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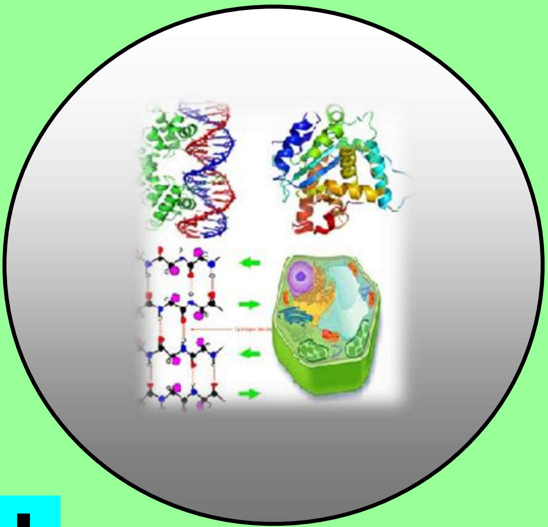

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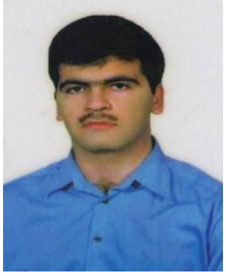

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RESEARCH PAPER

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Effects of Salinity and Planting Depth on the Cultivar Pea Alderman

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ABSTRACT

To evaluate the effect of sodium chloride salinity and depth of planting, on stem length traits, number of leaves after 12 days and number of days to seedling emergence in tested PEA ALDERMAN genotypes by using three levels of sodium chloride salinity (salinity 0/5%, salinity 1/5% and 2% salinity) three planting depths (1, 2 and 3 cm) and PEA ALDERMAN genotype in factorial randomized complete block design with three replications. Analysis of variance showed that there were significant differences for the three traits evaluated between the depths of planting. But between the levels of salinity, only for the two traits of stem length and leaves after 12 days there was significant difference at the 5% level. Based on the results of the comparison of factors, maximum stem length and the number of leaves after 12 days of sowing depths of 1 and 2 cm and least of all about the planting depth was three inches. The results showed that with increasing depth of planting, the number of days to germination increases. Also the results of the mean surface salinity showed that all traits except days for germination was affected by salinity and with increasing concentrations of sodium chloride in irrigation water, stem length and the number of leaves is reduced after 12 days. The results of correlation between traits showed that with increasing stem length, leaf number increased after 12 days (Significant correlation). On the other hand by the increase in the number of days to emergence, shoot length decreases (Negative and significant). But the correlation between the number of days to seedling emergence and number of leaves after 12 days were negative and insignificant. The result of linear regression analysis showed that the number of days to emergence (the dependent variable) and the number of leaves after 12 days, there is a

significant linear relationship between them according to the form below: y=5/91-0/267x. On the other hand, the result of the quadratic regression stem length trait (dependent variable) and the number of leaves after 12 days showed that there was a significant relationship between these characteristics: y=-0/956+3/753x-0/236x^2. These results indicate that stem length increased by the increase in the number of leaves, from 12 days. But after some extent, after 12 days, the number of leaves, stem length decreases.
Key words:Salinity, Depth of Planting, Stem Length, Regression and Correlation.

INTRODUCTION

Peas (Peagarden) with the scientific name *Pisum Sativum* is the annual grass and legume family plant (*Legomines*), psychrophilic, with long branches ascending to the use of green beans, is being cultivated. Cultivation and average global performance of a million hectares and 5.8 tons per hectare respectively. There are 1222 acres under cultivation in Golestan with the performance of 7.6 tonnes per hectare. Golestani farmers to observe the principles of rotation, especially in wheat planting and also its economical discuss that influence the region, engaged in cultivation (Mokhtarpour et al. 1383).

Salinity is one of the most important environmental stresses which affect the production of agricultural products. In all regions where irrigation is essential for crop production, soil salinization is inevitable that this phenomenon has gradually become a major problem in arid and semi-arid in Iran (Flowers and Flowers 2005). So to continue the production of crops in these areas, varieties of products are required that have good growth with irrigation of saline water and their reduction in performance threshold is high (Munns and Tester 2008).

In addition to the genetic diversity of the genetic treasury, understanding the physiological and morphological processes in response to stress in order to design the correction process of salt tolerant varieties is important (Bruce et al. 2002). As a result of salinity, secondary stresses such as oxidative stress may also occur. In this case, the production and accumulation of active radicals in the oxidation of proteins and lipids and thus leads to cell death will occur (Molassiotis et al. 2006).

The plant processes to cope with salt stress can be classified into two processes as reducing the effects of drought stress and ionic balance and elimination of toxic ions into the cell (Yoko et al. 2002). Though the study of physiological processes in salinity stress can help in the selection of the pea cultivars to salinity.

The study of sodium and potassium concentrations in the presence and absence of salinity were determined that the sodium concentrations in the shoots were rooted in the absence of stress. But in terms of salinity shoot sodium concentration was higher. However, the concentration of potassium in the stress condition and absence of salinity in the root was higher than shoot.

Ashraf M. and Mc Neilly (2004) reported that to maintain a high ratio of potassium to sodium in plant tissues in salinity tolerance is essential. While the relationship between salt tolerance and accumulation of nutrients legumes such as potassium in vegetative organs have been reported (Cordovilla et al. 1995). Compatibility of plant species in soils occurs by creating a negative osmotic potential (By the accumulation of minerals and dissolved organic material in their tissues) (Samaras et al. 1994).

Planting depth is also one of the factors affecting plant growth, in a way that an increase in the planting of green plants becomes weak. (Stem length and number of leaves of plants grown reduced). Also, by increasing the depth of planting, the number of days to germination increases.
Based on this, studies have been done to evaluate the effects of salinity and depth of planting peas called PEA ALDERMAN. Also, the purpose of this study was to evaluate the correlation and regression relationships between traits in pea cultivars under different levels of salinity and sowing depth.

MATERIAL AND METHODS

To evaluate the effect of sodium chloride salinity and depth of planting, experiment using three levels of salinity(5%, 1/5% and 2%) 3 planting depths (1, 2 and 3 cm) in factorial randomized complete block design with three replications.PEA ALDERMAN pea genotypes were cultivated. Traits, including length, number of leaves after 12 days (Number of leaves of a plant appeared after 12 days of cultivation) and the number of days to germinate (Number of days that appear germinated seeds in the soil) were measured.
Disinfected seeds were cultivated in pots (One seed per pot) and were maintained at 27 ° C under greenhouse conditions. Seeds at depths of 1, 2 and 3 cm in pot were cultivated and with water containing 0/5, 1.5 and 2 percent sodium chloride were irrigated once every three days.
For statistical analysis of data (Analysis of variance, mean comparison, correlation, regression) SPSS software was used.

RESULTS AND DISCUSSION

Analysis of variance and comparison of mean traits

Analyses of variance are shown in Table 1. Results showed that the effect of salinity at various levels (Irrigation with water containing 0/5, 1/5 and 2% salt every three days) on shoot length, number of leaves after 12 days was significant at the 5% level. But the numbers of days for germination significant differences were not observed between the different levels of salinity. Most likely, these results indicate that the number of days to germinate, PEA ALDERMAN Genotypes in response to environmental conditions such as salinity, there is little difference.
Among various traits, stem length has the lowest coefficient and number of leaves after 12 days had the highest coefficient of variation. Coefficient of variation was a standard and shows the reliability of the repeated traits. The acceptable coefficient of variation depending on the degree of control experiments and the heritability of the trait under study and other factors vary. Different planting depths (1, 2 and 3 cm) of all traits were significantly different at the 1% level which shows the effect of planting depth on all the traits under study.
The interaction between salinity levels at planting depth was insignificant for all traits. Indicating the lack of interaction between salinity levels and the planting depth. According to Table 2, it can be seen that the maximum length of the stem and number of leaves after 12 days in the salinity level of 0.5% and the lowest salinity level was 2%. On the other hand, it was shown that different levels of salinity from the number of days to germinate have no significant difference (Table 2).

These results indicate that the genotype of PEA ALDERMAN, days to emergence is not affected by salinity. Based on the results shown in Table 3, it was observed that the maximum length of the stem and leaves after 12 days of planting depths are 1 and 2 cm. Planting depth 3 cm has lowest stem length and number of leaves after 12 days. For the number of days to germinate, the maximum value of the depth is 3cm and the lowest deep was 1cm (Table 3). These results suggest that by the increased planting depth, the number of days to germination increases.

Table 1.The variance Analysis of evaluated traits.

Sources of variation	df	Mean square		
		Stem length	Number of leaves after 12 days	Number of days for germination
Block	2	0/477	0/704	0/481
Level of salinity	2	14/258*	4/148*	0/481
Planting depth	2	57/602**	11/370**	7/148**
Planting depth × salinity levels	4	4/597	1/648	1/537
Error	16	2/987	0/870	0/568
CV(%)		%5/61	%12/67	%10/05
** and * significant at 1% and 5% respectively.				

Table 2. Comparison of salinity levels of the traits.

Level of salinity	Stem length (cm)	Number of leaves after 12 days	Number of days for germination
%0/5	10/86[a]	4/56[a]	4/67[a]
%1/5	9/98[ab]	4/11[ab]	5/11[a]
%2	8/38[b]	3/22[b]	4/78[a]

Different letters in each column indicate significant differences of factor levels at the 5% level.

Table 3.Comparison of the depth of planting from the point of trait analysis.

Depth of planting	Stem length (cm)	Number of leaves after 12 days	Number of days needed for germination
1cm	11/68[a]	4/67[a]	4/00[c]
2cm	10/66[a]	4/56[a]	4/78[b]
3cm	6/88[b]	2/67[b]	5/78[a]

Different letters in each column indicate significant differences of factor levels at the 5% level.

Linear regression between the traits

Pearson correlation coefficients for traits showed that between stem length and number of leaves after 12 days at 1% probability, there were significant positive correlations (Table 4).

It means that with increasing stem length, leaf number increased after 12 days. The correlation length and the number of days to emergence were negative and significant at 1% probability and this shows the number of days to emergence, shoot length decreases. But the correlations between the number of days to seedling emergence and number of leaves after 12 days were negative and insignificant.
Linear regression analysis (Tables 5 and 6) showed a significant correlation between the two traits assessed as follows:
y=5/91-0/267x
y = the number of days to emergence (dependent variable)
x = number of leaves after 12 days (independent variable)

The above equation shows that the number of leaves after 12 days, days to germination decreases.

Secondary regression analysis (Tables 7 and 8) showed a significant correlation between the two traits evaluated as follows:
y=5/082+0/174x-0/052x^2
y = the number of days to emergence (the dependent variable)
x = number of leaves after 12 days (independent variable)

Tables 9 and 10 show the results of regression analysis of the third degree showed a significant correlation between the two traits evaluated as follows:
y=5/265+0/023x-0/014x^2-0/003x^3
y = the number of days to emergence (the dependent variable)
x = number of leaves after 12 days (independent variable)

Linear regression analysis of stem length and the number of leaves after 12 days (Tables 11 and 12) showed that there was no relationship between the level of 1% probability between them:
y=2/805+1/750x
y = stem length (dependent variable)
x = number of leaves after 12 days (independent variable)
The above equation shows that after 12 days the number of leaves increase as the stem length increases.

Table 4.Correlation coefficients between traits.

	Stem length	**Number of leaves after 12 days**	**Number of days for germination**
Stem length	1		
Number of leaves after 12 days	0/877**	1	
Number of days for germination	-0/548**	-0/347	1
** and * significant at 1% and 5% respectively.			

The result of secondary regression shoot length trait and the number of leaves after 12 days (Tables 13 and 14) showed that there was a significant relationship between them:

$y=-0/956+3/753x-0/236x^2$

y = stem length (dependent variable)

x = number of leaves after 12 days (independent variable)

It means that that by increasing the number of leaves after 12 days, stem length increases. But from a much later, as the number of leaves increase, stem length slowly decreases after 12 days.

Tables 15 and 16 show the results of regression analysis of the third degree that there is a significant correlation between the two traits evaluated are as follows

$y=-4/565+6/734x-0/987x^2+0/058x^3$

y = stem length

x = number of leaves after 12 days

Table 5. Linear regression analysis of evaluated traits (the number of days to germination, number of leaves after 12 days).

Sources of variation	df	Mean square
Regression	1	3/779*
Error	25	1/105
*** and * significant at 1% and 10% respectively.		

$y=5/910-0/267x$

y = the number of days to germinate

x = number of leaves after 12 days

Table 6.Results of t-test for linear regression coefficients.

	Coefficients B	T-test
X	-0/267	-1/849*
Constant	5/910	9/735***
*** and * significant at 1% and 10% respectively.		

Table 7. Results of regression analysis of second- order evaluated traits (the number of days to germinate number of leaves after 12 days.

Sources of variation	df	Mean square
Regression	2	2/032
Error	24	1/139
** and * significant at 1% and 5% respectively.		

$y=5/082+0/174x-0/052x^2$
y = the number of days to germinate
x = number of leaves after 12 days

Table 8.Results of t-test for quadratic regression coefficients.

	Coefficients B	T-test
X	0/174	0/195
X^2	-0/052	-0/501
Constant	5/082	2/877*
*** and * significant at 1% and 10% respectively.		

Table 9. Regression analysis of the cubic degree of traits (the number of days to germinate, number of leaves after 12 days).

Sources of variation	df	Mean square
Regression	3	1/365
Error	23	1/189
*** and * significant at 1% and 10% respectively.		

$y=5/265+0/023x-0/014x^2-0/003x^3$

y = the number of days to germinate
x = number of leaves after 12 days

Table 10.Results of t-tests for regression coefficients of the cubic degree.

	Coefficients B	T-test
X	0/023	0/006
X^2	-0/014	-0/015
X^3	-0/003	-0/041
Constant	5/265	1/095
*** and * significant and insignificant at 1% and 10% respectively.		

Table 11. Linear regression analysis of evaluated traits (stem length and number of leaves after 12 days).

Sources of variation	df	Mean square
Regression	1	162/219**
Error	25	1/945
** and * significant at 1% and 5% respectively.		

$y=2/805+1/750x$
y = stem length
x = number of leaves after 12 days

Table 12.Results of t-test for linear regression coefficients.

	Coefficients B	T-test
X	1/750	9/132**
Constant	2/805	3/482**
** and * significant at 1% and 5% respectively.		

Table 13. Regression analysis of second- order evaluated traits (stem length and number of leaves after 12 days).

Sources of variation	df	Mean square
Regression	2	84/051**
Error	24	1/781
** and * significant at 1% and 5% respectively.		

$y=-0/956+3/753x-0/236x^2$
y = stem length
x = number of leaves after 12 days

Table 14.Results of t-test for quadratic regression coefficients.

	Coefficients B	T-test
X	3/753	3/359***
X^2	-0/236	-1/817*
Constant	-0/956	-0/433
*** and * significant at 1% and 10% respectively.		

Table 15. Regression analysis of third-order evaluated traits (stem length, number of leaves after 12 days).

Sources of variation	df	Mean square
Regression	3	56/294
Error	23	1/825
*** and * significant and insignificant at 1% and 10% respectively.		

$y=-4/565+6/734x-0/987x^2-0/058x^3$
y = stem length
x = number of leaves after 12 days

Table 16.Results of t-tests for regression coefficients of the Cubicdegree.

	Coefficients B	T-test
X	6/734	1/434
X^2	-0/987	-0/854
X^3	0/058	0/654
Constant	-4/565	-0/766
*** and * significant and insignificant at 1% and 10% respectively.		

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