J. Int. Environmental Application & Science, Vol. 12(1): 9-13 (2017)

The Effect on Morphological Properties of *Agropyron* Species of Different Salt Concentrations[#]

Nur KOC[*], Ramazan ACAR

Department of Field Crops, Faculty of Agriculture, Selcuk University, Konya, TURKEY

Received November 10, 2016; Accepted December 28, 2016

Abstract: Salinity effects on many plants developments in parallel with morphological properties and yield of plants. This study carried out greenhouse conditions in 2015-2016. It was aimed to determination of the effects on Agropyron species (*Agropyron cristatum, A. desertorum* and *A. elongatum)* of different salt concentrations (0, 5, 10 and 15 EC dS/m NaCl). In the research was investigated such morphological properties as aboveground plant height, total plant height (shoot and root height), fresh shoot weight, total fresh plant weight (shoot and root weight) and seeds per Spica. Increasing salinity dosages wasn't effect on *A. desertorum*'s aboveground plant height in this study results. But increasing salinity dosages were caused that *A. elongatum*'s aboveground plant height was increased by 5.6% while aboveground plant height of *A. cristatum* was decreased by 4.6%. Seeds per Spica obtained from three Agropyron species grown until grain filling duration were observed that accordingly control groups', seeds per Spica of *A. cristatum, A. desertorum* and *A. elongatum* were decreased by increasing salt concentrations respectively 62.5 % 61.7% and 42.8 %. Our findings show that *A. elongatum* was less impressed by salinity conditions more than other Agropyron species. This results show that *A. elongatum* was more adaptable in salinity conditions in terms of morphological.

Keywords: *Agropyron cristatum, A. desertorum, A. elongatum, Morphological Properties, Salinity*

Introduction

Total area of saline soil in the world is 831.4 million ha, and this area is about 6.5 percent of the world (FAO, 2015). Of the then 230 million ha of irrigated land, 45 million ha (19.5 percent) were salt-affected soils; and of the almost 1 500 million ha of dryland agriculture, 32 million (2.1 percent) were salt-affected soils (FAO, 2015).The area of salt -affected soil in the Turkey is 1.5 million ha, and one third of this salinity problem area is located in Konya Closed Basin (TOPRAKSU, 1978; Kanber *et al*., 2005). Salinity which is more often seen in arid and semiarid region is a stress factor for plants by bringing mutation in physiology and morphology of plants (Yildiz *et al*., 2010). This changing in the plants owing to salinity leads to non-economic yield obtained from these plants. It is the importance to economic yield obtained from plant and variety, in other words the selection of salt tolerant plants in the region having salinity problem (Ozturk, 2004).The salt resistance of plants are vary from soil, water and environmental factors to plant species (Acar *et al*., 2011). Yorgancilar and Yeğin (2012) indicated that plant nutrient contents changed with different salt treatments.

Agropyron species (*Agropyron* spp.) can naturally grow in areas with salinity problem in which more often seen drought rangeland of Central Anatolia (Acar *et al*., 2016). Tall wheatgrass *(A. elongatum)* and crested wheatgrass (*A. cristatum)* from *Agropyron* spp. give a yield with 50 percent yield loss in high salinity level (18 EC dS/m 25ºC) which isn't grown other plants species (Ozgul, 1974). Tall wheatgrass and crested wheatgrass having these properties were classified as salt tolerant forage crops (Tekeli & Ates, 2009). Dewey (1960) carried out that research which is aimed to observation of germination in different salinity levels (0, 7.3 dS/m, 12.4 EC dS/m and 16.2 EC dS/m) of 14 Agropyron species (*A. cristatum, A. desertorum, A. elongatum, A. imbricatum, A. inerme, A. intermedium, A. michnoi, A. riparium, A. sibiricum, A. spicatum, A. subsecundum, A. trachycaulum, A. trichophorum* and *A. trachycaulum x H. jubatum*). When in the research was increased salinity, forage yield sharply decreased. Agropyron species were classified 4 groups by mean yield. While tall wheatgrass was in first group, desert wheatgrass and crested wheatgrass were in third group in this

**Corresponding: E-Mail: E-mail: nurkoc@selcuk.edu.tr; Tel: +903322232999; Fax:+ 903322410108*
#This paper is presented from M.Sc. Thesis of Nur KOC

sorting. When these species were classified 4 groups by germination ratio, tall wheatgrass, desert wheatgrass and crested wheatgrass were in first group in this classification. Salinity don't effect only germination of plants, but also the number of seed and seed yield by means of effecting the number of fertile flower in which is produced plants (Culha and Cakırlar, 2011).

For this reason, in this research was aimed to determination the effect of different salt concentration on three Agropyron species (*A. cristatum, A. desertorum* and *A. elongatum)* grown until grain filling duration.

Materials and Methods

This research, which was trialed in the pots at October 21, 2015 in Plant Breeding Greenhouse Department of Field Crops, Faculty of Agriculture Selcuk University was carried out as three replications with regard to Completely Randomized Design. Seeds of three Agropyron species used in the study were population, and they were supplied from natural vegetation. In the study were used pots with 30 x 30 cm size. In each pot was grown six plants. The properties of sphagnum turf which was used in trial were given in the table 1.

Table 1. The Some Physical and Chemical Properties of Turf Used in the Research

Degree of Dissociation	**pH($CaCl_2$)**	**pH(H_2O)**	**Porosity Weight (%)**	**Bulk density (g/l)**	**Organic Matter (%)**	**Moisture Content (%)**
	5.00-6.00	5.50-6.50	96.00	80.00- 90.00	95.00-99.00	40.00-50.00
	Air Conduc. (%)	**Electrical Conduc. (dS m^{-1})**	**Fertilizer Ratio (g l^{-1})**	**N (mg l^{-1})**	**P_2O_5 (mg l^{-1})**	**K_2O (mg l^{-1})**
H2-H8	16.00-55.00	0.12-0.22	0.30	30.00-70.00	30.00-70.00	40.00-80.00

First irrigation with salt concentrations (0, 5, 10 and 15 EC dS/m NaCl) was made at December 3, 2015 which was tillering date in three Agropyron species. Salt concentrations given each Agropyron species were applied to 1 liter per week until grain filling duration.

These Agropyron species are belonging to cool season forage grasses which are need to vernalisation for passing generative period. For this reason, vernalisation need of these plants was met by taking out greenhouse on days when weather condition wasn't below zero. While vernalisation need of crested wheatgrass and desert wheatgrass were met at 24 hours by taking out greenhouse, vernalisation need of tall wheatgrass was met at 98 hours when weather condition was above zero (1-5 ^oC). While harvest date of crested wheatgrass and desert wheatgrass was at May 16, 2016, harvest date of tall wheatgrass was at June 22, 2016 because of late maturation than other two Agropyron species. Vegetation time for crested wheatgrass and desert wheatgrass was at 196 days, and this time for tall wheatgrass was found as 234 days.

In the research was saved as a cm aboveground plant height, total plant heights (shoot and root height). It was weighed as a g fresh shoot weight, total fresh plant weight (shoot and root weight). Finally, seeds per Spica were saved as number $spica^{-1}$.The statistical analysis of all of properties which were investigated in the research was made by using MSTAT-C package software. According to variance analysis, all properties which were important to level 1% from salt concentration, *Agropyron* spp. and their interaction's F values were tested LSD each of them. And means were being group.

Results and Discussions

Mean values belonging to some morphological properties of crested wheatgrass, desert wheatgrass and tall wheatgrass grown in different salt concentration were given in the table 2. In the variance analysis results was determined that F values of these properties were of significance in level 1% (Table 3). When values belonging aboveground plant height were examined, the maximum aboveground plant height among salt concentration was obtained from10 EC dS/m NaCl salt concentration by 74.39 cm. While increasing salinity dosages wasn't effect on aboveground plant height of desert wheatgrass, this values of crested wheatgrass was decreased by increasing salt concentration. Culha and Cakırlar (2011) stated that salinity caused to decrease in shoot height and root height. While this situation was sighted in crested wheatgrass, this wasn't sighted in tall wheatgrass, and aboveground plant height of tall wheatgrass was increased by 5.6 %. The minimum

total plant heights was obtained from 5 EC dS/m NaCl salt concentration of tall wheatgrass while the maximum total plant heights was obtained from control groups of desert wheatgrass by 585.00 cm. In researches related to salinity which were made by Avcıoglu *et al.*(2003), Golparvar (2011), Akhazari *et al.*(2012), Ashkan and Jalal (2013), Kusvuran *et al.*(2014 a, b) were determined that the plant height was decreased by increasing salinity.

Salt stress caused to decrease cell division ratio and number of cell in the stem of plant by influencing cell division and cell elongation (Burssens *et al.* 2000). So, it was occurred to reduction in shoot weight and root weight and reduction and thinning in leave (Culha & Cakırlar, 2011). In our results was shown that fresh shoot weight of crested wheatgrass was decreased by increasing salt concentration. But, increasing salt concentration caused to increase fresh shoot weight of other two *Agropyron* species. Salt tolerant plants take the water in their structure by more absorbing water from saline soil for decreasing adverse effects of salt (Strogonov, 1971). For this reason, the more salt concentration was increased, the more their structure absorbed the water. Thus, fresh shoot weight of desert wheatgrass and tall wheatgrass were increased. It was shown to decrease total fresh plant weight of three *Agropyron* species by increasing salinity.

It was stated by Munns (2002) that seed yield in the plants was negatively affected by salt stress, and this situation was determined in our research. Accordingly control groups', seeds per Spica of crested wheatgrass, desert wheatgrass and tall wheatgrass were decreased in highest level salt concentration (15 EC dS/m NaCl) respectively 62.5 %, 61.7% and 42.8 %.

Table 2. Mean values and Grouping Belonging to Morphological Properties of Agropyron Species Grown in Different Salt Concentration

Agropyron Species	Salt Concentrations (EC dS/m NaCl)	Aboveground Plant Height (cm)	Total Plant Heights (cm)	Fresh Shoot Weight (g)	Total Fresh Plant Weight(g)	Seeds Per Spica (number Spica^{-1})
A .cristatum **(Crested Wheatgrass)**	0	72.67 b	412.67 bcd	10.05 ab	44.33 a	89.50 a
	5	64.83 cd	347.00 e	5.70 def	10.38 c	84.00 ab
	10	71.17 b	436.67 bc	5.42 ef	9.18 c	58.00 c
	15	69.33 bc	382.66 de	4.83 f	8.26 c	33.50 de
	Mean	**69. 50 b**	**394.75 b**	**6.50 b**	**18.04**	**66.25 a**
A. desertorum **(Desert Wheatgrass)**	0	85.00 a	585.00 a	5.39 ef	29.72 b	81.00 ab
	5	85.00 a	342.67 e	5.21 ef	9.12 c	69.00 bc
	10	87.50 a	425.83 bcd	7.41 cde	10.14 c	49.00 cd
	15	84.67 a	445.67 b	7.89 bcd	11.11 c	31.00 def
	Mean	**85.54 a**	**449.79 a**	**6.46 b**	**15.02**	**57.50 a**
A. elongatum **(Tall Wheatgrass)**	0	52.33 f	389.41 cde	8,70 abc	16,21 c	21,84 ef
	5	59.34 de	221.84 f	9,56 abc	18,38 c	16,00 ef
	10	64.00 cd	234.17 f	10,95 a	16,45 c	13,67 ef
	15	55.17 ef	233.17 f	11,11 a	15,32 c	12,84 f
	Mean	**57.83 c**	**269.65 c**	**10,08 a**	**16,59**	**16,09 b**
Means	0	70.00 b	462.36 a	8.05	30.08 a	64.11 a
	5	69.72 b	303.84 c	6.82	12.63 b	56.33 a
	10	74.39 a	365.56 b	7.93	11.92 b	40.22 b
	15	69.72 b	353.83 b	7.94	11.57 b	25.78 c
	Overall Mean	**70.96**	**371.40**	**7.69**	**16.55**	**46.61**
LSD Salt concentrations(0.01)		**3.629**	**27.550**	**-**	**6.389**	**11.820**
LSD Agropyron species (0.01)		**3.143**	**23.860**	**1.229**	**-**	**10.230**
LSD Salt concentrations X Agropyron species(0.01)		**6.286**	**47.710**	**2.457**	**11.070**	**20.470**

Conclusion

In our study was searched to the effect on *Agropyron* species of different salt concentration. Consequently, each species was different response to salt concentrations. While the minimum effect of

increasing salt concentration was shown in tall wheatgrass, the maximum effect was determined in crested wheatgrass. For this reason, the selection of tall wheatgrass was found advisable within Agropyron species used in this study for soil which is high salinity level.

Table 3. The Summary of Analysis of Variance Table Belonging to Morphological Properties of *Agropyron* Species Grown in Different Salt Concentration

Source of Variance	Degrees of Freedom	Mean Square				
		Aboveground Plant Height	Total Plant Heights	Fresh Shoot Weight	Total Fresh Plant Weight	Seeds Per Spica
Total	35	-	-	-	-	-
Salt Conc.	3	47.244 **	39544.378**	2.990	734.395 **	2627.011 **
***Agropyron* spp.**	2	2322.527**	102267.111 **	51.537 **	27.303	8615.973 **
Salt Con. X *Agropyron* spp.	6	38.342**	7263.675**	11.915 **	242.111 **	438.883**
Error	24	7.576	436.468	1.158	23.478	80.340
CV (%)		**3.88**	**5.63**	**14.00**	**29.28**	**19.23**

** P< 0.01

Acknowledgements: *This research is financially supported by Selcuk University Coordinating Office of Academic Staff Training Program (OYP) under grant no 2015-ÖYP-078. This study has been prepared from Nur Koc's M. Sc. Thesis.*

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