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**STUDY OF DROUGHT AND SALT STRESS ON GERMINATION INDEXES OF  
ALYSSUM SPP AND TANACETUM PARTENIUM**

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**ABSTRACT**

Medicinal plants are the ones with certain effective substances that are used in preventing and treating the illnesses.

Among the most important stages of the plants' growths, germination one can be mentioned. This stage is often influenced by the environmental tensions, especially salinity and aridity. The thesis consists of introduction, materials and methods and results and discussion.

In order to examine the effects of salinity and aridity tensions on the germination of the two medicinal plants of Alyssum spp and Tanacetum partenium, two separate experiments were conducted factorially in a Completely randomized basic design format with 6 levels of salinity (0, 0.12, 0.25, 0.5, 0.75, and 1 molar) and 5 levels of (0, -0.3, -0.6, -0.9, and -1.2 bar) in 4 repetitions. NaCl and PEG were used for making salinity treatment and also for the aridity tension, respectively. The results of the experiment showed that along with the increase in the salinity and aridity tensions, the rate and percentage of germination, length and shoot lengths, and also the dry and wet weights of the under experiment seeds were significantly reduced. The highest limits of endurance against salinity for the seeds of Tanacetum partenium and Alyssum spp were respectively 0.5 and 0.75 molar, while it was to -0.9 bar concentration for the aridity tension. Mutual influencing of salinity and aridity was also indicative of the endurance limits of 0.5 and 0.75 molar and -0.9 and -0.9 bar for the Tanacetum partenium and Alyssum spp seeds, respectively. Correlational results of the attributes showed the very significant influencing of salinity and aridity tensions on the attributes of the root and stem lengths.

In salinity tension and by using NaCl as well as germination of the *Tanacetum partenum* and *Alyssum* spp seeds in the witness treatment of -0.3 and -0.6 bar, there was a significant increase in the length and shoot lengths as well as dry weight, while the seeds did not germinate in -0.9 and -1.2 bar treatments. In aridity tension and by using PEG 6000 as well as germination of the *Tanacetum partenum* and *Alyssum* spp seeds in the witness treatment of 0.12, 0.25, and 0.5 molar, there was a significant increase in the length and shoot lengths as well as the dry weight, while the seeds did not germinate in 0.75 and 1 molar treatment. Their growth was stimulated to some extent in this level of tension, but all three attributes were linearly decreased when tension severity got more increased. It was while no lengths and shoots were practically formed under the salinity and aridity tension conditions to 1 molar and -1.2 bar. The research results showed that *Tanacetum partenum* and *Alyssum* spp are sensitive to salinity and aridity tensions in the stage of germination and plantlet growth, with somewhat more sensitivity to salinity than aridity tension.

**Keywords:** Seed, drought, Salinity, *Alyssum* spp, *Tanacetum partenum*.

## INTRODUCTION

Germination is considered as one of the important and sensitive stages of the plant's life cycle as well as a key procedure in the plantlets growth (Hosseini and Rezvani Moghadam, 2006). Germination as the first stage in the plants life means the emergence and lengthening of the length and shoot as well as the allocation of the reserved nutrition's to the embryo part, and also plays a determinative role in making the plantlet (Kafiee, et al. 2005). Based on this definition, germination consists of a series of occurrences as a result the embryo changes from the inactive and static state to an active and constructive metabolites form. Physiologically, germination is a procedure that begins through absorbing water by the dry seed and ends by the emergence of the

initial root out of the seed coverage (Afzali, et al., 2006).

Germination and plantlet making are of special importance in determining the shrub's ultimate compactness in the surface unit (Hosseini and Rezvani Moghadam, 2006).

### Germination

On the whole, germination is the reactivation of the seed metabolical procedure and emergence of the length and shoot that leads to the seedlings formation, physiologically, germination begins by the initial stages of the biochemical reactivity and ends by the length removal (Dadkhah, 2010). Morphologically and also for testing the seed and plant adding, the definition of germination should also include the formation of the ordinary seedling out of the germinated seed. Totally,

germination is divided into three successive and separate, but simultaneous, stages ( Hosseini and Rezvani Moghadam , 2006).

- **First stage** : It is the stage of getting awake or active in which water is absorbed by the seed , anzyms become active , and length emerges as a result of the leaner growth of the cells .

- **Second stage** : It is the stage of digestion and transfer in which fats , proteins , carbohydrates , Endosperm , and cotyledon are digested , change into simpler chemical substances , and also transferred to the growth points of the embryos pivot .

- **Third stage** : It is the stage of seedlings growth in which development occurs as a result of cellular division in separate growth points of the embryonic pivot .

Background research

Seed the optimum temperature for germination is essential environment (clean race et al. 2013).

In the cellular response to the growing shortage of water can damage the cell surface, but may work with other responses to stress (Afzal 2005).

In particular with respect to the dry climate plants regulate hormone secretion and lack of moisture and plant transpiration process in compliance with the specific mechanism (Pak Nejad et al. 2013).

The figures are higher germination under stress conditions have a greater chance of emergence (Zare et al. 2006).

Afzali et al (2006) Effect of seed germination chamomile (*Matricaria chamomilla*) were investigated and found that germination was very sensitive to drought stress. Salari and aldin Shams al (2007) Effects of water stress on the germination and establishment of seedlings of plant species *Elymus Junceus* and *kochia prostrate* examined and the results showed that drought reduced growth and weight species.

Lack of germination of plants in saline soils often due to high salt concentration in the seed culture because the upward movement of the accumulation of salts in the soil solution subsequent soil. (Ramroudi et al. 2006). Germination stage one of the most critical stages of plant growth is salinity (Hassanpour, et al., 2009).

Salt into the seed can have toxic effects on tissues and can reduce germination (Zatvr et al., 2011).

Sharafi (2006) to test the effect of different levels of salinity on seed germination Martyghal showed that all traits including uniformity of germination and seedling growth were affected by salinity stress.

Jamshidi (2005) The anise seed germination under salt stress showed that the percentage

of seed germination and seed vigor during the shoot and root decreased under stress. Fallahi et al in (2010) by studying drought stress and salinity on seed germination private Syat sage showed that with increasing salinity and drought also reduced germination and seedling length and reduce the potential for water and increased salinity its dry weight was reduced.

### METHODOLOGY

In order to study the effect of osmotic treatment of polyethylene glycol 6000 (PEG) and sodium chloride induced salinity treatments on indices Germination Tan acetum premium and alyssum two separate tests based on completely randomized design with four replications in a factorial Herb Research Branch, Islamic Azad University was conducted in 2013. The effect of different levels of osmotic treatments (zero, -0/3 to -0/6 to -0/9 to -1/2 times, respectively, D1, D2, D3, D4, D5) and Salinity (zero 0/12, 0/25, 0/5, 0/75, 1 M, respectively, S1, S2, S3, S4, S5, S6) were investigated. The effects of water stress, soluble polyethylene glycol, using the formula of Michel and Kaufmann (Equation 1) was prepared. For the treatment of sodium chloride salt was used. Within each Petri dish of 10 cm, Whitman 100 filter paper was placed over the seed. Before, during and after the paper was disinfected

with alcohol to disinfect with alcohol was washed with distilled water. Then 5 ml of the desired solution (polyethylene glycol and sodium chloride) was added to each petri dish. To reduce water losses due to evaporation of the solution into Petri, a Petri around each sealed with Teflon and air to penetrate for germination of seeds of 3 small holes in the Teflon has been created. The Petri dishes for 15 days at 25 ° C and the optical rotation of 12 hours light and 12 hours of darkness were placed in germinator. During the experimental period the number of germinated seeds was recorded daily. Exclusion criteria for seed germination and view rootlet (Hosseini et al, 2006).

To calculate the percent germination of formula (2) for determining the germination rate of the formula (3) was used (stylish Hamm et al., 2009).

$$\Psi_s = -(1.18 \times 10^{-2})C - (1.18 \times 10^{-4})C^2 + 1)(2.67 \times 10^{-4})CT + (8.39 \times 10^{-7})C^2T$$

$$\text{Germination} = 100 (NG / NT)$$

here NG stands for the number of germinated seeds, and NT stands for the whole number of seeds.

$$RS = \sum_{i=1}^n \frac{Si}{Di}$$

Where RS equals the germination rate equal to the number of germinated seeds per day

and DI the number of days to the count of n.n stands for day (for counting).

## **RESULTS**

In this research , the effects of salinity and aridity tensions on germination and also such attributes of the two plants of Alyssumspp and Tanacetumpartenuim as percentage and rate of germination , length and shoot lengths , and also dry and wet weights were measured . The results obtained out of the variance analysis and also the comparison of the means of the mentioned attributes based on Doncan test have been presented separately for two plants of Alyssumspp and Tanacetumpartenuim in the tables and figures.

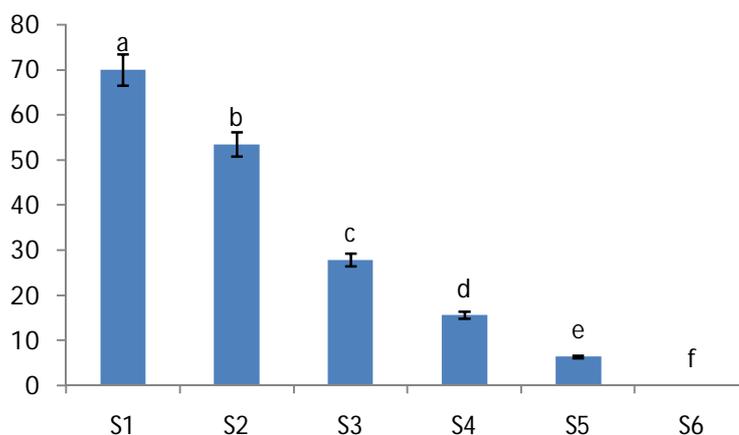
1-4) Rate of germination of Alyssumspp and Tanacetumpartenuim seeds under the influence of the salinity tension.

Rate of germination of Alyssumspp and Tanacetumpartenuim seeds was made under the influence of the salinity tension by which the highest rate was seen in the witness treatment and the lowest in the highest concentration of salinity.

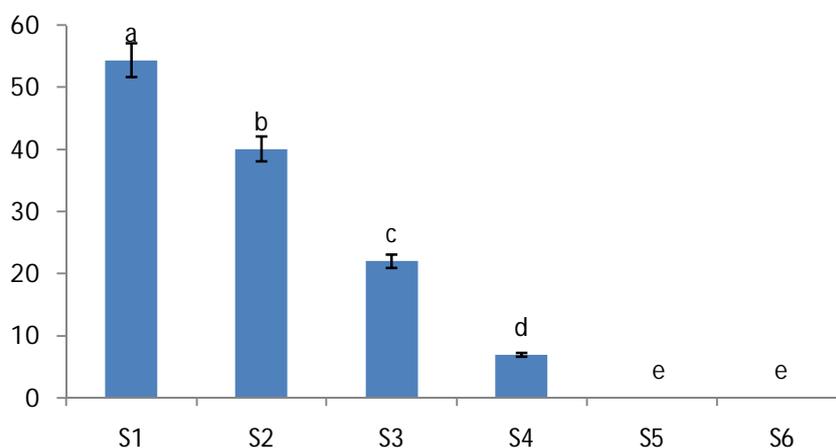
In concentrations of 1 as well as 0.75 and 1 molar, Alyssum spp and Tanacetum partenuim seeds did not germinate, respectively . The endurance thresholds of the germination rates of Alyssumspp and Tanacetumpartenuim seeds against the salinity tension were seen at 0.75 and 0.5 molar , respectively ( figures 1-4 and 2-4 ).

2-4 ) Rate of germination of Alyssumspp and Tanacetumpartenuim seeds under the influence of the aridity tension .

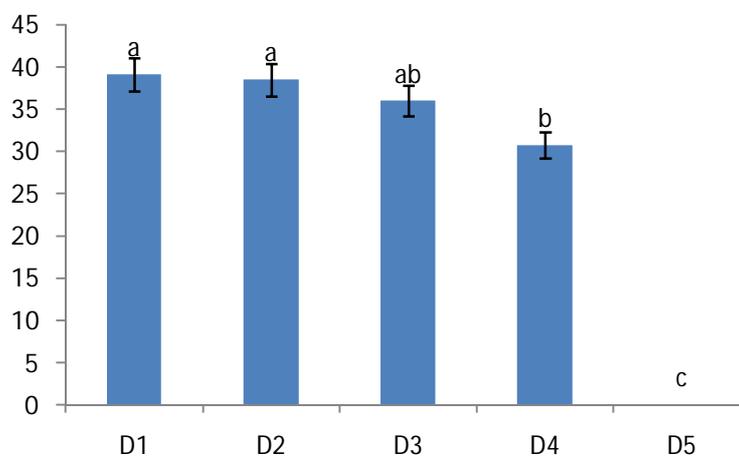
Rate of germination of Alyssumspp and Tanacetumpartenuim seeds was influenced by the aridity tension by which the highest one was seen in the witness treatment and the lowest in the concentration of -0.9 bar . Rate of germination was reduced along with the increase in the aridity tension severity, insuch a way that Alyssumspp and Tanacetumpartenuim seeds did not germinate at the concentration of -1.2 bar . The endurance threshold of the rate of germination of Alyssumspp and Tanacetumpartenuim seeds was seen against the aridity tension of -0.9 bar . ( figures 3-4 and 4-4 ) .



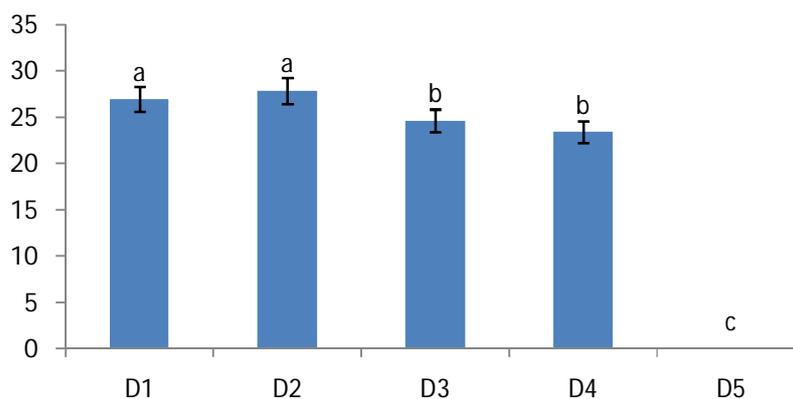
Figures 1-4 : Rate of germination of Alyssum spp seed under the salinity tension .



Figures 2-4 : Rate of germination of Tanacetum partenum seed under the salinity tension



Figures 3-4 : Rate of germination of Alyssum spp seed under the aridity tension



**Figures 4-4 : Rate of germination of Tanacetum partenum seed under the aridity tension**

Correlation of the under examination attributes of the Alyssum spp plant has been given in table (1-4). As it has been determined, there is a positive significant correlation among the number of germinated seeds, percentage and rate of germination, as well as the length and shoot lengths.

Regarding the relationship between the and dry weights as well as the other attributes, a negative correlation has been shown.

This means that the obtained wet and dry weights in each of the treatments have decreased by continuing the experiment under the different salinity and aridity treatments. It is while the lengths of shoot and also length increased by increasing the application of treatments thanks to obtaining nutrients and light for the embryo, its nutrition and growth. However, this increase is accompanied by thinning the herbal structure.

Investigating the extent of the attributes correlation in the plant of Tanacetum partenum.

Table (1-4): results correlation estimated Alyssum spp under stress drought and salinity conditions laboratory.

( $y_1$ - $y_{15}$  number of germinated seeds,  $y_{16}$  germination,  $y_{17}$  germination rate,  $y_{18}$  weight,  $y_{19}$  dry,  $y_{20}$  during the shoot,  $y_{21}$  root length).

Correlation of the under measurement attributes in the plant of Tanacetum partenum has been shown in table (2-4). As it has been determined, there is a positive significant correlation between the number of germinated seeds, percentage and rate of germination, as well as the length and shoot lengths. Regarding the relationship between the wet and dry weights and the other attributes, a negative correlation has been seen. This means that wet and dry weights of each of the treatments have

decreased by increasing the number of application days of different salinity and aridity treatments . It has been seen that application of treatments , but just the obtained dry and wet weights decrease thanks to thinning the herbal structures .

Table (2-4) : results correlation estimated Tanacetumpartenium under stress drought and salinity conditions laboratory .

(y<sub>1</sub>-y<sub>15</sub> number of germinated seeds ,y<sub>16</sub> germination , y<sub>17</sub> germination rate , y<sub>18</sub> weight , y<sub>19</sub> dry , y<sub>20</sub> during the shoot , y<sub>21</sub> root length ) .

Y10	Y9	Y8	Y7	Y6	Y5	Y4	Y3	Y2	Y1	
									1	Y1
								1	0/82**	Y2
							1	0/97**	0/83**	Y3
						1	0/98**	0/96**	0/83**	Y4
				1	0/98**	0/98**	0/97**	0/96**	0/84**	Y5
			1	0/99**	0/97**	0/97**	0/96**	0/94**	0/84**	Y6
		1	0/99**	0/99**	0/97**	0/97**	0/96**	0/93**	0/84**	Y7
	1	0/99**	0/99**	0/98**	0/96**	0/96**	0/95**	0/93**	0/85**	Y8
1	0/99**	0/99**	0/99**	0/98**	0/95**	0/95**	0/94**	0/92**	0/85**	Y9
0/99**	0/99**	0/99**	0/98**	0/98**	0/95**	0/95**	0/94**	0/91**	0/85**	Y10
0/99**	0/99**	0/99**	0/98**	0/98**	0/95**	0/95**	0/94**	0/91**	0/85**	Y11
0/99**	0/99**	0/99**	0/86**	0/91**	0/94**	0/94**	0/94**	0/91**	0/86**	Y12
0/99**	0/99**	0/98**	0/98**	0/97**	0/94**	0/94**	0/94**	0/91**	0/86**	Y13
0/99**	0/98**	0/98**	0/97**	0/97**	0/95**	0/94**	0/94**	0/91**	0/87**	Y14
0/99**	0/99**	0/99**	0/99**	0/99**	0/97**	0/97**	0/97**	0/94**	0/87**	Y15
0/99**	0/98**	0/98**	0/97**	0/97**	0/95**	0/94**	0/94**	0/91**	0/87**	Y16
0/99**	0/98**	0/98**	0/97**	0/97**	0/95**	0/94**	0/94**	0/91**	0/87**	Y17
-0/046	-0/045	-0/045	-0/046	-0/045	-0/046	-0/038	-0/041	-0/038	-0/032	Y18
-0/05	-0/05	-0/05	-0/051	-0/051	-0/052	-0/044	-0/047	-0/044	-0/038	Y19
0/83**	0/83**	0/83**	0/83**	0/84**	0/86**	0/83**	0/86**	0/84**	0/84**	Y20
0/87**	0/87**	0/86**	0/86**	0/87**	0/88**	0/86**	0/87**	0/85**	0/85**	Y21

21	Y20	Y19	Y18	Y17	Y16	Y15	Y14	Y13	Y12	Y11	
											Y1
											Y2
											Y3
											Y4
											Y5
											Y6
											Y7
											Y8
											Y9
											Y10
										1	Y11
									1	0/99**	Y12
								1	0/99**	0/99**	Y13
							1	0/99**	0/99**	0/99**	Y14
						1	0/99**	0/99**	0/99**	0/99**	Y15
				1	0/99**	0/99**	0/99**	0/99**	0/99**	0/99**	Y16
			1	-0/043	-0/042	-0/048	-0/045	-0/45	-0/045	-0/045	Y17
		1	-0/042	-0/043	-0/048	-0/05	-0/05	-0/05	-0/05	-0/05	Y18
	1	0/7**	0/8**	0/86**	0/85**	0/85**	0/84**	0/83**	0/83**	0/83**	Y19
1	0/99	0/12	0/13**	0/88**	0/88**	0/88**	0/87**	0/87**	0/86**	0/86**	Y20
											Y21

Y10	Y9	Y8	Y7	Y6	Y5	Y4	Y3	Y2	Y1		
										1	Y1
								1	0/67**		Y2
							1	0/84**	0/5**		Y3
						1	0/97**	0/82**	0/48**		Y4
					1	0/98**	0/95**	0/81**	0/45**		Y5
				1	0/99**	0/97**	0/93**	0/77**	0/43**		Y6
			1	0/99**	0/97**	0/95**	0/92**	0/75**	0/39**		Y7
		1	0/99**	0/98**	0/96**	0/94**	0/92**	0/89**	0/69**	0/34**	Y8
	1	0/99**	0/98**	0/96**	0/94**	0/92**	0/89**	0/69**	0/33**		Y9
1	0/99**	0/9**	0/97**	0/96**	0/94**	0/92**	0/89**	0/68**	0/33**		Y10
0/99**	0/98**	0/98**	0/97**	0/96**	0/95**	0/93**	0/9**	0/69**	0/34**		Y11
0/98**	0/98**	0/98**	0/97**	0/96**	0/94**	0/93**	0/9**	0/7**	0/36**		Y12
0/98**	0/97**	0/97**	0/97**	0/96**	0/94**	0/93**	0/9**	0/7**	0/37**		Y13
0/97**	0/96**	0/96**	0/97**	0/95**	0/95**	0/93**	0/9**	0/72**	0/38**		Y14
0/97**	0/96**	0/96**	0/96**	0/95**	0/94**	0/93**	0/9**	0/72**	0/38**		Y15
0/98**	0/98**	0/98**	0/99**	0/98**	0/97**	0/96**	0/93**	0/76**	0/42**		Y16
0/97**	0/96**	0/96**	0/96**	0/95**	0/94**	0/93**	0/9**	0/72**	0/38**		Y17
-0/02	-0/02	-0/02	-0/016	-0/011	-0/006	-0/002	0/001	0/04	0/092		Y18
-0/03	-0/03	-0/03	-0/029	-0/025	-0/020	-0/01	-0/01	0/02	0/081		Y19
0/92**	0/91**	0/91**	0/9**	0/89**	0/88**	0/87**	0/84**	0/72**	0/43**		Y20
0/89**	0/88**	0/88**	0/89**	0/88**	0/88**	0/87**	0/84**	0/72**	0/46**		Y21

Y21	Y20	Y19	Y18	Y17	Y16	Y15	Y14	Y13	Y12	Y11	
											Y1
											Y2
											Y3
											Y4
											Y5
											Y6
											Y7
											Y8
											Y9
										1	Y10
									1	0/99**	Y11
								1	0/99**	0/99**	Y12
							1	0/99**	0/99**	0/99**	Y13
						1	0/99**	0/99**	0/99**	0/98**	Y14
					1	0/98**	0/98**	0/99**	0/99**	0/99**	Y15
				1	0/98**	0/99**	0/99**	0/99**	0/99**	0/98**	Y16
			1	-0/02	-0/01	-0/03	-0/03	-0/02	-0/02	-0/02	Y17
		1	0/99**	-0/04	-0/02	-0/04	-0/04	-0/04	-0/04	-0/04	Y18
	1	0/18**	0/19**	0/92**	0/92**	0/92**	0/91**	0/92**	0/91**	0/91**	Y19
1	0/97**	0/26**	0/28**	0/92**	0/91**	0/92**	0/91**	0/91**	0/9**	0/9**	Y20
											Y21

**RESULTS AND DISCUSSION**

Considering the obtained results , it is inferred that the highest limits of endurance against salinity and aridity for the two plants of Alyssum spp and Tanacetum partenum were 0.75 and 0.5 molar as well as -0.9 and -0.9 bar , respectively .

By comparing the growth trend of the length and shoot lengths under the different salinity and aridity treatments , it was observed that a reducing trend began in the plants of Tanacetum partenum and Alyssum spp from the limit of 0.5 and 0.75 molar on , respectively . It is while regarding the endurance against aridity , the reducing trend was seen in the plants of Alyssum spp and Tanacetum partenum from the limit of 0.5 and -0.9 bar on , respectively .

Considering the table (1-4) and (2-4) , a correlation is seen among the attributes based on which there is an increasing trend between the length and shoot lengths (0.088 and 0.099) , and a decreasing and reverse one between the dry and wet weight attributes ( 0.032 and 0.038) .

By studying the figure showing the linear trend of length and shoot lengths , dry and wet weights , as well as rate and percentage of the germination , it is observed that there is not a significant difference between the two plants of Alyssum spp and Tanacetum partenum for the salinity of 0.75 and 0.5 molar and the aridity of -0.9 bar . However , they are completely distinct from each other for the other levels of salinity and aridity ,that it is indicative of more influence

from salinity and aridity on the plants of *Alyssum* spp and *Tanacetum* partenuim .

In the stage of seed germination , salinity causes the cellular membranes' , especially the cytoplasm one , to be damaged , which this brings forth as a result the increase in the membranes permeability thanks to the replacement of  $Ca^{+2}$  by  $Na^{+}$  by which  $K^{+}$  losses increase too ( Takel , 2000)

There was a correspondence between the reduction in the dry weight of the shoot and length resulting from the salinity and aridity tension , because increasing the salinity and aridity tensions causes the dry weight of the shoot and length to be decreased in the present research . The results obtained out of this research corresponded with the ones got out of the present study ( Karimi, et al . 2011) .

It seems that the reduction in the plantlets wet weight issued the reduction in the water absorption . Osmosis regulation can decrease the growth sensitivity to the aridity and salinity tension or make the slight increase intension by regulating the pressure.

Therefore , the reduction in the plantlets growth and as a result changing its wet Weigth can be related to the regulation of the pressure ( Basirirad and Kooldool , 2006) .

Both NACL and PEG Solution Affected negatively the plantlets initial germination

and growth , but comparisons of the two solutions effects in a similar osmosis potential indicated that PEG preventing effect was more severe than NACL solution . It is because PEG molecules are very large and prevent water absorption and also reduce the water potential by the seed through absorbing water and reducing osmosis Potential .

The results showed that the preventing effect of osmosis potential reduction in salinity conditions was more important than the ionic Toxicity effects resulting from  $Na^{+}$  and  $Cl^{-}$  .In addition , the results obtained out of examining the germination of the non-germinated seeds under the salinity conditions in the unstressed environment (improvement experiment were also indicative of the germination significance having been conveyed to the unmentioned environment . ) (Khajeh Hosseini , et al .2007, lynch and laoochi , 1988 ) .

Similar results were obtained regarding Canola ( Andalibi et al 1973) , wheat ( Majnon Hoseinietal et al , 2002 ) , sunflower ( Kaya et al , 2006 ) and pea ( okcu et al k , 2005) , based on which water absorption by the seed was disordered under the aridity tension conditions , which this can cause the seeda germination to be decreased under these conditions . It seems that reduction in

water absorption by the seed resulting from the aridity tension causes the physiological and Metabolical procedures of the seed to be decreased, and so it falls in trouble accessing to the abundant available substances for the plantlets survival until growing to the full placement stage (De& kar , 1994) .

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