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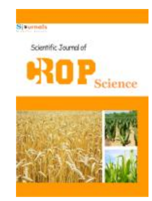

Original article

The effect of zinc on yield and yield components of sunflower (Helianthus.annuus L.)under drought stress

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A R T I C L E I N F O

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In the modern era Drought Stress is a major factor limiting the growth of sunflower crops in arid and semiarid regions of the world. To this end, a study to evaluate the effects of Stress at different growth stages in a split plot factorial by randomized block method of research station in the central province, Delijan city, Village Qlavar was done in the 2011 crop year. Drought Stress as a major factor: full irrigation (I1),no irrigation at the pollination level (I2) and no irrigation at seed filling stage (I3) and amount of secondary factors of potash and zinc fertilizers (including zero rate of potash sulfate, 100 and 200 kg in each hectare and zero rate of zinc sulfate, 60.30 kg per hectare) was considered and Data were analyzed by using MINITAB software and then based on the combined analysis of traits were evaluated. Finally, the more using of zinc and potash fertilizers on seed the better yield. This figure is based on the optimal irrigation conditions in terms of some traits such as number of leaf, plant height, plant diameter at 5% level was not significant But there was a significant difference in terms of other characteristics, and ultimately final yield of plant under drought stress is reduced.

1. Introduction

Sunflower is one of the five major oil crop in Iran because of the drought resistant and being compatible with the climatic conditions of the country, the development of a wide range of soils, the possibility of short growing season (on 85-110 days) and it is grown as a second crop after wheat and barley harvested and each year over 120 thousand hectares of cultivated land in the country is accounted for (Sepehr and Malakuoti, 2001). Also the crop's yield as a result of the lack of rainfall during the growing season greatly reduced and the need for irrigation increases. Jafarzadeh Kenarsari and Poostin (1999) stated that flowering and pollination are the most critical stages of sunflower growth in drought. Sunflower is one of the plants needs to be fertilized more often than others which it shows a positive response to using chemical fertilizers. Despite of good production potential of the country, its culture, which dedicated only to the relatively poor soils with poor management of fertilizer (consuming unconditioned) has been faced with a low yield of this product. Efficient fertilizer using in plants not only makes an increasing in seed yield, increases seed oil, increases plant resistance to environmental stresses such as drought, salinity and frost, improves biological activity in the soil, early product, decreasing density of some pollutions such as cadmium into seed, boron toxicity and increasing water use efficiency(Malakouti and Sepehr,2004). Various experimental results have shown the consumption of micro-nutrients in sunflower crops impact significantly on plant height, head diameter, number of seeds per head, seed weight, seed oil percent, number of leaves and eventually yield of seed(Sepehr and Colleagues, 2004). The lack of micro-nutrients in calcareous soils in arid and semi-arid limit the growth of the world's most oil-producing plants. When the stress is caused by the reduced moisture around the roots so that the plant cannot absorb enough water, or in other words the greater transpiration of water uptake will be done(Benjamin, 2007). Stress results in the abnormal physiological processes and is obtained as the effect of a combination of biological and environmental factors is. In fact, the amount or severity of undesirable factors that could be problematic for a living(MirMohammadi Meybodi and Gharebaghi, 2002). Hero(1981) reported water stress usually occurs when the amount of water intake on factors such as drought, high temperature and salinity is lower than water losing. However, the adverse effects of water stress on the growth and yield of maize depends on the time and stress type, stress intensity, growth stage and plant genotype. Brown (1977) announced that one of the major factors limiting crop production in dry and semi-arid regions is water deficit. Levitt, 1980, and Arshi, 1373, introduced deep root system and activate as one of the most important characteristics of genotypes likely to dryness. Taheri Asbagh and colleagues (1387) proved that by increasing drought stress all physiological indices decreased. The most critical growth period of plants to drought stress at pollination and two weeks after it was introduced (Hinger, 2001). Under stress conditions, food availability, uptake and transport disrupts (Layer, 2003). According to this matter that Iran is one of the world's arid regions, and it is necessary to examine the effects of drought stress on plants, this study was conducted to investigate the effects of drought stress on yield and yield components in various stages of growth were performed in the presence of various amounts of zinc.

2. Materials and methods

This research field tested in 2011 in the central province of Delijan city, Qlavr Village in orbit 30-25 degrees east longitude and 34-32 degrees north latitude geographical split plot factorial in a randomized complete block design with three replications. This test consists of three levels of irrigation such as full irrigation (according to crop water requirement), no irrigation at pollination (vegetative period) and no irrigation at seed filling stage (reproductive) as main factors and has been considered three levels of sulfate of potash in the form prior to planting, zero rates, 100 and 200 and foliar application of zinc sulfate, one in a pre-pollination stage and the other in post-seed filling stage. A total of 81 plots in three replications and each plot area of 6 m 2 × 3 sub-plots consisted of four lines each crop in each plot, 50 cm between rows and 20 cm distance between the bottom of the bay. Tillage and deep plowing and land preparation were classified two perpendicular disks, atmosphere and stack plots. Planting of June 25 was done by hand and dry manner. All-star seed varieties were used. To measure plant height, stem diameter, head diameter, plant height, number of seeds per plant, number of seeds per head hollow, the total dry weight of 10 plants per plot were selected and their mean in the plot were registered. To measure the number of leaves, 10 plants per plot were selected and counted, and the average number of leaves as it leaves per plot were recorded. To measure seed weight of five samples from each treatment was recorded as 1000 seed weight. Data analysis using MINITAB software and comparison of means was used by Duncan's test at 5% probability level.

3. Results and discussion

Data analysis showed that potash fertilizer on plant height was significant if the effects of drought stress and foliar application of zinc was not significant (Table 1). The effect of water stress on stem diameter was significant, while the interaction of zinc and foliar treatments on stem diameter was not significant (Table 1). Kelans and Shaw (1970) stated that water deficit at vegetative growth stage in compared with water deficit at flowering and seed filling has less impact on the final yield But in terms of the expansion of the leaf and stem development and reducing of accumulation in organs affected greatly and it corresponded with these results. Thus, when the plant is placed on water stress the stem diameter is reduced and ultimately affects the overall yield.

3.1. Number of seed at head

Analysis of variance showed that drought stress and foliar application of zinc sulfate and potash had a significant effect on the number of seeds per head, as well as the interaction of the stress of zinc was also significant (Table 1). Jaafarzadeh and colleagues (1997) reported that application of stress in the period before flowering sunflower inflorescence flower number and seed number can lead to reduced yield. Mirzapur and colleagues (2005) concluded that the use of fertilizers and micronutrients on sunflower seed has a positive effect on the results correspond.

3.2. Number of empty seed at head

Survey results indicated that the interaction effect of drought stress and foliar application of zinc in zinc had a significant effect on the number of empty seeds (Table 1). Zinselmir and colleagues reported that in the absence of seed filling because of drought stress can be due to insufficient assimilates at pollination and seed filling before it. Water stress can affect the development of embryonic stem cells - that are consistent with these results.

3.3. Weight of thousand seeds

Analysis of variance showed that drought, foliar application of zinc and potash fertilizer, drought interaction of zinc had no significant effect on seed weight(Table 1). Frederick et al (1990) also concluded that the greatest impact of drought on seed weight, the filling can be seen. When plants are exposed to drought stress due to the shorter duration of seed filling, seed weight decrease and the seed has a better yield and better resistance and also corresponded with the results. Also Kuchaki and colleages stated one major component is a function of the100 seeds weight and 100 seeds weight increases yield . Also concluded that 100 seeds weight of four factors: the length of the seed filling stage of development in reproductive leaves, leaf area and shoot dry weight and get affected depends on the weight of seeds and irrigation than that the results of this study correspond.

3.4. Dry weight

Analysis of variance showed that drought stress and foliar application of zinc and potassium had no significant effect on dry weight, but no significant interaction between stress zinc sulfate(Table 1). Kvzlvsky et al (1972) in their study concluded that any stress on plant growth directly affects the weight and it is decreased. The interaction of water stress and potassium in leaf area and leaf dry weight were increased. Water scarcity is an important factor limiting plant growth in addition to reduced dry matter production, seed carbohydrates is impaired, resulting in reduced harvest index, which also corresponded with the results.

Table 1

Sheet Analysis of variance (mean squares) Effects of water stress and foliar application of zinc on the properties of sunflower.

S.O.V	df	Number of leaves per plant	Plant height	Stem diameter	Diameter of tray	Number of seed	number of empty seeds	1000 seeds weight	Seed yield
Repeat	2	75.22**	1907.76**	7.75**	52.45**	36.08ns	246.70**	1.10**	780963.15 ns
Irrigation	2	4.70ns	39.12ns	3.74**	3.29ns	7752290.23**	747.81**	2.10*	56461.90**
Potassium	2	8.25ns	254.19*	0.03 ns	3.54ns	9831.16**	156.48*	6.93**	424070.50*
Zinc	2	4.16 ns	38.88ns	0.17ns	7.50*	655.93*	672.48*	1.44**	911681.90 ns
Error a	4	32.57	360.64	0.85	25.99	211.34	267.35	0.01	113471.12
Potash irrigation	4	0.96ns	112.03 ns	1.51 ns	3.07 ns	11297.19**	961.90**	1.90 **.	2318084.18**
Zinc irrigation	4	0.31ns	60.74 ns	0.49 ns	1.45 ns	12059.75**	626.75**	1.40**	783818.76**
Potash*Zinc	4	4.22 ns	81.38 ns	0.12 ns	3.07 ns	30605.79**	943.96**	0.57**	310196.44**
Potash*Zinc irrigation	8	0.85 ns	28.96 ns	0.10 ns	0.30 ns	101040.04**	1413.44**	2.11**	1038012.67**
Error b	48	22.20	54.61	0.34	2.34	165.95	47.95	0.004	27042.27

Table 2

Comparison of the mean levels of the main effects of drought and foliar application of zinc sulfate on yield of sunflower.

Experimental treatments	Number of leaves per plant (cm)	Plant height (cm)	Stem diameter (cm)	Diameter of tray (cm)	Number of seed (cm)	number of empty seeds (cm)	1000 seeds weight	Seed yield
Irrigation levels								
I1	19.05a	90.50a	5.08a	14.82a	872.07a	53.04a	5.11c	47.66a
I2	19.00a	91.31a	4.63b	14.24a	542.63b	58.63b	4.65b	39.59b
I3	18.30a	88.94a	5.76c	14.87A	638.48c	63.56c	4.60a	38.22c
Zinc Sulfate								
Z1	18.45a	89.54a	5.08a	14.81a	680.93a	52.81a	5.00c	43.62a
Z2	19.23a	91.64a	5.24a	15.07ab	690.04b	62.41b	4.54a	41.48ab
Z3	18.57a	8958a	5.14a	14.05b	682.22a	60.00b	4.82b	40.37b

Statistical characters of different levels of irrigation and zinc levels are compared separately.

Full irrigation (I1), irrigation at pollination (I2) and irrigation at seed filling stage (I3). Zinc sulfate fertilizer as the subplot (including zinc sulfate at zero, 30 and 60 kilograms per hectare). Overall, the survey results indicate that the samples that were faster than their phonological stages (in dry conditions) and had higher productivity. Also, especially after flowering drought had a negative impact on yield. Accordingly, in a cool and dry area to be sprayed on the manure can be effective in reducing the adverse effects caused by dehydration.

References

Arshi, Y., 1373. Sunflower Technology Sciences. Cotton and Oilseeds head department press. page 25.
Benjamin, J., 2007. Effects of water stress on corn production. USDA Aaricultural Research service, Akron., Pp, 3- 5.
Brown, C.L., 1977. Effect of date of final irrigation on yield components of sun flower. Agronomy J., 54, 19- 23.
Classen, M.M., show, R.H., 1970. Water deficit effect on corn: II Grain components. Agron J., 62, 652- 655.

Denmead, O.T., show, R.H., 1960. The effect of soil moisture stress at different stages of growth on the development and yield of corn. Agron. J., 52, 272- 274.

Fredrick, J.R., Below, F.E., Hesketh, J.D., 1990. Carbohy & rate, nitrogen and dry matter accumulation and partitioning of maize hybrids under drought stress. Ann. Bot., 66, 407-415.

Herrero, M.P., Johnson, R.R., 1981. Drought stress and its effects on maize reproductive system. Crop. sci., 21, 105-110.

Heydari, S., 1384. Green plants. Isfahan University press. Page 32.

Jaffarzade Kenarsari, M., Poustini, K., 1377. Examining the effect of the strain, drought, in different phases of developments in regards of some morphological characteristics and performance components of sunflower (record figure). Iran Agr. Sci. Magaz., volume No. 29, No. 2, page 353 – 361.

Kouchaki, A., Madenia, G.h.M., 1378. Arable Plants Physiology (Translation), Mashhad Academic Jihad press, page 467.

Kozlowski, T., editor, T., 1972. Water deficite and plant growth. Academic press. New York. Pp, 236- 368.

Lauer, J., 2003. what happens within the corn plant when Drought occurs. Corn Agronomist., 10(22),153-155.

Levit, J., 1980. Response of plant to environmental stress. Academ. press, Newyork.

Malakouti, M.J., Sepehr., 2004. Optimize nourishment for oil seeds (effective step to attained oil independence in country). Khaniran press, Tehran.464P.

Mirzapur; M.H., Kouchebaghi, A.H., vakil, R., Naeini, M.R., 2005. Effect of using iron chelate on the growth and yield of sunflower variety Rackord in saline calcareous soils in Ghom. Ith oil seeds int. congr., Gorgan.

Sepehr, A., Malakouti, M.J., 2001.Necessaries of optimized fertilizer using for in creasing yield and improved quality of sunflower. Technical ,No.102. Agr. educat. publicat., Tehran

Sepehr, A., Rasuli sedghiani, M.H., Malakouti, M.J., 2004. Effect of different resource of potassium and micronutrients fertilizers on quality and quantity increasing in sunflower.optimized nourishment of oil grains.Khaniran press, Tehran.

Taheri, A., et.al., 1387. Tehran University press. Page 114.

Zinselmeier, C., lauer, M.J., Boyer, J.S., 1995. Reversing drought – induced losses ingrain yield : sucrose maintain embryo growth in maize. Crop. sci., 35, 1390- 1400.