on number of aken per plant of Chicory

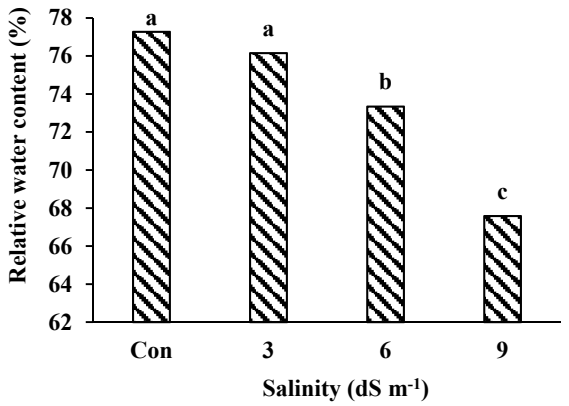

Fig. 6. The effects of different levels of EC_{iw} on relative water content of Chicory

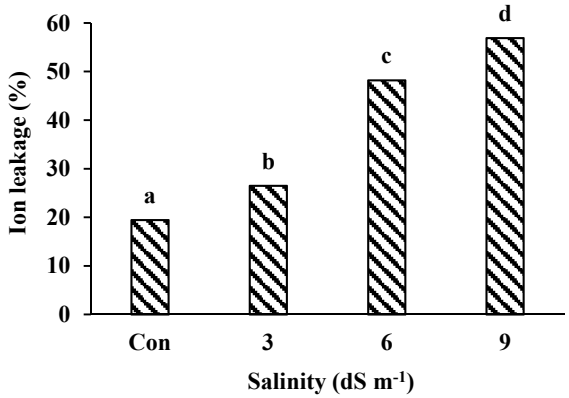

Fig. 7. The effects of different levels of EC_{iw} on ion leakage of Chicory

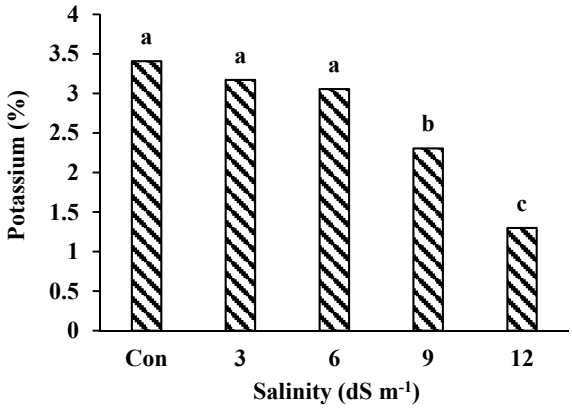

Fig. 8. The effects of different levels of EC_{iw} on potassium content of aerial part of Chicory

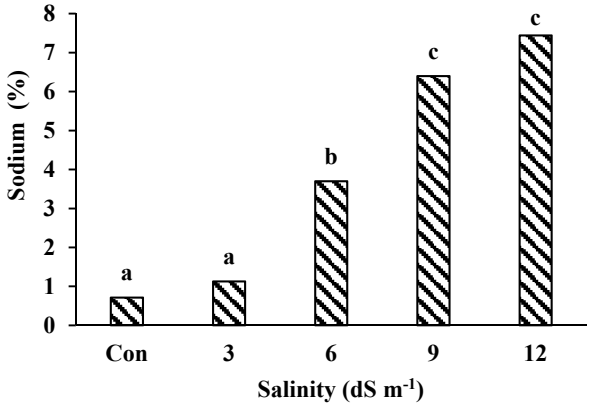

Fig. 9. The effects of different levels of EC_{iw} on sodium content of aerial part of Chicory

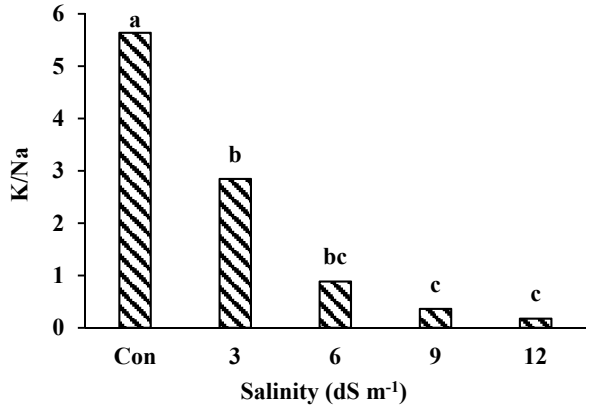

Fig. 10. The effects of different levels of EC_{iw} on K/Na of Chicory

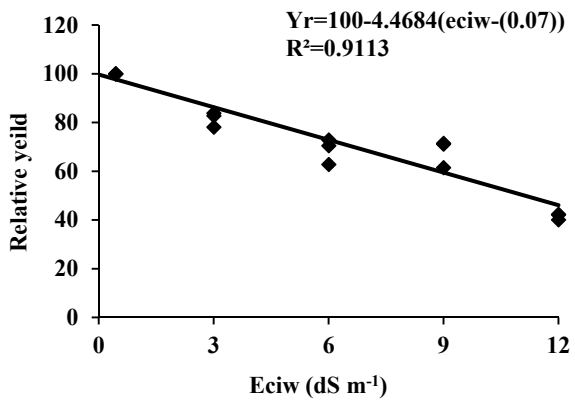

Fig. 11. Response of relative aerial yield to salinity stress in Chicory based on model of Mass and Hoffman

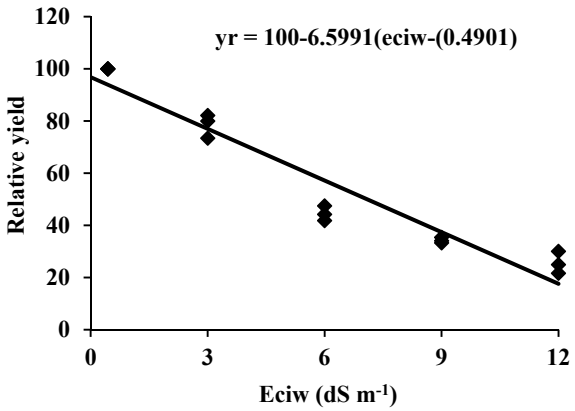

Fig. 12. Response of relative root yield to salinity stress in Chicory based on model of Mass and Hoffman