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THE POSITIVE EFFECT ON THE PLANT AND YIELD BY TREATING WHEAT SEEDS WITH SALT WATER

Aiad Abdelkareim Akhreim Alzway[1*] Ghazala Ahmad Hamaden Mansour[2]

[1*]Department of Botany, Faculty of Sciences, University of Omer Al-Mukhtar, Albida – Libya. E- mail; aiad.abdelkareim@omu.edu.ly
[2]Department of Botany, Faculty of Sciences, University of Benghazi, Benghazi - LibyaE- mail: ghazala.mansour@uob.edu.ly M.Sc. at Department of Botany, Faculty of Sciences, University of Benghazi, Benghazi – Libya.

***Corresponding Author:** Aiad Abdelkareim Akhreim Alzway
[*]Department of Botany, Faculty of Sciences, University of Omer Al-Mukhtar, Albida – Libya. E- mail; aiad.abdelkareim@omu.edu.ly

Abstract:
salt stress often causes serious problems in wheat production areas. Salinity is one of a major threat in harvesting good wheat stand. In this study, potential of seed priming techniques to improve the performance of wheat in a saline field was tested .this is seed priming is a technique which is used to improve seed germination in field. Results indicated that wheat sown under effects of sea water An experiment was conducted on the Seed wheat For priming, wheat seeds were soaked in sea water solution . For comparison, also untreated seeds were also taken as control. Seed priming treatments. Seeds were primed for 6,12 and 24 hours at three concentration sea water (salinity of water) (25, 50 ,75 and 100) and distilled water as control). Maximum seed germination percentage in lower dilutions was observed when the seeds primed by 0.0,25,50 dilutions of sea water, The most stem length was obtained for seeds . Maximum (MGT) of wheat was obtained from seeds primed with sea water 25 and 50found the increases, value germination was improved increases on lower concentration 25,50 include control.

Keywords: wheat, triticum aestivum, Salinity of water priming, salt stress, root,shoot.

1.1. Introduction

The bread wheat (*Triticum aestivum* L.); is as an important cash crop among the food crops throughout the world farming which occupies a significant position among all of the cultivated cereal crops. The cultivation of wheat has been remained the symbolic of the green revolution which has played a pivotal role in making the nations a food spare nation. The bread wheat is one of the member of the poaceae family with chromosomes 2n = 42 and is highly self-pollinated crop among cereals (Dixon et al., 2009; Sears, 1954; Shewry, 2009). Wheat ranks first among the world food and grain crops, (Asseng et al., 2015). Wheat contributes higher calories up to 20% and higher protein to the growing population of the world's more than any of the other food crops.

Under abiotic stress conditions the wheat is highly affected which caused reduction in the yield and productivity. The salt stress caused cell membrane damage, production of toxic chemicals and accumulation of reactive oxygen species in the plant body (Govt 2018:Sarker etal 2015 We have conducted our research while keeping few research objectives in mind as given below: To evaluate the effects of salicylic acid wheat seedling growth and development. To find out the stress resistant wheat variety from selected varieties for research work and to find out the seed priming effects on wheat seedling growth with water and salicylic acid (SA). However, production of wheat crop is seriously threatened by increasing soil salinity (Bouthour et al., 2015). Most of cultivated crops are glycophyte; such as wheat crop which is sensitive to salt stress, however, varietal response varies in their sensitivity to salinity (Aflaki et al., 2017). The varietal selection can be made on the basis of greater salt tolerance, which is mainly. The seed priming is an affective parameter which reduces adverse impacts of salinity. The seed priming is an effective and durable technique to enhance the performance of abiotically stressed plants, in term of biochemical and physiological changes (Oliveira & Gomes-Filho, 2016). The seed priming with various types of salt solution having high osmotic potential, can be used to proceed first seed imbibition phase, but prevent radical projection phase (Mustafa et al., 2017).The wide variety of seed priming techniques were deployed to induce positive pre-germination changes in seed. Environmental stresses reduce the quality and quantity of agricultural production. (Pirasteh-Anosheh et al., 2016b). Salinity is a major factor limiting crop production in the world. Maas and Hoffman, 1977; Pirasteh-Anosheh et al. (2016b) believed that salt stress is one the most important abiotic stresses that adversely affecting plant growth and development and crop yield. Many of scientists and the experts believe salinity and drought are equally important in having adverse effects on plants and could not say that one being more important than the other. However, the author believed salinity could be more important than drought, because salinity can occur anywhere, even though the water resources are not limited. Large body of researches have studied seed priming for improving seed germination and plant growth in saline conditions, and there is a need to deduction of their results for better decision. Therefore, the aim of this study is examination of different seed priming strategies and comparison in wheat plants that grown in saline conditions. Plants experience salt stress at different growth stages, such as germination, vegetative and reproductive growth. Under stressful environments, rapid and uniform germination of crops, particularly of annuals, is necessary to achieve enhanced quality and yield potential (Pirasteh-Anosheh et al., 2014). An important approach to increase crop yield under salt stress is seed invigoration. Seed invigoration strategies include hydropriming, osmopriming, halopriming, thermopriming and hormopriming. Plant establishment is improved by seed priming in many crop species. Priming is defined as seed pre-sowing in solutions that allow them to imbibe water to improve the first stage of seed germination; however, this prevents radical protrusion through the seed coat. Seed germination is a critical stage of the plant life cycle. During germination, the dormant seed becomes highly active and eventually becomes a healthy seedling (Rajjoul etal 2012 , Finch-Savage and Leubner-Metzger G 2006). Seed germination begins with water absorption and is accompanied by degradation of macromolecular substances, repair of genetic materials, and expansion of the embryo and endosperm, eventually leading to rupture of the seed coat and endosperm and the production of a prominent radicle (Afreen F etal 2006, Bewley JD1997). Healthy seed germination strongly influences early seedling establishment and final yield (Zhu G etal 2019). However, germination is susceptible to environmental stresses such as salt stress (Cesur A& Tabur S.2011, Zheng C etal 2009). Although all stages of plant growth are affected by salt stress, the seed germination stage is the most sensitive (Cuartero J etal 2006). Seed germination is inhibited by high concentrations of sodium and chloride ions, mainly because they reduce the osmotic potential of the surrounding environment, thereby suppressing seed imbibition and embryo growth (Rajjoul etal 2012**,** Shao Q etal 2014, Daszkowska 2011). In addition, ion toxicity also destroys macromolecular substances and affects energy utilization and metabolism during germination (Li J etal 2019). Numerous studies have shown that salt stress can significantly reduce seed vigor and inhibit germination and early seedling growth in many species (Bybordi A 2010- Duan D etal 2007). Effective methods for promoting seed germination in saline conditions are therefore needed, and they are especially crucial for crop production on saline-alkali land (Li J etal 2019). At present, seed coating and seed priming are the main two methods for enhancement of seed germination under salt stress conditions. Seed priming is one of the most frequently used techniques, and is the method mainly employed by farmers (Hussain etal2018). This pre-sowing treatment allows partial hydration of seeds without causing full radicle protrusion. Seed priming usually involves the first two stages of seed germination (imbibition and activation), and it eventually leads to a higher seed germination rate and improves the uniformity of germination. (Chen K and Arora R 2013). Seed priming technology is used to improve germination under both favorable and unfavorable conditions (Jisha KC etal 2012) and its effects may be greater under adverse conditions than under favorable conditions (Demir I&Mavi K2004 - Chen K& Arora R2011). Hydropriming and osmopriming are the two most common priming methods (Paparella S etal 2015). During hydropriming, seeds are soaked in water, which promotes seed germination to some extent (Ibrahim EA 2016). Many studies have reported that hydropriming is effective in promoting seed germination under salt stress (Li J etal 2011- Yan M& Hydro 2016). Different methods can be used to improve the agricultural production while seed priming is the most suitable and simple technique to increase germination, emergence and yield (Dalil B., et al.2014). Seed priming theory was proposed by Heydecker., et al 1973. It is a technique which is used prior to seed sowing, it includes seeds hydration to permit metabolic events prior to germination while prevents emergence of radicle (Nascimento WM., et al.2004). Improvement in metabolic events improves the speed of seed germination in vegetables, ornamental species and some small seeded grasses.

1.2. Materials and methods

1.2.1. Experiment details

Seed priming treatments used in this study were selected from previous experiments (Afzal et al. 2005,2006, Ashraf et al. 2010, Basra et al. 2005). The ratio of seed weight to solution volume was 1 : 5 g ml.1. (Farooq et al. 2006a). The seeds were surface sterilized (disinfected) with sodium hypochlorite ($Na2HCl$) solution for 10 min and then thoroughly washed for 5 min with distilled water. For each seed priming treatment, wheat seeds was soaked in 100 ML aerated distilled water/respective solution for (6 h,12 h, and 24h). For hydropriming, seeds were soaked in distilled water, seeds were soaked in (25,50,75 and 100 mM) from (sea water) NaCl / for (6 h,12 h, and 24h). After priming, seeds were removed and washed with tap water and then rinsed three times in distilled water. Finally, seeds were left in air between two filter papers to re-dry to their original moisture level , Nonprimed wheat seeds were maintained as control for comparison.

1.2.2. Measurements

1.2.2.1. Germination test:

Germinated seeds were counted daily and germination percentage was calculated at the end of the germination period for each treatment as following:

Germination percentage% = number of seeds that germinated / Number of seeds sown * 100 Ruan *et al*., 2002

TSG = Seed germination during day seven - Seed germination during the first day.

Seed emergence rate (SER) = Mean germination Time (MGT)

MGT = n1 x d1 + n2 x d2 + n3 x d3 + --------/ Total number of days Where, n is the number of germinated seed d is the number of days. (Alvarado *et al*., 1987; Ruan *et al*., 2002; (Ellis and Roberts, 1981; Shatpathy,etal 2018).

Peak Value (Czabator, F. J. (1962).;Shatpathy,etal 2018).

PV = Highest germinated seed / Number of days.

Germination Value (Czabator, F. J. (1962).;Shatpathy,etal 2018).

GV = PV X MDG.

Mean Daily Germination (Czabator, F. J. (1962). Scott SJ, etal (1984).;Shatpathy,etal 2018).

MDG = Final GP / number of days to final GP.

1.2.2.2. Early seedling development:

For measurement of shoot length (SL), shoot fresh weight (SFW), shoot dry weight (SDW), root length (RL), root fresh weight (RFW), and root dry weight (RDW), and the mean was calculated. SL and RL were measured with a ruler. Shoot and root tissues were dried to a constant weight at 80˚C in an oven. Fresh and dry weights were measured using analytical balances .

Root / shoot ratio (R ⁄ S) was calculated for each treatment used for corn & wheat as following:

R / S = Dry weight of root (g)/Dry weight of shoot (g).

Relative water content was estimated by Weatherley (1950); Evans, G.C. (1972) Maiti,R.K etal1996. formula as follow:

RWC (%) = Fresh weight – dry weight / Fresh weight *100

Specific shoot length (SSL), Specific root length (SRL)

Specific shoot length (SSL) = Shoot length / Dry weight shoot

Specific root length (SRL) = Root length / Dry weight root

Numbers of emerged seedlings were recorded daily according to the seedling evaluation handbook of the Association of Official Seed Analysis (AOSA) (1983).

3.1. Result :

3.1.1. Seed germination

Seed priming treatments significant improved of seed germination percentages of *Triticum aestivum* L (wheat) seeds were calculated under different dilutions of salinity of water for each 6,12,24h on Table 3.1. This parameter was significantly ($F = 33.63$, $P< 0.001$, $F=128.88$, $P<0.001$, $F=272.01$, $P< 0.001$) respectively. For each 6,12,24h of the germination period. Tukey's pairwise comparisons test reveals significant differences in germination percentages of *Triticum aestivum* the results showed significant differences within different treatments of the same dilutions. The differences between different dilutions of salinity of water were found to be between lower dilutions including control treatment compared to the higher dilutions of the same compound, between higher concentrations 75, 100% of salinity of water for 6h and between higher concentration 50,75,100 % of salinity of water for 12h. As well as between lower concentration 25%, and higher concentration 75,100% of salinity of water.

Table 3.1. Effect different dilutions of salinity of water on the seed germination percentage % for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seeds.

* ** = significant at $P< 0.001$. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Treatment (%)	SGP%		
	6H	12H	24H
0.0	*** 99.84[a] ± 0.16	*** 100.0 [a] ± 0.0	*** 100.0[a] ± 0.0
25	99.37[a] ± 0.45	100.0[a] ± 0.0	95.24[b] ± 0.634
50	99.05[a] ± 0.49	93.0[b] ± 1.44	57.6[c] ± 2.08
75	81.3[b] ± 2.40	76.7[c] ± 2.04	61.9[c] ± 2.75
100	87.5[c] ± 2.12	59.84[d] ± 2.4	28.9[d] ± 1.9

Seed priming treatments significantly improved the seed germination parameters such as mean germination time (MGT), was not affected by different concentrations of salinity of water for 6h, wherease for 12, 24h were significantly (F = 6.28, P< 0.001,F=26.78,P<0.001) respectively. Tukey's pairwise comparisons test reveals significant differences in (MGT) for 12h, between higher concentrations 100% and lower concentration including the control. Tukey's pairwise comparisons test reveals significant differences in (MGT) for 24h, significant between higher concentration 75,100 % of salinity of water in fig3.1. The mean daily germination (MDG) of *Triticum aestivum L.* (Wheat) seeds**.** The results showed significant differences in (MDG) (Fig. 3.2) (F=33.63, $P< 0.001$,F = 128.88, $P< 0.001$, F = 272.01, $P< 0.001$) respectively within different treatments of the same of concentration of salinity of water for each 6,12 and 24h. The differences between different dilutions of salinity of water were found to be between higher dilutions including 75,100% in the 6h and 24 h, as well as 50% for 12h. The management of time start germination (TSG) of wheat seeds under the different dilution of salinity of water the seed priming treatment This parameter was significant (F = 33.63, P< 0.001,F=128.88,P<0.001,F=272.01,P< 0.001) respectively. For each 6,12,24h of the germination period. Tukey's pairwise comparisons test reveals significant differences (TSG) of *Triticum aestivum* the results showed significant differences within different treatments of the same dilutions. The differences between different dilutions of salinity of water were found to be between lower dilutions including control treatment compared to the higher dilutions of the same compound in 6h, Likewise was between higher concentrations

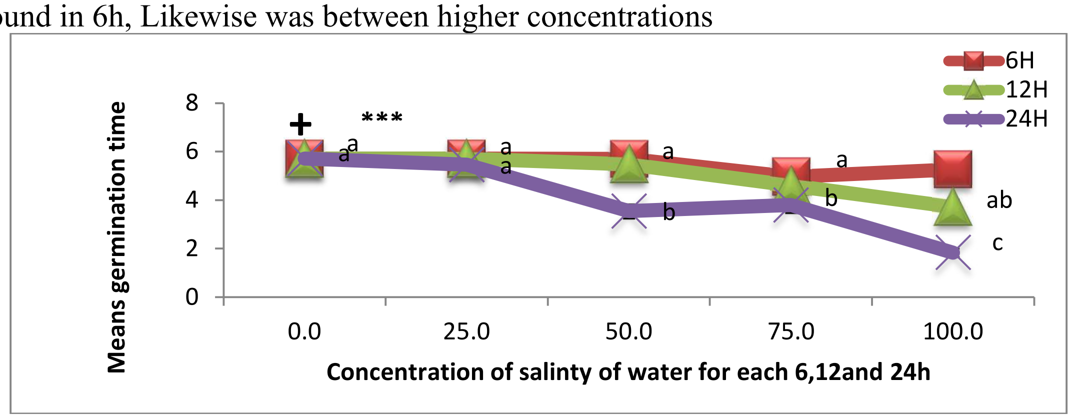

Fig 3.1. Effect of different dilutions of salinity of water on means germination time (MGT) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seeds.

+ = Not significant. *** = Significant at *P*< 0.001. Similar letters = Not significant. Different letters = Significant. Bars = SEMean.

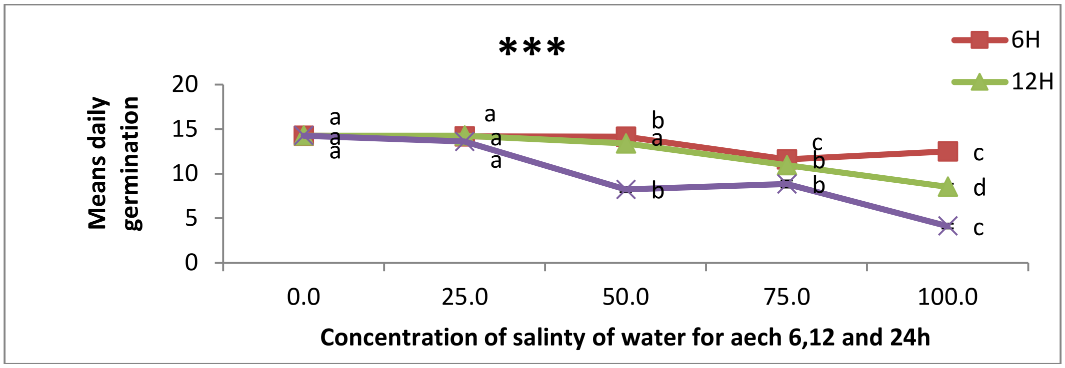

Fig 3.2. Effect of different dilutions of salinity of water on means daily germination (MDG) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seeds.

*** = Significant at *P*< 0.001 Bars = SEMean
Similar letters = Not significant. Different letters = Significant.

50, 75, 100% of salinity of water for 12h and between higher concentration 50,75,100 % of salinity of water for 24h,on (Table 3.2). In fig3.3.seed priming treatments significantly affected on the peak value of wheat seeds, the results showed significant differences within different treatments of the dilutions of salinity of water for each6,12and 24h was significant(F = 33.63, P< 0.001,F=128.88,P<0.001,F=272.01,P< 0.001) respectively. Tukey's pairwise comparisons test reveals significant differences (PV) of *Triticum aestivum* the results showed significant differences within different treatments of the same dilutions. The differences between different dilutions of salinity of water were found to be between lower dilutions including control treatment compared to the higher dilutions of the same compound in 6h, Likewise was between higher concentrations 50, 75, 100% of salinity of water for 12h and between higher concentration 50,75,100 % of salinity of water for 24h. In table 3.3. and fig 3.4. Effect different dilutions of salinity of water on the germination value (GV) for each 6,12,24 h of *Triticum aestivum* seeds. The seed priming treatments significantly affected on the (GV) of wheat seeds, the results showed significant differences within different treatments of the dilutions of salinity of water for each 6,12 and 24 h, was significant(F = 155.74, P<0.001, F = 155.74, P<0.001, F=369.90,P< 0.001) respectively. Tukey's pairwise comparisons test reveals significant differences (GV) of same plant the results showed significant differences within different treatments of the same dilutions the decreases

Table 3.2. Effect different dilutions of salinity of water on the time to start germination (TSG) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seeds.
* ** = significant at *P*< 0.001. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Treatment (%)	Time to start germination (TSG)		
	6H	12H	24H
0.0	***	***	***

	$0.0159^{a} \pm 0.0159$	$0.000^{a} \pm 0.000$	$0.000^{a} \pm 0.000$
25	$0.0635^{a} \pm 0.0445$	$0.000^{a} \pm 0.000$	$0.4762^{b} \pm 0.0634$
50	$0.0952^{a} \pm 0.0491$	$0.619^{b} \pm 0.144$	$4.240^{c} \pm 0.208$
75	$1.873^{b} \pm 0.242$	$2.333^{c} \pm 0.204$	$3.810^{c} \pm 0.275$
100	$1.254^{c} \pm 0.212$	$4.016^{d} \pm 0.240$	$7.111^{d} \pm 0.187$

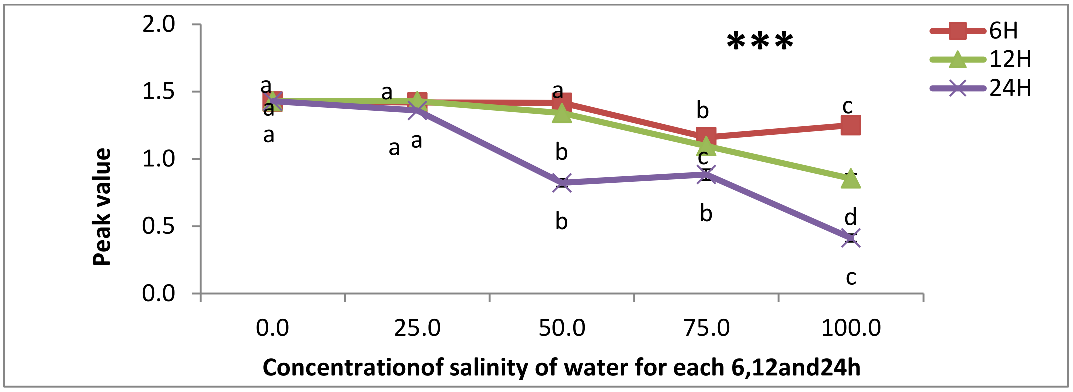

Fig 3.3. Effect of different dilutions of salinity of water on means peak value (PV) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seeds.

*** = Significant at *P*< 0.001. Bars = SEMean Similar letters = Not significant. Different letters = Significant.

in concentration 100% salinity of water and increases on all treatments, different between control and treatment 50,75 and 100% water salinity for priming time 6,12 and 24h.in the Table 3.3

3.1.2. Seedling growth :

Growth of *Triticum aestivum* seedlings under different concentrations of different dilutions of salinity of water was measured (Table 3.4). Various growth parameters such as shoot and root length in tables 3.4 and 3.5 the significantly different (*P*< 0.001) for each 6,12,24 h. Tukey's pariwise comparisons test reveals significant differences in seedling's length shoot and root of *wheat* between lower concentration 25mM including control treatment, and the higher concentrations salinity of water 75,100m M for 6 h. The results showed of the 12h the significate differences in seedling shoot between lower concentration and higher concentration 100mM is decreased, whereas significate differences in seedling root length between all treatments and include control and higher concentration 100mM, under stress conditions. The 24h showed a significant difference for most of the parameters of seedlings of shoot and root lenght, the decreased in the treatment higher dilution of silently of water. There was significant effect of salinity of water priming on the various growth parameters such as shoot and root fresh weight attributes (Table 3.6 &3.7 and Figer3.5). Wheat seedling in water, the fresh weight of wheat seedlings were significantly reduced (*P*< 0.001) under different dilutions of salinity of water for 6,12,24h. Tukey's pariwise comparisons test reveals significant differences in seedling's fresh weight of *wheat* between lower concentration including control treatment and the higher concentrations of salinity of water 75,100mM. respectively. within 6h. whereas in the 12h was significant effect of salinity of water priming on the fresh weight shoot between the control and dilutions 50,75mM and found significant between dilutions up about25 mM to 75mM and

Table 3.3. Effect different dilutions of salinity of water on the germination value (GV) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seeds.

* ** = significant at *P*< 0.001. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Treatment (%)	Germination value (GV)		
	6H	12H	24H
0.0	*** 20.347^{a} ± 0.062	*** 20.408^{a} ± 0.000	*** 20.408^{a} ± 0.000
25	20.175^{a} ± 0.164	20.408^{a} ± 0.000	18.562^{b} ± 0.246
50	20.052^{a} ± 0.182	18.222^{b} ± 0.501	7.324^{c} ± 0.484
75	14.221^{b} ± 0.731	12.520^{c} ± 0.576	8.780^{c} ± 0.694
100	16.181^{c} ± 0.674	8.024^{d} ± 0.614	2.144^{d} ± 0.202

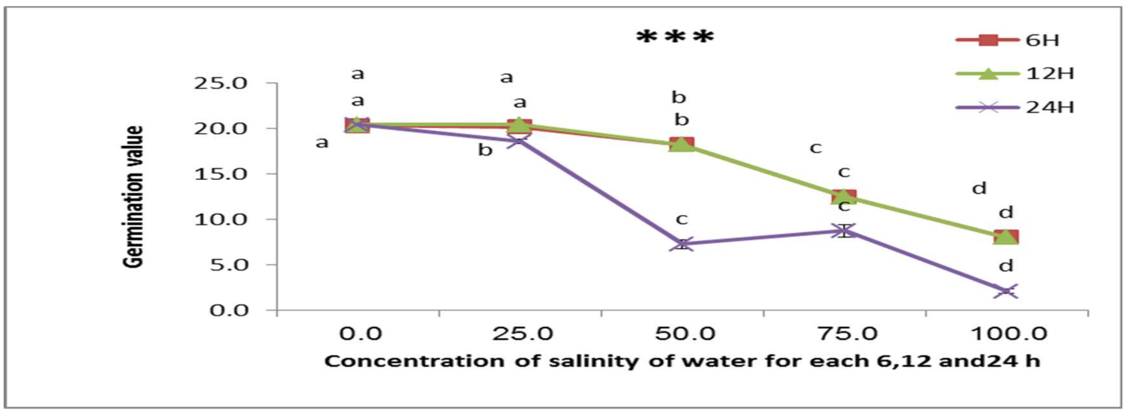

Fig3.4. Effect of different dilutions of salinity of water on germination value (GV) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seeds.
*** = Significant at *P*< 0.001 Bars = SEMean
Similar letters = Not significant. Different letters = Significant.

Table 3.4. Effect different dilutions of salinity of water on length shoot (cm) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.
* ** = significant at *P*< 0.001. ± = SEMean.
Similar letters = not significant. Different letters = significant

Treatment (%)	Length shoot (cm)		
	6H	12H	24H
0.0	11.508^{a} ± 0.43	13.073^{a} ± 0.45	13.514^{a} ± 0.29
25	12.466^{a} ± 0.34	14.35^{a} ± 0.505	11.303^{b} ± 0.44
50	14.29^{b}± 0.36	12.79^{a} ± 0.531	8.89^{c} ± 0.743
75	11.316^{ac} ± 0.5	11.43^{a} ± 0.604	7.641^{dc} ± 0.66
100	8.642^{d} ± 0.6	8.124^{b} ± 0.753	3.05^{ed} ± 0.58

100mM,was the fresh weight shoot decreases on the control and concentration 100 mM, the result was in the concentration 25mM increases. Whereas the result showed for each 24h was found significantly in all treatments, showed increases on concentration 25mM and decrease in all treatments. Parameter of fresh weight (g) root of wheat for 6h (Table 3.7 and .fig3.6). The obtained results showed that these measures were decreased with concentrations of 25 ,100 mM

. and increases within 50,75 mM. Using analysis of variance revealed highly significant differences in these measures (P< 0.001) . Tukey's pairwise comparisons test indicated that significant differences were found between lower concentrations 25,50 mM including control treatment and higher concentration means of salinity of water. Whereas 12h and 24 hour, the obtained results showed that these measures were decreased with concentrations of 100mM, and increases within

Table 3.5. Effect different dilutions of salinity of water on length root (cm) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.

* ** = significant at $P< 0.001$. ± = SEMean.

Similar letters = not significant. Different letters = significant.

Treatment (%)	Length root (cm)		
	6H	12H	24H
0.0	$11.98^{a} \pm 0.454$	$11.94^{a} \pm 0.572$	$12.382^{a} \pm 0.308$
25	$12.916^{a} \pm 0.9$	$14.966^{b} \pm 0.725$	$14.216^{a} \pm 0.699$
50	$17.856^{b} \pm 0.610$	$14.733^{ab} \pm 0.804$	$10.64^{ab} \pm 0.922$
75	$13.103^{ac} \pm 0.610$	$13.894^{ab} \pm 0.830$	$9.164^{b} \pm 0.799$
100	$9.200^{d} \pm 0.535$	$7.956^{c} \pm 0.74$	$2.85^{c} \pm 0.49$

Table 3.6. Effect different dilutions of salinity of water on fresh weight (g) shoot for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling

* ** = significant at $P< 0.001$. ± = SEMean.

Similar letters = not significant. Different letters = significant.

Treatment (%)	Fresh weight (g) shoots		
	6H	12H	24H
0.0	$0.07840^{a} \pm 0.004$	$0.07884^{a} \pm 0.0036$	$0.08540^{a} \pm 0.00297$
25	$0.08740^{a} \pm 0.0034$	$0.1156^{b} \pm 0.00544$	$0.10799^{a} \pm 0.00925$
50	$0.10773^{b} \pm 0.00343$	$0.10434^{b} \pm 0.00554$	$0.07540^{ca} \pm 0.00675$
75	$0.09703^{ab} \pm 0.00471$	$0.10272^{b} \pm 0.00593$	$0.06992^{ca} \pm 0.00625$
100	$0.07731^{ac} \pm 0.0055$	$0.06250^{ac} \pm 0.00635$	$0.02650^{b} \pm 0.00523$

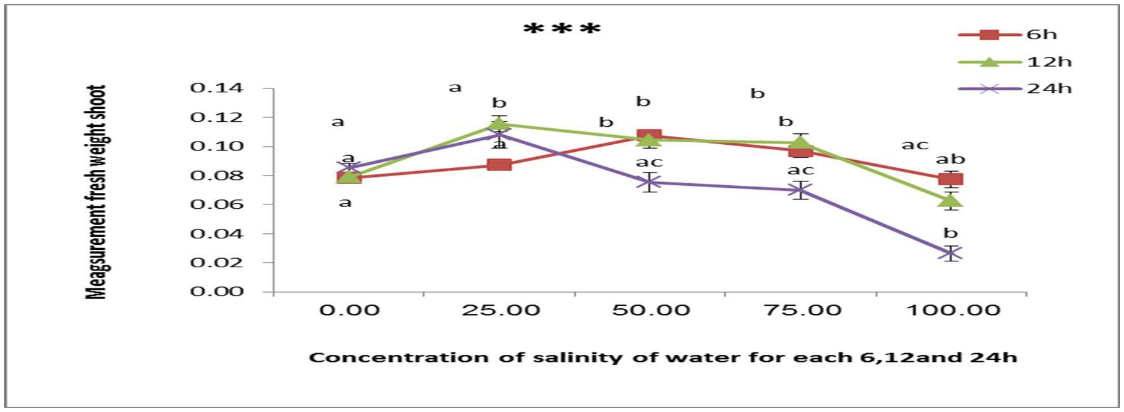

Fig3.5. Effect of different dilutions of salinity of water on fresh weight shoot(g) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seedling.

*** = Significant at $P< 0.001$. . Bars = SEMean

Similar letters = Not significant. Different letters = Significant.

25,50,75mM include the control. Using analysis of variance revealed highly significant differences in these measures (P< 0.001) . Tukey's pairwise comparisons test indicated that significant differences were found between lower concentrations 25,50 mM including control treatment and higher concentration means of salinity of water. The effect of different dilutions of salinity of water

Table 3.7. Effect different dilutions of salinity of water on fresh weight (g) root for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.

* ** = significant at $P< 0.001$. ± = SEMean. Similar letters = not significant. Different letters = significant.

Treatment (%)	Fresh weight (g) roots		
	6H	12H	24H
0.0	0.04131^{a} ± 0.00276	0.03184^{a} ± 0.00199	0.04244^{a} ± 0.00193
25	0.04131^{a} ± 0.00202	0.05724^{b} ± 0.00321	0.06900^{b} ± 0.00395
50	0.05956^{b}± 0.00272	0.04586^{c}± 0.00310	0.03099^{c}± 0.00294
75	0.05551^{b} ± 0.00312	0.06003^{b} ± 0.00364	0.04226^{a} ± 0.00378
100	0.04810^{ab} ± 0.00313	0.03167^{ab}± 0.00336	0.01200^{d}± 0.00206

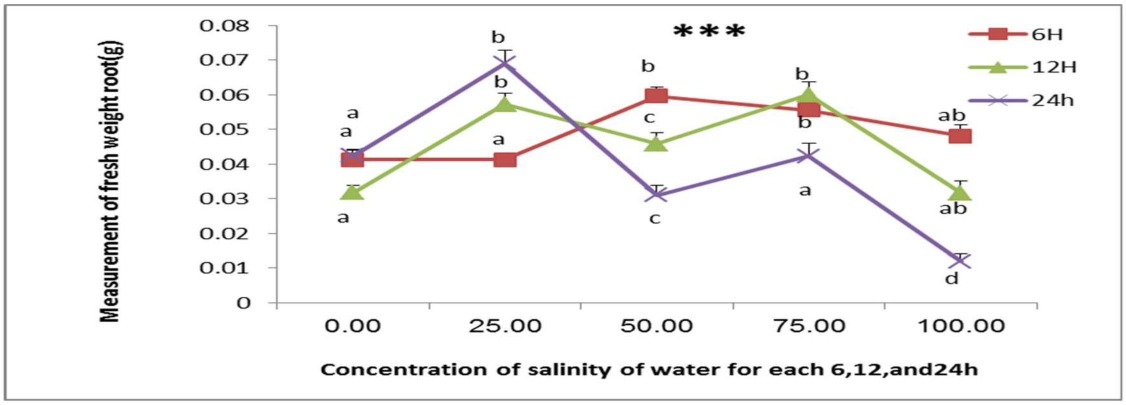

Fig3.6. Effect of different dilutions of salinity of water on fresh weight root(g) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seedling.
*** = Significant at *P*< 0.001 Bars = SEMean
Similar letters = Not significant. Different letters = Significant.

for 6 , 12 and24 hour on the dry of shoots of wheat seedlings is illustrated in(Table3.8 and fig3.7). The results showed that concentration of 25,50,75 mM had the highest means of these measures. and decreases of concentration 100mM. The data was statistically analyzed and showed significant differences in dry of shoots and root (P< 0.01, P< 0.001, P< 0.001) respectively, within treatment means. Tukey's pairwise comparisons test suggested significant differences in these values between dilution of 25mM include the control and treatments of higher concentration(100mM). Table3.9 and figure3.8 in showed the effect Seedling dry weight (g) of root parameter of wheat was not affected by different concentrations of salinity of water for 6 hour. Whereas were results found for 12 and 24 hour for seedling's dry weight root of the same plant species was significantly increased under lower concentrations of salinity of water P< 0.001). and decreases on higher concentration 100mM. Tukey's pairwise comparison test reveals significant differences in dry weight (g) root of wheat between lower concentration including control and the highest concentration 100 (mM) of salinity of water. The table3.10 and figure3.9 on wheat showed non significant effect (P< 0.05) on the root / shoot ratio of all treatment of salinity of water for 6 and 12 hour, The interaction between the different levels seedling priming with different dilution of salinity of water on wheat was non-significant. Whereas were results found for 24 hour for seedling's root/ shoot ratio of the same plant species was significantly between lower concentration of salinity of water 25mM and include the control and higher concentration 100mM. Effect of concentration and soaking duration in salinity of water in relative water of wheat seedling. The results of analysis variance (Table3.11) refer that there are significant differences in the studied characters due to the impact of lower

Table 3.8. Effect different dilutions of salinity of water on dry weight (g) shoot for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling
** = significant at *P*< 0.01. * ** = significant at *P*< 0.001. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Treatment (%)	Dry weight (g) shoots		
	6H	12H	24H
0.0	** 0.00916[a] ± 0.0005	*** 0.01123[a] ± 0.0005	*** 0.0106[a] ± 0.00035

25	0.00932[a] ± 0.0004	0.01350[a] ± 0.00062	0.0115[a] ± 0.00052
50	0.00973[a]± 0.0004	0.01036[a]± 0.0006	0.00833[ab]± 0.00075
75	0.01185[a] ± 0.00112	0.01060[a] ± 0.00062	0.00780[b] ± 0.0007
100	0.00901[b]± 0.00094	0.00709[b]± 0.00071	0.00345[c]± 0.00064

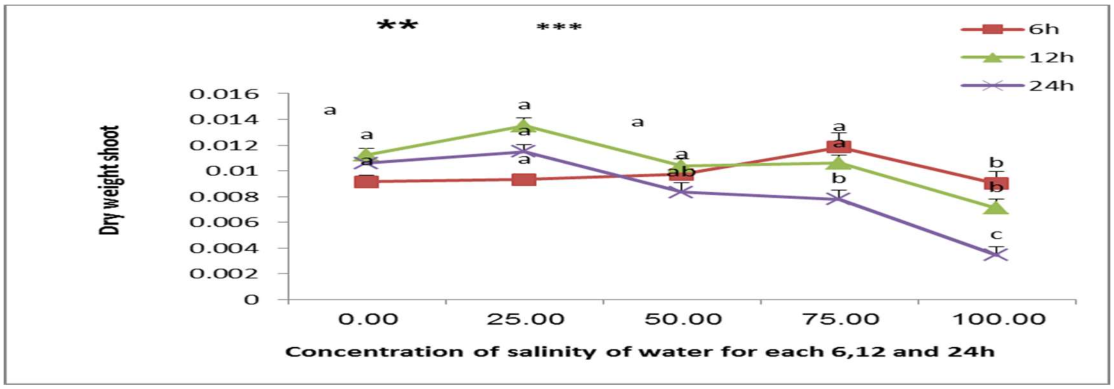

Fig3.7. Effect of different dilutions of salinity of water on dry weight shoot(g) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seedling.
** = significant at *P*< 0.01. * ** = significant at *P*< 0.001. ± = SEMean.
Similar letters = not significant. Different letters = significant.

concentration and higher concentration 100,75mM , within 6,12 and 24 hour, the results found the 6,12,24 hour of soaking duration gave increases in the lower dilution and decreases of higher dilution surpassed significantly on the treatment of salinity of water which gave increases of lower concentration figure3.10 Show the measurements of specific shoot length on concentration of salinity of water gave increases on lower concentration25mm include the control and decreases on higher concentration 75,100mM. The combination of treatment of salinity of water for 6,12,24 h surpassed significantly against most other combinations include 75,100mM, It gave the highest average in the lower concentration and which without differing significantly in some of other combinations, while the lowest average of the specific shoot length was higher concentration of salinity of water which belongs to the combination 100mM ,table 3.12 and figure3.11. Effect different dilutions of salinity of water on Specific root length (SRL) for each 6,12 h of Triticum aestivum , The results of analysis of variance showed that both salinity level not significantly and the 24 hour of salinity had significantly decreased the specific root on wheat in both concentrations 75,100 mM (Figure 3.12). Though increasing salinity increases rate of specific root on wheat in lower concentrations include the control . Tukey's pairwise comparison test reveals significant differences in specific root of wheat between lower concentration including control and the highest concentration 100 (mM) of salinity of water on table 3.13.

Table 3.9. Effect different dilutions of salinity of water on dry weight (g) root for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.

+= Not significant. * ** = significant at $P< 0.001$. ± = SEMean Similar letters = not significant. Different letters = significant.

Treatment (%)	Dry weight (g) roots		
	6H	12H	24H
0.0	+ 0.00891 ± 0.00040	*** 0.00952[a] ± 0.00035	*** 0.00934[a] ± 0.00030
25	0.00807 ± 0.00033	0.00950[a] ± 0.00042	0.01012[a] ± 0.00050
50	0.00818± 0.00035	0.00700[b]± 0.00046	0.00591[cb]± 0.00052
75	0.00883 ± 0.00040	0.00843[ab] ± 0.00050	0.00666[cb] ± 0.00060
100	0.00760 ± 0.00044	0.00522[c]± 0.00052	0.00280[d]± 0.00050

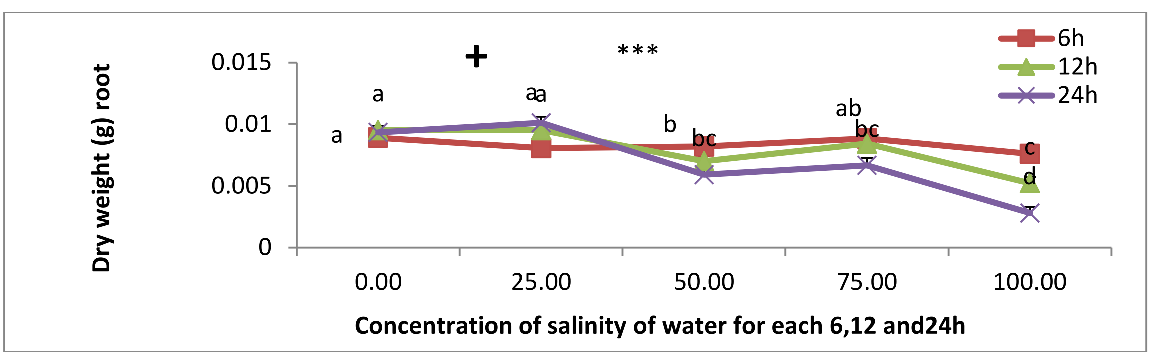

Fig3.8. Effect of different dilutions of salinity of water on dry weight root(g) for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seedling.

+ = Not significant * ** = significant at $P< 0.001$. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Table 3.10. Effect different dilutions of salinity of water on root / shoot ratio for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.

+= Not significant. * ** = significant at *P*< 0.001 ± = SEMean.
Similar letters = not significant. Different letters = significant.

Treatment (%)	Root / Shoot ratio		
	6H	12H	24H
0.0	+ 1.0490 ± 0.0454	+ 0.8507 ± 0.0324	*** 0.9408[a] ± 0.0326
25	0.9106 ± 0.0408	0.7799 ± 0.0520	0.9217[a] ± 0.0632
50	0.8815± 0.0392	0.6397± 0.0475	0.5454[b]± 0.0591
75	0.970 ± 0.125	0.6806 ± 0.0370	0.05992[b] ± 0.0515
100	0.692± 0.670	0.980 ± 0.3760	0.3932[b]± 0.0981

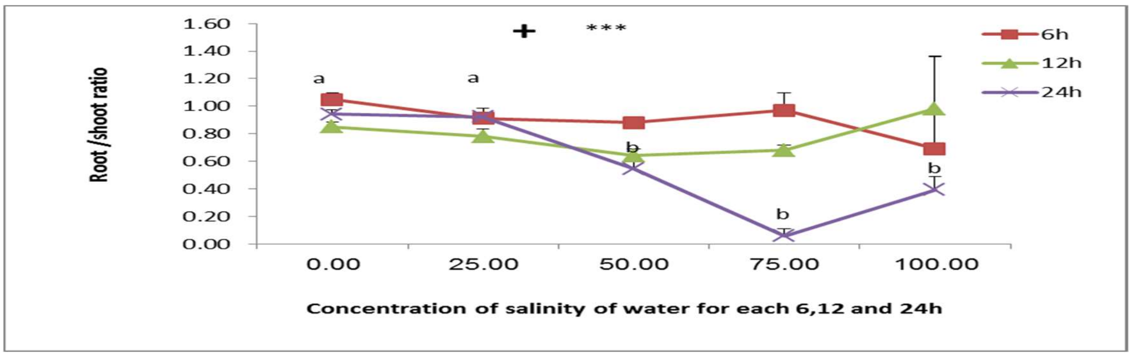

Fig3.9. Effect of different dilutions of salinity of water on root/ shoot ratio for each 6,12 and 24 h of *Triticum aestivum L.* (Wheat) seedling.
+= Not significant. * ** = significant at *P*< 0.001 ± = SEMean.
Similar letters = not significant. Different letters = significant.

Table 3.11. Effect different dilutions of salinity of water on relative water content for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.
* ** = significant at *P*< 0.001. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Treatment (%)	Relative water content		
	6H	12H	24H
0.0	*** 0.8735[a] ± 0.0100	*** 0.8164[a] ± 0.0188	*** 0.8736[a] ± 0.0028
25	0.8907[a] ± 0.0032	0.8609[a] ± 0.0142	0.8417[a] ± 0.0199
50	0.9006[a]± 0.0103	0.7790[a]± 0.0336	0.6020[cb]± 0.0440
75	0.8011[ab] ± 0.0285	0.7470[a] ± 0.0354	0.5914[cb] ± 0.0443
100	0.75902[bc]± 0.0334	0.5551[b]± 0.0453	0.2490[d]± 0.0435

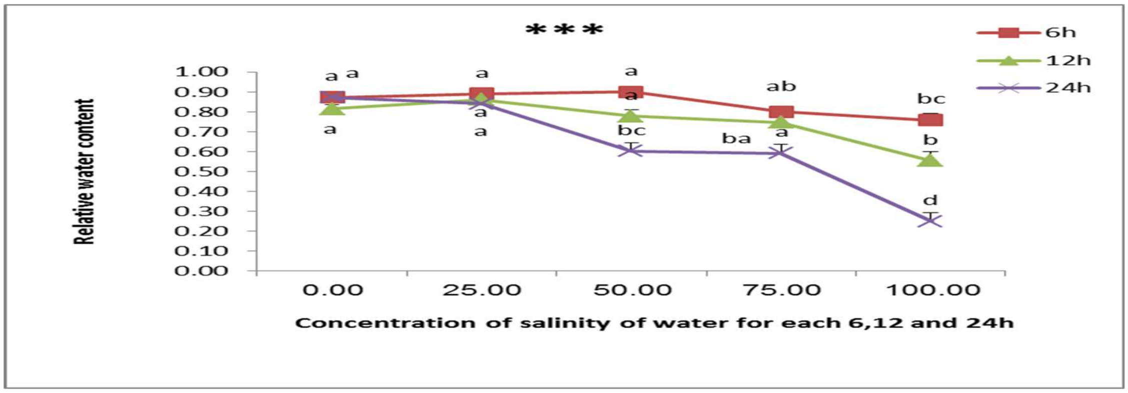

Figure 3.10. Effect different dilutions of salinity of water on relative water content for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.
* ** = significant at $P< 0.001$. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Discussion & Conclusion

High salinity stress has negatively affected growth of glycophytes that include most of agronomic crop such as wheat (Almutairi & Toulibah, 2016). The osmotic effect, due to high accumulation of salts in the root area due to salinity stress causes dehydration of root cells. The findings of our experiments revealed that seed priming and salinity have significantly affected accumulation of sodium content in shoot of wheat .. by Mahmood *et al*., (2010). The retardation of growth in saline stress environment is due to presence of excess Na+ ions, which even facilitate absorption of heavy

Table 3.12. Effect different dilutions of salinity of water on Specific shoot length (SSL) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.
** = significant at $P< 0.01$. * ** = significant at $P< 0.001$. ± = SEMean.
Similar letters = not significant. Different letters = significant.

Treatment (%)	Specific shoot length		
	6H	12H	24H
0.0	*** 1366.2^{a} ± 44.8	** 1166^{a} ± 39.2	*** 1347.2^{a} ± 30.2
25	1511.2^{a} ± 96.8	1236.6^{ab} ± 84.0	1022.5^{b} ± 41.2
50	1697^{a} ± 108	1277.2^{ac} ± 91.4	757.1^{cd} ± 59.7
75	1173^{ab} ± 117	939.9^{ac} ± 49.6	677.7^{cd} ± 54.3
100	1021^{abc} ± 114	893^{acb} ± 129	297.3^{e} ± 54.0

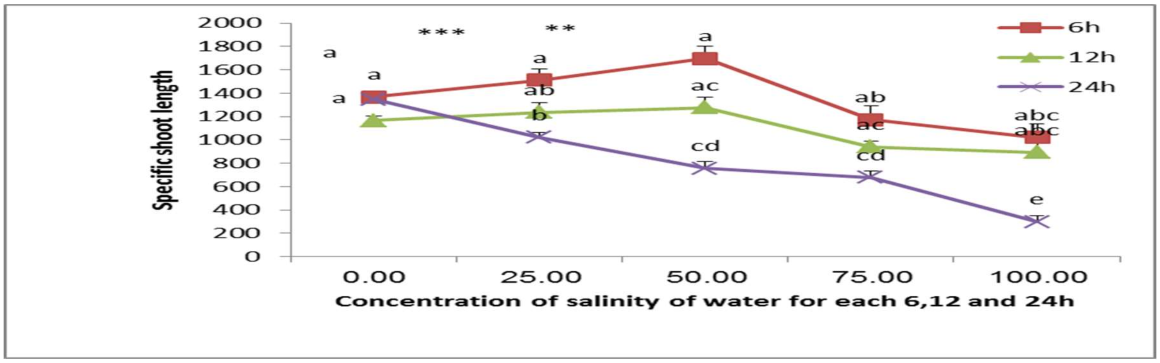

Fig 3.11. Effect different dilutions of salinity of water on Specific shoot length (SSL) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.
** = significant at *P*< 0.01. ** = significant at *P*< 0.001. ± = SEMean. Similar letters = not significant. Different letters = significant.

Table 3.13. Effect different dilutions of salinity of water on Specific root length (SRL) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.
+ =Not significant * ** = significant at *P*< 0.001. ± = SEMean.
Similar letters = not significant. Different letters = significant

Treatment (%)	Specific root length		
	6H	12H	24H
0.0	+ 1442.1 ± 58.6	+ 1216.7 ± 50.5	*** 1410.6^{a} ± 52.4
25	2424.0 ± 55.3	1655.0 ± 92.2	1445.3^{a} ± 75.7
50	2512.0± 156	2637.0± 310	1352^{a} ± 121
75	1430.4 ± 69.8	1421.8 ± 84.1	920.8^{b} ± 78.2
100	1604.0± 392	2128.0± 110.4	349.8^{c} ± 60.5

metals (Shafi *et al*., 2011; Wu *et al*., 2015). The accumulation of Na+ content in shoot was decreased by beneficial influence of seed priming technique. In our results, gradual elevation in salinity stress has markedly decreased photosynthetic pigments. The prime reason behind low photosynthesis under salt stress could be osmotic effect of salts, which creates scarcity of water, stomatal closure, limited Co2 inflow and impaired assimilates partitioning (Anjum *et al*., 2011). The loss of GSI under salt stress could be related to the negative impact of low water potential on water uptake as well as toxic effect of ions (Na and Cl) on biochemical processes and catabolic (enzymatic hydrolysis of seed storage materials) and anabolic (generation of new tissues by materials

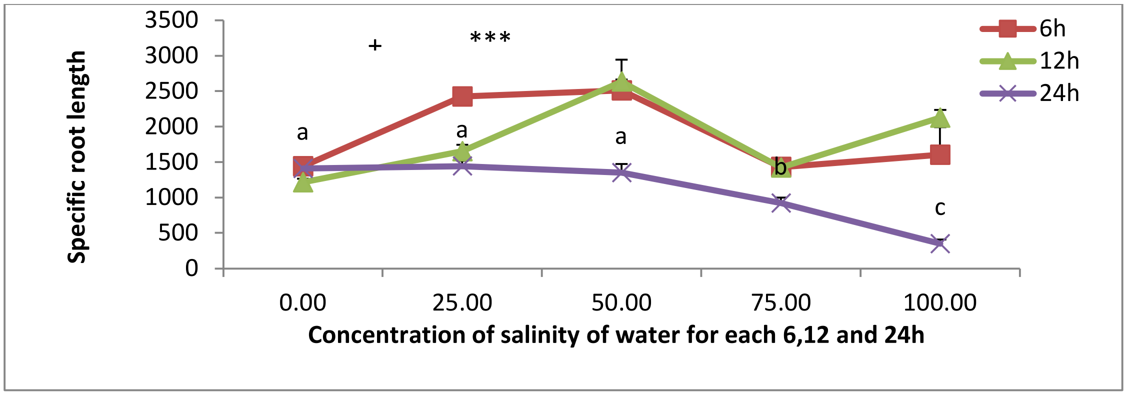

Fig 3.12. Effect different dilutions of salinity of water on Specific root length (SRL) for each 6,12,24 h of *Triticum aestivum L.* (Wheat) seedling.

+ =Not significant * ** = significant at $P< 0.001$. ± = SEMean.
Similar letters = not significant. Different letters = significant

hydrolyzed at the first step) stages of germination (Shamsadin Saeid et al., 2008). However, the positive effect of SA on GSI could be due to reducing oxidative damage under high salinity (Lee et al., 2010). The reduced MGT in SA primed seeds may be attributed to the increased water uptake and promotion of the biological processes during ger0mination provoked by SA in those seeds (Debez et al., 2018), and the reduced accumulation of Na+ and Cl^- ions by SA application (Jini and Joseph, 2017) Entesari et al. (2012) reported the same effect on the mung bean grown under salinity stress and primed with SA. The positive effect of SA treatment on seedling growth under salinity stress could probably be caused by the involvement of this growth regulator in cell division (Shakirova et al., 2003; Dolatabadian et al., 2009). Increased cell division of apical meristem of initial roots, which in turn resulted in an increased level of elongation was shown in SA treated wheat (Shakirova et al., 2003). dry weight. Delavari et al. (2014) founded germination, length of root and shoot, fresh and dry weight decreased under salinity but pre-treatment with SA improved them.SA treatment alleviates osmotic stress and allows better water uptake. As mentioned above, the low effect of SA on seedling vigor under salinity stress could be attributed to the low rates of SA tested in this study. The mechanism by which SA improves root and shoot growth is not well-understood. According to our results salinity reduced relative water content and SA improved that. Likewise, Agarwal et al. (2005) concluded that foliar application of SA improved RWC of leaves in wheat plants. Singh et al. (2015) reported the exogenous application of SA reduced the growth inhibition of plants caused by NaCl, and increased leaf relative water contents. Reduced activity of the Hill reaction was also observed in salt-stressed chloroplasts of various plant species (El-Shintinawy, 2000; El-Shahaby et al., 2003; Zeid, 2009). This study assessed the effect of salinity stress and SA seed priming on *L. sativus* germination parameters and early growth, for which research data do not exist in the literature. Salinity stress (50 mM and 100 mM NaCl) resulted in significant decline of germination parameters, seedling vigor, and seedling growth, whereas the application of SA priming alleviated some negative effects of salinity on germination and related traits and improved most growth and physiological traits of *L. sativus*. Sorghum growth is easily inhibited by salt stress, especially during the germination stage [Sun L, etal 2012]. In this study, sorghum germination was significantly inhibited by salt stress: germination potential, germination rate, germination index, and vigor index were all reduced, and seedling growth was inhibited . There are various reasons for delayed and repressed seed germination under salt stress. First, salinity reduces the osmotic potential of the external medium, limiting the seedlings' capacity for water absorption and thereby inhibiting cell growth [Migahid MM etal 2019]. Second, salt stress may reduce the efficiency of seed reserve mobilization during germination by various mechanisms, such as the perturbation of protein structure [Ibrahim EA 2016]. In addition, seed respiration may also be enhanced, thereby reducing the levels of reserve substances available for seedling growth [Chen K, Arora R 2011]. Seed priming is an effective way to alleviate the inhibition of seed germination and seedling growth by salt stress [Jiang XW2020]. In this study, although the effects of different priming agents differed, all promoted the germination of sorghum seeds under salt stress to some extent . Iqbal et al. 2006 reported that seed priming with NaCl, KCl, and CaCl2 alleviated salt stress damage, thereby increasing shoot fresh weight and dry weight in maize. Similarly, Tsegay BA, Yohannes G.2013] showed that seed priming with 5g/L NaCl significantly improved early seedling growth under salt stress in maize. Likewise, seed priming with PEG-6000 alleviated the adverse effects of salt stress on seed germination and early seedling growth in common vetch [Aydinoğlu B etal 2019]. Seed priming with distilled water increased the germination index, root and shoot length, and dry weight and promoted the germination and normal seedling growth of maize under salt stress [Li J etal 2011]. These results show that a variety of substances can be used as seed priming agents and can promote seed germination under saline conditions, consistent with the findings of this study. Jafar et al. 2012] reported that although different priming treatments improved the salt tolerance of wheat, priming with CaCl2 was the most effective treatment compared with ascorbic acid, salicylic acid, and kinetin. Afzal et al. 2008] showed that seed priming with CaCl2 was more effective than NaCl in improving wheat salt tolerance at the germination stage.

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