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Study of some morphological traits of Alfalfa (*Medicago sativa* L.) ecotypes under salinity stress condition

Mahmood Khosrowchahli[1], Amir Houshang Hosseinzadeh Moghbeli[2*], Hassan Monirifar[3] and Ghorban Noormohammadi[4]

1- Department of Plant Breeding, Science and Research Branch, Islamic Azad University, Tehran, Iran
2- Ph.D student of Department of Plant Breeding, Science and Research Branch, Islamic Azad University, Tehran, Iran
3- Agriculture and Natural Resources Research Center of East Azarbayjan, Tabriz, Iran.
4- Department of Agronomy, Science and Research Branch, Islamic Azad University, Tehran, Iran

***Corresponding author*:** Amir Houshang Hosseinzadeh Moghbeli

ABSTRACT: Salinity a significant limitation on productivity by adversely affecting the morpho-physiological traits of plants. In order to study of morphological traits of ten alfalfa ecotypes of Azarbayjan region of Iran in salinity stress condition, an experiment was conducted in the Agriculture and Natural Resources Research Center of East Azarbayjan, Khajeh station during 2009 and 2010. This experiment was conducted under salinity stress condition (EC=9.82 dsm-1). Therefore a randomized completly block design with three replications was carried out. Plants harvested in four different times (two harvest for each year) and some morphological traits such as plant height, Number of stems, Number of nodes on stem, Number of leaves, Leaf area and Leaf/stem ratio were measured per plant, and mean of four harvest results calculated for each trait. The relationship of dry forage yield and studied morphological traits was investigated by calculating Pearson's correlation coefficient. All of the studied traits were significantly correlated with dry forage yield. Results of analysis of variance revealed significant difference among ecotypes for all the traits indicating high genetic variability.

***Keywords*:** Alfalfa (Medicago sativa L.), Ecotype, Genetic variability, Morphological traits, Salinity condition.

INTRODUCTION

The effects of saline soils on plants growth have been a focus of research for nearly 100 years because salt stress is a major stress limiting crop productivity. Salt tolerance of plants is a complex phenomenon that involves morphological and developmental changes as well as physiological and biochemical processes (Fougere et al., 1991). Area under saline soils is increasing in the world, mainly because of improper agricultural practices. Salinity is a major factor limiting growth on many soils of the world. Saline soils cover about 10% of the total arable land in Iran and about 23% of the cultivated Lands are saline (Seifi et al., 2010).

Several biochemical processes of plants are affected adversely by soil salinity. However the magnitude of salt stress effects various with plant species, types and its levels. Alfalfa (Medicago sativa L.) is a species whose tolerance to salinity stress has been well-studied (Bhardwaj et al., 2011). Alfalfa is one of the most important forage crops in the world and is moderately tolerant to salinity (Rumbaugh and Pendery, 1990). But there are high morphological variations noted in center of diversity among the germplasm led to selection of the most tolerant cultivated to salinity (Soltani et al., 2012). Morphological characterization is the first step in the description and classification of germplasm (Smith and Smith, 1989). In this study some of morphological traits as related forage yield of Azarbayjan alfalfa ecotypes was evaluated.

MATERIALS AND METHODS

In order to evaluate of some morphological traits of ten alfalfa ecotypes, an experiment was conducted in the Agriculture and Natural Resources Research Center of East Azarbayjan, Khajeh station during 2009 and 2010. This experiment was conducted under salinity stress condition (EC=9.82 dsm^{-1}). Ten soil samples were analyzed for electrical conductivity and calculated mean of soil samples. In this study a randomized completly block design with three replications was carried out. Plants in four turn and different times harvested (two harvest for each year) and some morphological traits such as plant height, number of stems, number of nodes on stem, number of leaves, leaf area, leaf / stem ratio were measured. Then dry forage yield (dried at $74^{\circ c}$ for 48 h) were measured. Twenty plants of each experimental unit were harvested. All of the traits measured per plant and mean of four harvest calculated for each trait. After analysis of variance, comparisons of mean for studied traits by Least Significant Difference (LSD) method at 5% probability level was carried out. Then relationship of forage yield and studied morphological traits was investigated by calculating Pearson's correlation coefficient. Software's such as SAS and SPSS were used for statistical calculations.

RESULTS AND DISCUSSION

Results of analysis of variance revealed significant differences among ecotypes for all of the traits (Table 1). Various ecotypes had different responses to saline condition indicating high genetic variability for studied alfalfa ecotypes. Genetic variation for morphological traits of alfalfa genotypes under salinity stress reported by several researchers such as Vayghan et al, (2002), Petcu et al, (2007) and Soltani et al, (2012). By comparing some perennial forage species, Bell et al, (2007) reported that alfalfa morphological traits were more adapted to environmental stresses. Salinity tolerance of plants can be determined by using different growth parameter like root and shoot length and dry mass of root and shoot (Khodarahmpour and Soltani, 2013).

Results of comparisons of mean for studied traits (Table 2) indicated Qara yonjeh and Khajeh with significant difference than other ecotypes had highest and Alhord and Satlo had lowest mean of plant height among the ecotypes. For number of stem per plant, Qara yonjeh, Khajeh, Nir, Leghlan and Bahraman had maximum mean and Joshin and Seivan had minimum mean among the ecotypes. Also Khajeh and Qara yonjeh had the highest number of nodes on stem among the ecotypes under salinity condition. Qara yonjeh with significant difference than other ecotypes had the highest mean of number of leaves per plants. In this study Qara yonjeh and Khajeh had maximum leaf area per plant (measured by leaf area meter) and Dizaj Safarali, Joshin and Alhord had minimum mean of this trait. For leaf/stem ratio only Alhord with significant difference, lower than other ecotypes. Results of comparisons of means for dry forage yield indicated that Qara yonjeh was better adapted to salinity condition than other studied ecotypes. Monirifar et al, (2004) reported the various phenotypic response among Azarbayjan alfalfa cultivars at different salinity levels.

Results of phenotypic correlation coefficients (Table 3) showed all of the studied traits except leaf/stem ratio were significantly correlated (at 1% probability level) with forage yield.

Table 1. Analysis of variance for studied traits of alfalfa ecotypes

		Mean of squares						
Source of variation	Degree of freedom	Plant height	Number of stems	Number of nodes on stem	Number of leaves	Leaf area	Dry forage yield	Leaf/stem ratio
Replication	2	5.784^{ns}	1.308^{ns}	0.071^{ns}	0.737^{ns}	37.392^{ns}	0.612^{ns}	0.018^{ns}
Ecotypes	9	81.862**	6.020**	2.870**	558.124**	140.393**	3.314**	0.025*
Error	18	2.718	0.358	0.201	14.326	44.393	0.380	0.008
Coefficient of variation		4.007	7.310	6.607	6.527	7.420	9.898	7.343

*,** : significant difference at 5 and 1% probability levels respectively
ns: non significant difference

Table 2. Comparisons of mean for studied traits of alfalfa ecotypes

Ecotypes	Plant height (cm)	Number of stems per plant	Number of nodes on stem	Number of leaves per plant	Leaf area per plant (cm^2)	Dry forage yield (gr/plant)	Leaf/stem ratio
Leghlan	43.932	9.155	7.020	67.783	104.202	6.920	1.215
Seivan	38.808	6.714	6.405	52.241	79.749	5.798	1.140
Satlo	40.805	7.845	6.354	53.277	83.361	5.963	1.144
Bahraman	44.676	9.266	7.100	63.818	101.670	6.630	1.292
Nir	44.936	9.399	7.342	66.694	99.496	6.481	1.405
Khajeh	47.132	9.669	8.319	71.641	113.180	6.784	1.286
Dizaj Safarali	32.575	6.475	5.495	41.669	62.193	5.773	1.213
Joshin	34.993	6.201	5.859	40.531	62.850	4.713	1.216
Alhord	36.449	7.425	5.825	43.255	67.924	4.924	1.080
Qara yonjeh	47.164	9.785	8.206	78.937	123.233	8.343	1.195
LSD 5%	2.828	1.027	0.770	6.492	11.429	1.058	0.153

Table 3- Phenotypic correlation coefficients of morphological traits

Traits	Plant height	Number of stems	Number of nodes on stem	Number of leaves	Leaf area	Dry forage yield	Leaf/stem ratio
Plant height	1						
Number of stems	0.955**	1					
Number of nodes on stem	0.955**	0.904**	1				
Number of leaves	0.967**	0.943**	0.960**	1			
Leaf area	0.974**	0.927**	0.966**	0.966**	1		
Dry forage yield	0.826**	0.830**	0.844**	0.930**	0.922**	1	
Leaf/stem ratio	0.496	0.534	0.496	0.482	0.445	0.349	1

** : significant at 1% probability level

REFERENCES

Bell LW, Williams AH, Ryan MH and Ewing Na. 2007. Water relations and adaptations to increasing water deficit in three perennial legums, *Medicago sativa, Dorycnium hirsutum and Dorycnium rectum*. Plant and soil. 290: 231-243.

Bhardwaj S, Varshney KA, Sharma NK and Shokla G. 2011. Variablility in response of Indian fodder legume (*Medicago Sativa*) to salt stress on physiological attributes. Inter J of Pharma and Bio Sci. Vol 2: 52-60.

Fougere F, Ruduiler D and Streeter G. 1991. Effect of salt stress on amino acid, organic acid and carbohydrate composition of roots, bacteriodes and cytosol of Alfalfa (*Medicago sativa* L.). Plant physiol. 96: 1228-1236.

Khodarahmpour Z and Soltani A. 2013. Multivariate analysis alfalfa (*Medicago sativa* L.) cultivars for salinity tolerance at germination stage. Technical J of Engineering and Applied Sci. 3/2: 139-144.

Monirifar H, Valizadeh M, Mohammadian R, Abedi M and Milani O. 2004. Variation for salt tolerance in five alfalfa cultivares. International scientific symposium, Ganja, Azarbayjan.

Petcu E, Schitea M and Badea D. 2007. The behavior of some Romanian alfalfa genotypes to salt and water stress. Romanian Agric Res. No 24.

Rambaugh M and Pendery B. 1990. Germination salt resistance of alfalfa (*Medicago sativa* L.) germplasm in relation to subspecies and centers of diversity. Plant and Soil. 124: 47-51.

Seifi MR, Alimardani R, Sharifi A and Akram A. 2010. Using apparent soil electrical conductivity to improve agricultural yield in Iran. Res J Appl Sci Engg Technol. 2: 499-503.

Smith J and smith O. 1989. The description and assessment of distances between inbred lines of maiz. Maydica. 34: 151-161.

Soltani A, Khodarahmpour Z, Jafari A and Nakhjavan Sh. 2012. Selection of alfalfa (*Medicago sativa* L.) cultivars for salt stress tolerance using germination indices. African J of Biotech. Vol. 11 (31): 7899-7905.

Vayghan LS, Macodom, J, Smith S and Dudley L. 2002. Root growth and yield of different alfalfa rooting populations under increasing salinity and zero leaching. Crop Sci. 42: 2064-2071.