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Effect of Priming in of Water Stress various Conditions in some Vegetative traits Medicinal Plant (fennel *Foeniculum vulgare*. L)

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ABSTRACT: To evaluate the priming effects of different solutions on dehydration tolerance in vegetative stage fennel, a factorial experiment was conducted in a completely randomized design in the laboratory and greenhouse with four replications in year 2012 at the agriculture station of Islamic Azad University of Tabriz. Factors include priming with a solution of (gibberellin, HCL, water and lack of priming) and water levels(30% of field capacity, 50% of field capacity, 70% of field capacity and full irrigation), respectively. Traits Such as stem height, number of branches, stem dry weight, leaf dry weight, biomass dry weight, root length and root dry weight, respectively. The results showed that the effect of priming and low level of water and the interaction of different types of priming per water low level in all studied traits were significant at (P 0.01). The comparison of the means showed that, priming with gibberellin, HCL and water with increasing irrigation water on stem height, number of branches, stem dry weight, leaf dry weight, biomass dry weight, root length and root dry weight added. In full irrigated condition, priming with gibberellin compared to the lack of priming, led to increase 102%of stem length,34% of number of branches, 182% of dry weight, 366% of shoot dry weight, 311%of dry weight, 141% of root length, and 760% of root dry weight. Only when primed with gibberellin root only root length increased levels of irrigation. In general, it was observed either full or in term of irrigation water, with priming, especially with gibberellin, can be improved traits.

Keywords: Priming, vegetative stage, fennel, drought stress

INTRODUCTION

Medicinal plants are economically very important and an important source of business and economy are among the most important agricultural export products (Azzaz *et al.,* 2009). (Fennel (*Foeniculum vulgare*) is one of the most important medicinal plants that are cultivated worldwide and has many medicinal uses. Factors such as appropriate date of planting, planting methods, plant population, water and nutrient elements management and weed control affects the production of fennel (Mubeen *et al.,* 2009). In Iran, fennel be cultivated in semi-arid areas as a cold plant (Moosavi *et al.,* (2012) stated that Drought is the most important factor in reducing the performance in this plant. The results of the study state on the impact of drought stresses on growth and yield of fennel showed that dehydration in this plant leads to a reduction in the number of verticillate inflorescences, the total number of seeds per plant and seed yield. Affect priming emerged seedlings can quickly lead to the production of plants in addition, it can help improve the rate of emergence of better plant populations under different environmental conditions. But under the influence of priming some improvement in ground cover plants is associated with the emergence of early and successful deployment of seedlinges (Ghassemi-Golezani *et al.,* 2008). Some biological and abiotic stress reduces seedling in field conditions. One of the most effective strategies for overcoming stress is the dryness priming. Priming techniques to accelerate the emergence of seedlinges, make plants stronger and better resistance against stresses (Yagmur and Kaydan 2008). Under unsuitable environmental conditions such as drought and salinity, the compounds responsible for the compatibility in inside seeds, such as malondialdehyde, proline and soluble sugar composition and activity of protective enzymes such as superoxide dismutase, catalase and peroxidase will improve under priming condition, So Stressful factors increases under tension factors such as drought resistance (Kazemi, and Eskandari 2012). In an experiment on wheat seeds primed with potassium phosphate and water germination under drought and salinity stress increased and reduce the negative effects of stress on seedling growth of wheat and thus increase the number of optimal and robust seedlings in the field. Shoot fresh weight was also increased. Chen *et al.,* (2002), Lee *et al.,* (2012) stated that he hormone of gibberellin has an important role in the germination of seeds.

Two mechanisms have been proposed for the role of gibberellin, firstly, induction of genes encoded by hydrolysis of endosperm and secondly, direct stimulation of fetal growth. In addition, gibberellin eliminates the effects of abscisic acid to induce sleep (Debeaujon and Koornneef 2000). In number of plants has also been reported that gibberellin reduce the base temperature for germination of seed (Eisvand *et al.*, 2011). Habib, (2010) in a study on the sugar beet showed that seeds treated with hydrochloric acid increases the sugar beet seed germination percentage and germination rate. The purpose of this study was to evaluate the effects of priming with various solutions on dehydration tolerance in vegetative stage was fennel.

MATERIALS AND METHODS

This experiment was conducted in 2011 at the Experimental Station of Islamic Azad University of Tabriz. The area east of longitude 46 degrees 17 minutes north latitude 38 degrees 5 minutes with a height of 1360 meters above sea level. The factorial experiment was conducted in a completely randomized design in the laboratory and greenhouse. Factors examined include: A factor of 4 sorts of fennel seed treatment: a1) gibberellin, a2) hydrochloric acid a3) water a4) lack of pretreatment; Factor B includes 4 levels of irrigation: b1) 30% of field capacity b2) 50% of field capacity b3) 70% of field capacity b4) full irrigation. In this review gibberellin concentration of 250 ppm and the concentration of hydrochloric acid pretreatment was used. To prepare a hydrochloric acid solution of equation 1 and the fit was used to prepare solutions of gibberellin. The proportion of 250 grams of gibberellin 1,000,000 cc of water were used. Gibberellin content of the solution was heated 0/25.
Equation (1) the equation of hydrochloric acid solution

$$N_1 V_1 = N_2 V2 \quad \ldots(1)$$

Since in vitro pretreatment with the best time of 6 hours, to test the greenhouse seeds were treated for 6 h. To prepare the seed bed, farmyard manure was mixed with soil at a ratio of 1 to 3 and then was poured in pots with a diameter equal to the volume of 9 ml of 25 and 30 cm height. Seeds were placed in a greenhouse with a fungicide before planting captain of 2 per 15 minutes after 15 minutes, 15 seeds were sown in the soil at a depth of 2 cm. After planting seeds, watering was done. The emergence of the plants were recorded and then completely green bushes, thinning and at 5 plants per pot were kept. Water treatment applied after full deployment of the fennel plant. Water stress was applied based on the weight of the pots. In this case the pot with soil dry weight was measured. Then they were fully irrigated. After 24 hours after removal gravity of water, pots with soil, re-weighed. The difference between saturated soil and dry soil weight multiplied by the percentage of the pot with soil dry weight represents the weight of the pot should be watered.

Traits measured in the greenhouse stem height, stem diameter, number of branches, leaves, dry weight, shoot dry weight, root length, fresh and dry weight and root dry weight plant.
Stem height: Plant height was measured from the crown to the end with a ruler at 5 plants and their averages were considered as plant height. Fresh weight of roots: the last day of sampling after separating different sections of the plant, the more weight the various parts of the plant pot was measured as the average weight of participants from different sections of the plant were considered. Dry weight of leaves, stems and roots: different parts of the plants were placed in a paper bag and placed in an electric oven at 75°C for 24 hours, then weighed on scales 0/001. The mean dry weight of the dry weight of the plant parts of the plant were considered. Analysis of variance examined was performed using the software M STAT-C. Comparison of the data using the same software and using Duncan and drawing shapes using the Excel software was performed.

RESULTS AND DISCUSSION

The results of analysis of variance showed that in terms of greenhouse effect of priming, low water levels and types of priming in surface water interaction was significant for all traits.

A. Stem length
Based on the results of this study with gibberellin application greatest total Stem length is obtained compared to the other treatments (Table 1). In water level of 30% field capacity only if fennel seed treatment with gibberellin plants were green, in other treatments such as hydrochloric acid, water and non-treated seeds, the lack of emergence, shoot length is obtained zero. At 50% of field capacity significant difference in Stem length between the pre-treatment of water and hydrochloric acid was observed, but in pre-treatment with gibberellin Stem length was greater than the pre-treatment with hydrochloric acid and water. In condition the Stem length field of zero is obtained in 50% capacity due to lack of emergence of fennel. 70% of field capacity, the highest level of stem length in condition with treatment is obtained with gibberellin. This treatment leads to a lack of pre-treatment or control a 98 percent increase in Stem length as compared to control. Pre-treatment with hydrochloric acid and water, leading to an increase of 36% and 38% respectively compared to control Stem length. Full irrigation or irrigation control pre-treatment with gibberellin fennel seeds fennel had the greatest impact on long stems. This treatment led to an increase of 102 percent compared to the control condition during the shoot. The pre-treatment with hydrochloric acid and water irrigation by 40 and 22% of the full Stem length (Fig. 1).

Table 1: Analysis of variance to assess the fennel in the pot experiment.

Root dry weight	Root length	Dry weight	Shoot dry weight	Leaf dry weight	Number of lateral branch	Stem height	Degrees of freedom	Sources of change
14/005**	168/255**	7/544**	2/626**	0/539**	10/702**	720/316**	3	Types of priming
6/73**	173/390**	9/304**	3/678**	0/667**	40/639**	937/129**	3	Dehydration
1/38**	16/821**	0/781**	0/385**	0/032**	5/473**	33/712**	9	Types of priming * Dehydration
0/017	0/777	0/049	0/019	0/008	0/145	2/811	48	Error
13/32	5/49	19/46	20/59	27/58	12/77	12/26		C.v

** And * respectively significant at one percent and five percent

The results showed that the application of gibberellin, hydrochloric acid and water to increase the amount of irrigation water was added to increase the height of the stem. Irregularities in breathing rate also resulted in a restriction of metabolic energy (ATP) and ultimately reduce the rate of germination and seedling growth (Bogatek *et al.,* 2005).

Reduce seedling growth and can eventually lead to a reduction in the overall growth of plants. The priming can reduce the negative effects of drought. Researchers have reported that the uniformity of seed germination and seedling emergence of treatment can improve. Thus, priming effects may be more pronounced under unfavorable conditions (Ghassemi-Golezani *et al.*, 2008).

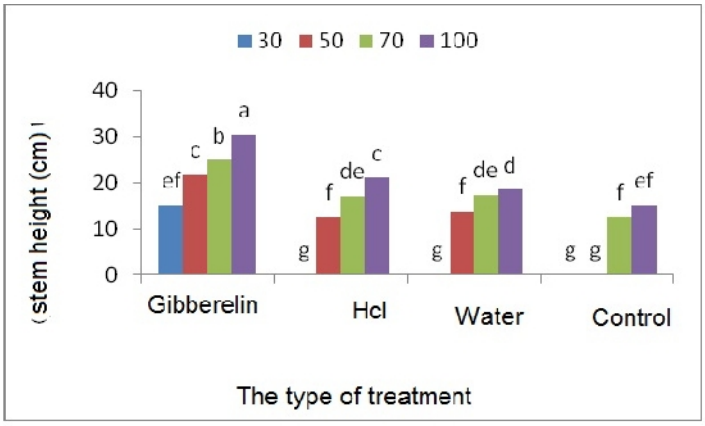

Fig. 1. Comparison of average stem height affect priming type and irrigation levels.

The results of this study indicated that the Number of lateral branch in fennel seed pre-treatment with gibberellin and full irrigation to the 5/37 number was obtained. Irrigation in 30% field capacity of the treatment plant gibberellin green and 3.25 branches per plant were produced. In water level in 50% field capacity in the absence of pretreatment fennel seeds, Number of lateral branch is obtained zero (Fig. 2). In the pre-treatment with gibberellin fennel seeds, water and hydrochloric acid, the minimum number of branches in fennel seed pre-treatment with hydrochloric acid no significant difference is obtained in the water. Irrigation at 70% field capacity, with no significant difference between the pre-treatment of water and hydrochloric acid pre-treatment difference was not statistically significant. Complete sets in the highest rates in the tributaries is obtained treatment with gibberellin treatment and the Number of lateral branch increased by 34% relative to control levels. But other pretreatment had no significant influence on the number of tributaries. Researchers have reported that the most severe of drought effect on germination of and seedling growth stage of the plant. Researchers have reported that some biological and abiotic stress reduces seedling establishment in the field. One of the most effective strategies for overcoming stress is the drought priming. Priming techniques to accelerate the emergence of crop plants, make plants stronger and better resistance to stress are used. This plant can grow better and better use of resources.

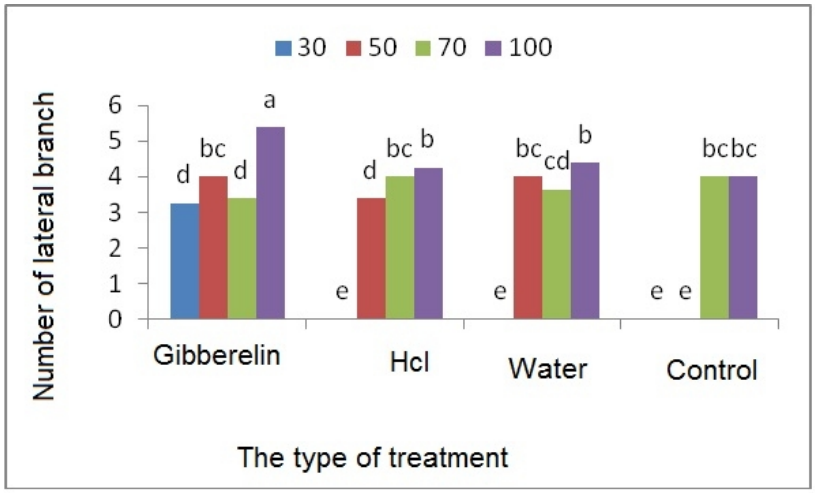

Fig. 2. Comparison of Number of lateral branch under the influence of priming and the level of irrigation.

B. Leaf dry weight

The mean dry weight of leaf affected by pretreatment with different solutions and different levels of irrigation showed that the fennel seeds in the pre-treatment with gibberellin, obtained the highest leaf dry weight. Therefore, pre-treatment with gibberellin, irrigation 30% of field capacity at a rate of 156% of the dry weight of the leaves to reduce water treatment, but increased compared to control. The pre-treatment with hydrochloric acid, water and a seed treatment, no significant differences in leaf dry weight at 70% field capacity and full irrigation, respectively (Fig. 3). For full irrigation, pre-treatment with gibberellin in the amount of 182% of the dry weight of leaves added to the lack of pre-treatment. Pre-treatment with hydrochloric acid and water, this attribute to the lack of pre-treatment levels increased 106% and 72% (Fig. 3).

Between the two treatments in terms of total irrigated area and leaf dry weight were was no significant difference. In terms of average water also leads to weight gain, dry leaves, and fennel seed pretreatment. Irrigation at 70% field capacity, pre-treatment with gibberellin fennel seeds, hydrochloric acid and water, respectively, 200, 182 and 176% of the dry weight of leaves added. Mohamed *et al.*, 1988) stated that there is a strong correlation between the rate of germination, seedling emergence rate and rate of leaf production. Other researchers have also reported strong growth in relation to the rapid emergence and early seedling uniform, with a top speed of leaf appearance (Ueno *et al.*, 1999). In this study, the experimental results showed that priming fennel seed germination rate increases, thereby increasing the number of leaves and dry leaves, which leads to weight gain.

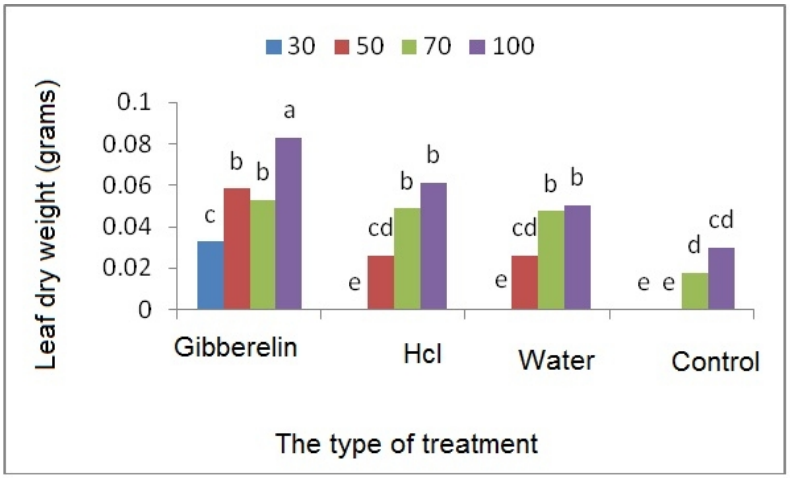

Fig. 3. Comparison of leaf dry weight under the influence of priming and levels of irrigation.

C. Stem dry weight

Based on the results of this study with gibberellin application greatest total Stem dry weight is obtained compared to the other treatments. In water level of 30% field capacity only if fennel seed treatment with gibberellin plants were green, in other treatments such as hydrochloric acid, water and non-treated seeds, the lack of emergence, shoot length is obtained zero. At 50% of field capacity significant difference in Stem dry weight between the pre-treatment of water and hydrochloric acid did not observed, but in pre-treatment with gibberellin Stem dry weight was greater than the pre-treatment with hydrochloric acid and water. In condition the Stem dry weight field of zero is obtained in 50% capacity due to lack of emergence of fennel. 70% of field capacity, the highest level of Stem dry weight in condition with treatment is obtained with gibberellin. This treatment leads to a lack of pre-treatment or control a 150 percent increase in Stem dry weight as compared to control. Pre-treatment with hydrochloric acid and water, leading to an increase of 115% and 100% respectively compared to control Stem dry weight. Full irrigation or irrigation control pre-treatment with gibberellin fennel seeds fennel had the greatest impact on long stems. This treatment led to an increase of 366 percent compared to the control condition. In this levels of irrigation water pre-treatment with hydrochloric acid and Stem dry weight than non-pre-treated seeds at the rate of 154 and a 78 percent increase. The results showed that the application of gibberellin and hydrochloric acid to increase the amount of irrigation water is added to the dry weight Stem, in pre-treatment with stem dry weight in water treatment by 50%, 70% field capacity and full of irrigation significant difference was observed (Fig. 4). Researchers have reported that Under unsuitable environmental conditions such as drought and salinity, the compounds responsible for the compatibility in inside seeds, such as malondialdehyde, proline and soluble sugar composition and activity of protective enzymes such as superoxide dismutase, catalase and peroxidase will improve under priming condition, So Stressful factors increases under tension factors such as drought resistance.

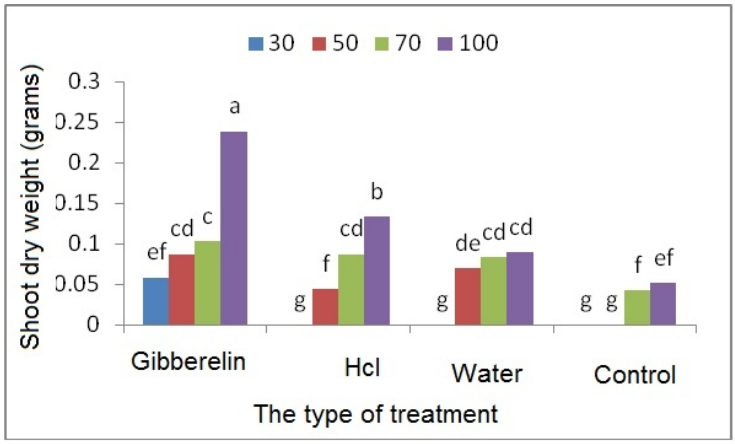

Fig. 4. Comparison of shoot dry weight under the influence of priming and the level of irrigation

D. Plant dry weight

Based on the results of this study with gibberellin application greatest total plant dry weight is obtained compared to the other treatments. In water level of 30% field capacity only if fennel seed treatment with gibberellin plants were green, in other treatments such as hydrochloric acid, water and non-treated seeds, the lack of emergence, shoot length is obtained zero. At 50% of field capacity significant difference in Stem dry weight between the pre-treatment of water and hydrochloric acid did not observed, but in pre-treatment with gibberellin Plant dry weight was greater than the pre-treatment with hydrochloric acid and water. In condition the Plant dry weight field of zero is obtained in 50% capacity due to lack of emergence of fennel. 70% of field capacity, the highest level of Plant dry weight in condition with treatment is obtained with gibberellin. This treatment leads to a lack of pre-treatment or control a 150 percent increase in Stem dry weight as compared to control. Pre-treatment with hydrochloric acid and water, leading to an increase of 115% and 100% respectively compared to control Plant dry weight. Full irrigation or irrigation control pre-treatment with gibberellin fennel seeds fennel had the greatest impact on long stems. This treatment led to an increase of 366 percent compared to the control condition. In this levels of irrigation water pre-treatment with hydrochloric acid and Stem dry weight than non-pre-treated seeds at the rate of 154 and a 78 percent increase. The results showed that the application of gibberellin and hydrochloric acid to increase the amount of irrigation water is added to the dry weight Stem, in pre-treatment with stem dry weight in water treatment by 50%, 70% field capacity and full of irrigation significant difference was observed (Figure 4). Researchers have reported that Under unsuitable environmental conditions such as drought and salinity, the compounds responsible for the compatibility in inside seeds leads to a reduction of 73 percent of plant dry weight or capacity to fully of irrigation the farm.

While in seed pre-treatment with hydrochloric acid, water, and no pre-treatment, irrigation, 30% of field capacity, leading to reduced plant dry weight which was 100 percent. Fennel seeds in pre-treatment with hydrochloric acid, maximum plant dry weight in of irrigation without significant differences is obtained with 70% of field capacity, but those treatment with of irrigation in field capacity of the plant dry weight was observed. . In water level of 30% field capacity only if fennel seed treatment with gibberellin plants were green, in other treatments such as hydrochloric acid, water and non-treated seeds, the lack of emergence, Plant dry weight is obtained zero. At other levels of irrigation, there was no significant difference in terms of plant dry weight. Based on the results in full irrigation, only pre-treatment with gibberellin resulted in a significant increase of 311 percent compared to the lack of pre-treatment plant dry weight, but in 70% of field capacity significantly different between the treatments plant dry weight was observed (Fig. 5). Other investigators have reported that the rapid emergence of useful crops, because crops are more opportunities for growth and, therefore, can store more Smilates (Wit and Su 2005). Therefore priming increased germination of rate may be increased plant dry weight.

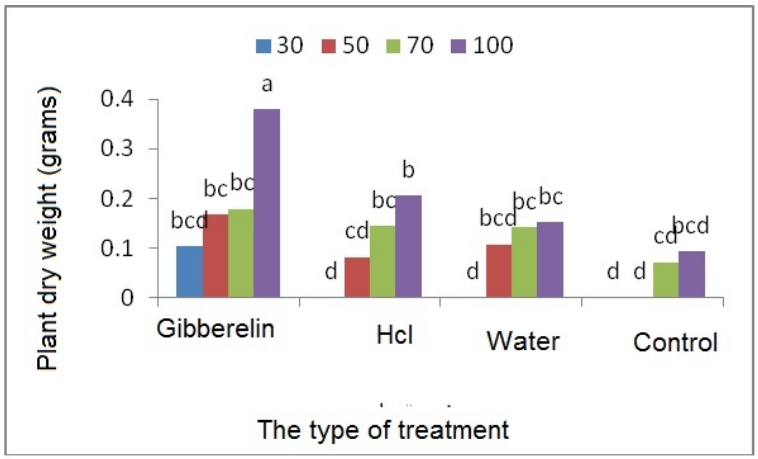

Fig. 5. Comparison of the effects of priming and plant dry weight under the levels of irrigations.

E. Root length

Based on the results of this study in application of gibberellin maximum root length is obtained compared with other treatments. In water level of 30% field capacity only if fennel seed treatment with gibberellin plants were green, in other treatments such as hydrochloric acid, water and non-treated seeds, the lack of emergence, root length is obtained zero. At 50% of field capacity significant difference in root length between gibberellin and acid pre-treatment was observed, however, pretreatment with water, root length was less than the pre-treatment with hydrochloric acid and gibberellin. The roots of control plants at 50% capacity due to lack of emergence of fennel field was zero. At 70% of field capacity in terms of the highest root length was treated with gibberellin. The lack of pre-treatment group than in the control leads to an increase of 160% compared to control the length of the roots. Pre-treatment with hydrochloric acid and water, leading to an increase of 45% and 54% respectively compared to control the length of the roots.

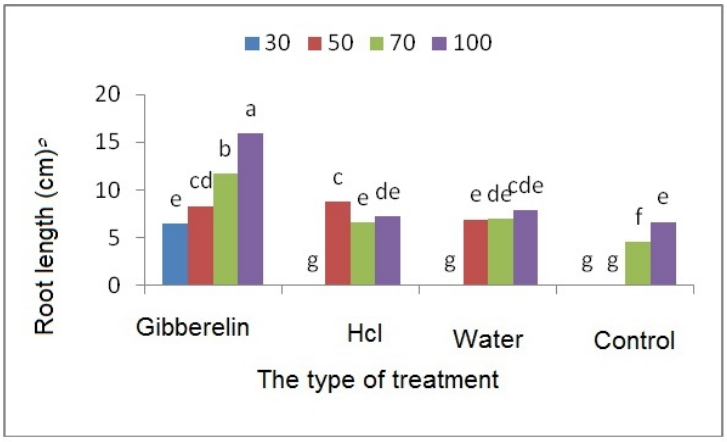

Fig. 6. Comparison of root length under the influence of priming and the level of irrigation.

For full irrigation or watering the seeds of fennel are also pre-treated with gibberellin had the greatest impact on the roots of fennel. This treatment led to an increase of 141 percent compared to the control condition over the roots. Researchers have reported that root growth is leading to increased use of gibberellin (Leite, *et al.*, 2003). In this levels of irrigation and water pre-treatment with hydrochloric acid had no effect on root length. The results showed that the effect of gibberellin application by increasing irrigation water is added. The use of hydrochloric acid at 50% field capacity, maximum root length was observed. However, pre-treatment of water from root length treatments of 50, 70% of field capacity and full of irrigation significant difference was observed (Fig. 6).

F. Root dry weight

Based on the results of this survey, the largest root of fennel seed treatment with gibberellin in 0/043 grams and full irrigation was obtained. This treatment led to an increase in total of irrigation area 7.6 times the weight of the dried roots of the fennel seeds was no pretreatment. Full irrigation, seed pre-treatment with hydrochloric acid and water, root dry weight increased, compared to the non-pre-treatment, 100 and 100% respectively. Irrigation at 70% field capacity of the pre-treatment with gibberellin, hydrochloric acid and water, leading to an increase in the order of 332, 37 and 73 percent of the dry weight of roots, fennel seeds. In the water level at 50% field capacity and root dry weight in terms of pre-emergence treatment due to lack of fennel was zero. While In the pre-treatment with gibberellin, hydrochloric acid and water, root dry weight was achieved reat 0/021, 0/007 and 0/005 grams. Irrigation In the 30% field capacity of the plant from seeds pre-treated with gibberellin green and root dry weight of 0/007 g was produced (Fig. 7). Amooaghaieand Valivand (2011) stated that Gibberellin application on the germination of seeds stressing factors can have a greater role than normal conditions. Other researchers have also suggested that gibberellin increases the activity of the alpha and beta amylase in conditions of stressing factors (Bialecka and Kepczynski 2009). The gibberellin application can reduce the impact of drought on seed germination and as a result, the death of seedling by drought been prevented. The root has also been reported that the rapid development of an extensive root system during the early stages of development is in relation to the power plant (Sigari *et al.*, 2000). Thus, priming and germination speed increases root growth.

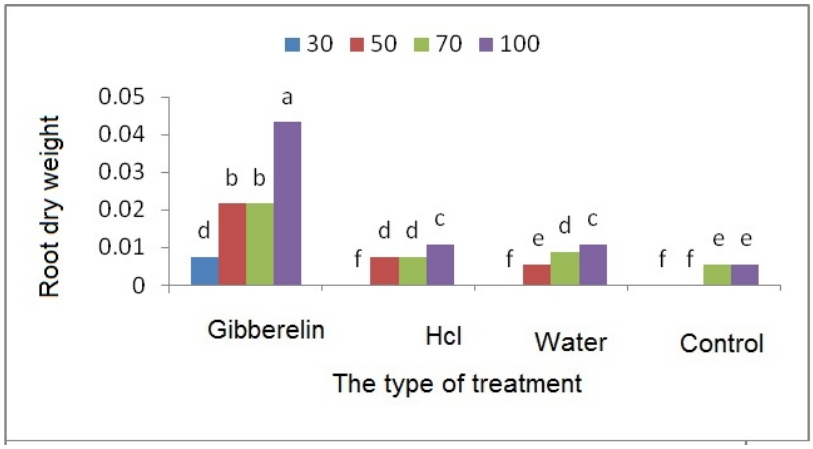

Fig. 7. Comparison of the root dry weight under the influence of priming and levels of irrigation.

CONCLUSION

The results of this study showed that in all studied traits in greenhouse trials in the treatment of irrigation water and 30% of field capacity, and the pre-treatment hydrochloric acid and higher levels of irrigation and 50% field capacity when applied pre-treatment, the lack of emergence, the characteristics studied was obtained zero. The water level of 30%, a seed treatment with gibberellin and irrigation at 50% capacity in the field of pre-treatment with water, hydrochloric acid and gibberellin plant death by the drought was prevented. At all levels of irrigation, fennel seeds pre-treated with gibberellin greatest effect of an increase of the characteristics studied found in the greenhouse.

Also the effect of pretreatment with water and hydrochloric acid was not significantly different, but in general, the pretreatment or full irrigation and water conditions led to an increase in greenhouse. The pre-treatment with gibberellin, hydrochloric acid and water to increase the amount of irrigation water on stem height, stem diameter, leaf fresh weight, dry weight, shoot dry weight, dry weight and total plant dry weight root was added. During the pre-treatment with gibberellin root only increased with increasing levels of irrigation. In general, it was observed either in full or in conditions of irrigation water, with priming, especially with gibberellin, it can be improved.

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