

Evaluation of different levels of water deficient effects on sunflower cultivars

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ABSTRACT: Among the oily seeds, the sunflower having both a high oil quality and its oil being suitable and desirable for edible consumption, is also resistant to dryness tension and can resist against it better than some weeding plants. In order to investigate the resistance of different cultivars of sunflowers against the drought tension, the effects of irrigation time on the cultivars of Zaria, Master, Hysun36, Favorit and Lakumka were investigated in a study in the farm of Kabootar Abad in Isfahan in 1392. Irrigation times as the primary plots in 3 levels as well as the cultivars as the secondary plots in 5 levels were examined in the form of split plots in the design format of completely randomized blocks in 3 repetitions. The highest and lowest efficiencies of water consumption were obtained through irrigation treatment based on the evaporations of 180 and 130 millimeters out of the evaporation small tubs, respectively. In addition, the highest efficiency of water consumption was obtained by Zaria cultivar, which was not significantly different from the other cultivars of Master, Favorit and Hysun36. The lowest efficiency of water consumption was obtained by the cultivar of Lakumka. The highest and lowest percentages of oil were obtained through irrigation treatment based on the evaporations of 130 and 180 millimeters out of the evaporation small tubs, respectively. Besides, the highest and lowest percentages of oil were obtained by the cultivars of Zaria and Favorit, respectively. The highest amount of biologic performance, yield index, oil performance, seed performance, one thousand seeds weight, leaf surface, bush height and also the number of flowering, as well as full flowering and reaping were obtained by the witness treatment, while the lowest amounts were obtained by the irrigation treatment based on the evaporation of 180 millimeters out of the evaporation small tub. The results of this study indicate that under the mild tension conditions (irrigation based on the evaporation of 130 millimeters out of the evaporation small tub). The cultivar of Master had the highest stability tension index (STI), as well as the highest indexes of geometrical mean productivity (GMP) and mathematical productivity (MP), which seems a suitable figure in mild tension conditions of the Master cultivar. Under the severe tension conditions (irrigation based on the evaporation of 180 millimeters out of the evaporation small tub), the cultivar of Zaria had the highest STI, as well as indexes of GMP and MP, which seems a suitable figure in severe tension conditions of the Zaria cultivar.

Keywords: Sun flower, drought tension, Oil percentage

INTRODUCTION

One of the most important managements for the farm to reach the suitable conditions of growth in herbal population and performance is supplying enough water for the plant in order not to be afflicted with moisture tension in sensitive stages of its growth. According to a definition, tension is the result of the abnormal trend of the physiological procedures which is obtained out of the effect of one or several environmental and biological

factors. In total, tension is the excessive pressure exerted from some counter forces that cause natural systems to be prevented from doing their own performances (Alessi and Zimmermann, 1997). By the beginning of the dry conditions, the bulge of the plants gets deficient continuously and increasingly, which this is more tangible at the beginning of the dryness period because of the quick increase in sweating made by the air dryness. Among the environmental factors, water has a very important role in plant growth. One of the effects of water shortage is reduction in cellular development due to the reduction in cell bulge, which this causes the reduction in plant photosynthesis thesis as well as in the extension of its leaves and stem. Water shortage is effective in the blockage of the gaps, and this reaction has a very important effect in production. It is because this controls directly the amount of carbonic gas absorbed through the photosynthesis thesis leaf. Water shortage or dryness tension is effective in many physiological procedures of the plant like photosynthesis, transferring the saved and photosynthetic material to the seed, cellular division, and also cumulation and transferring the nutritional material in the plant (Boyer, 1999). water tension is effective not only on metabolism, but also on the absorption of the soil elements. Among the first signs of the dryness tension, transferring phosphorus from the old leaves to the meristem tissues and stem can be mentioned. Transferring azote from old parts to young ones is also indicative of protein analysis and changes in the cell usual actions. It has been seen in numerous studies that dryness tension causes the leaf surface to be decreased, and so the plant performance to be influenced negatively. In some reports, it has been said that dryness tension brings forth early oldness in leaves, as well as reduction in the leaves numbers, diameter of pallet, surface of leaf, and finally performance of seed in sunflowers. In the plant of sunflowers, the number of pallets in the area unit, the number of seeds in the pod, as well as the one thousand seeds weight constitute the main components of the seed performance. The number of seeds in the pallet is the most important part of the sunflower performance, which should be considered to be able to increase it. It has been proved during a study that there is a positive and significant correlation between the seed performance and the one thousand seed weight in this plant. There is a compensatory state among the performance components in the sunflower, and reduction in the number of seeds in the pallet may cause the seed weight to be increased in its consequence. Frequently, reduction of water in soil makes the most amount of influence on the seed performance, while it is less on the oil percentage (Fernandez, 2003). At present, edible oils are among the most important imported items of the country.

Statement of the problem

Sunflower is one of the oily plants that in terms of the under cultivation area in the world is ranked after such plants as soy and cotton, in the order of such plant as colza and peanut. Furthermore, the other feature of this plant is its capability of tolerating different environmental conditions. Accordingly, it is possible to cultivate it in different areas. Since Iran is considered among the semi dry areas, so getting acquainted with the features related to the growth, performance, and also adaptability of this agricultural plant, especially to the dryness tension, can play an important role in developing its under cultivation area as well as increasing its performance. In this regard, knowing the stages sensitive to dryness in this plant and also avoiding unnecessary irrigations can increase the efficiency of using water and soil resources. Considering the increasing need of the human societies to oil and also the increasing limitation of the cultivatable lands, especially in our country, the increase in demand for agricultural crops should be compensated through increasing the crop efficiency in the surface unit as well as introducing the plants with capability of producing abundant and high quality oil.

MATERIALS AND METHODS

This experiment was conducted in design format of broken plots (split plot) with 3 repetitions. The time of irrigation conducting as well as the free pollinating cultivars of the sunflower were regarded as the main plot in 3 surfaces and the subsidiary plot, respectively. Irrigation treatments were as follows: irrigation based on the evaporation of 60 millimeters out of the evaporation small tub (ordinary irrigation), irrigation based on the evaporation of 120 millimeters out of the evaporation small tub, and also irrigation based on the evaporation of 180 millimeters out of the evaporation small tub. The cultivars taken here into account were Hysun36, Lakumka, Master and Zaria. The time of tension exerting was after placing the plant and from the 6 leaf stage on. During the growth period, in the meantime of conducting the necessary agricultural cares, the essential note takings regarding the growth stages, morphological features, and also the bush height were also done. Date of emergence of each one of growth stages consisted of becoming star-like, budding, beginning of flowering, ending of flowering, and physiological completion. After the completion of the pallets as well as harvesting the

bushes, the measurements of the pallet diameter and also the seed performance and one thousand seeds weight were done, respectively.

Data analysis

In different conditions of the moisture tension, the performance components and the under study cultivars performances differed significantly from each other. The variance analysis of the experiment regarding the evaluation of the free pollinating sunflower cultivars towards the water shortage tension showed the effect of the moisture tension surfaces on the pallet average diameter was significant. It is while the average amount of the values relating to this performance part in different levels of the dryness tension showed that reduction in pallet diameter in the irrigation treatment based on the evaporation of 180 centimeters has caused these differences to become significant. In the witness treatment, the average value of the pallet diameter in different cultivars has been measured as 20.33 centimeters. In terms of the comparison of the test on the basis of Duncan, there was an insignificant relationship between this value and the average value of the pallet diameter in mild tension conditions (irrigation based on the evaporation of 120 millimeters) which was equal to 17.66 centimeters. In the irrigation treatment based on the evaporation of 180 millimeters out of the evaporation small tub (severe cumulative tension), the average value of the pallet diameter reduced to 15.29 centimeters. Therefore, it is observed that one of the most important elements of the performance was influenced by the moisture regimes. There was also a very significant difference among the under examination cultivars in terms of the pallet diameter, in such away that the highest value was seen in the cultivar of Lakumka. Regarding this attribute and in comparison with Lakumka, the cultivar of Master with the average value of 18.44 centimeters was placed in a different statistical class with the maximum difference of 1.5 centimeter.

In addition, the cultivar of Zaria was seen with the average pallet diameter of 16.88 centimeters, and finally the lowest value of pallet diameter was seen in the cultivar of Hysun 36 (with the average value of 14.11 centimeters). The effect of different moisture regimes on the weight of one thousand seed was very significant, in such away that the average value of this attribute in different levels of moisture tension showed that the one thousand seed weight in the control treatment, i.e. Irrigation based on the evaporation of 60 millimeters, was 83.61 grams on average. By decreasing the available moisture for the bushes with longer distances, the seeds weights declined remarkably. Under the mild dryness tension, the one thousand seed weight reached to 73.98 grams, which this was statistically significant in comparison with the tensionless conditions. Besides, by increasing the severity of dryness tension and reaching to the severe tension, the one thousand seed weight declined remarkably once more. Under these conditions, the average one thousand seed weight reduced to 57.77 grams. All three treatments of the drought tension were placed in different statistical groups in terms of the one thousand seed weight. The mild and severe tensions caused the one thousand seed weight to be decreased about 10 and 26 grams, respectively. The difference in the one thousand seed weight among the different cultivars was also very significant. Absolutely, the highest one thousand seed weight was seen in the cultivar of Lakumka. This value was on average of about 85.80 grams for one thousand seed weight. The cultivar of Master was also seen with the average weight of 81.42 grams for one thousand seed, which it was not significantly different from Lakumka. These two cultivars are considered as large seeded ones in different experiments. The cultivar of Hysun 36 was seen as the next one with the average weight for one thousand seed with 71.95 grams. The lowest weight for one thousand seed was also seen in Zaria cultivar. The difference between the minimum and maximum weight of one thousand seed was about 27 grams. The mutual effect of the moisture tension and the cultivar on the weight of one thousand seed was very significant. The variance analysis of the under examination attributes in the experiment of evaluating the free pollinating cultivars of the sunflower towards the water shortage tension, and in terms of the difference between different layers of moisture regimes regarding the seed performance comparison, was significant at the probability level of 1 %. The mean performance of the seed, in separation for the different layers of dryness, is indicative of the noticeable effect of water shortage on the level of the obtained performance

RESULTS AND DISCUSSION

According to the obtained values and figures, the seed performance decreased along with the increase in the dryness cumulative tension, and also all three treatments of irrigation were placed in separate groups in the manner of Duncan in terms of the statistical grouping. The average level of the seed performance in all the under study cultivars in the conditions of usual irrigation was 3695.4 killograms in hectare. Under the conditions of mild dryness tension, the seed performance decreased to 2792.5 killograms in hectare. In the irrigation treatment after

the evaporation of 180 millimeters (severe tension), the average performance of the seed still decreased and reached to 2166.1 kilograms in hectare. Considering the point the two important elements of the seed performance, namely the pallet diameter and the one thousand seed weigh, are both influenced by the moisture tension, so the reduction in the seed performance under these conditions is evident. The squares means of the performance elements in this study (table1) indicate that the different under study cultivars differed very significantly from each other in terms of the seed production amount. The comparison of the means of different cultivars has placed the average amount of the seed performance in the four under study cultivars with in three statistical groups. The highest performance of the seed under the conditions of this study belonged to the Master cultivar. Following it, the cultivars of Lakumka and Hysun 36 which had in order the performance of about 2880.6 and 2760.2 killograms in hectare were placed in the next rankings. Besides, the lowest level of the seed performance was seen in the cultivar of Zaria. Compared with the other cultivars, this cultivar produced significantly less amount of seed to just 1820 killograms in hectare. Totally, the mean of the measured attributes in different cultivars was indicative of the superiority of the high yield cultivars in terms of the performance elements of the pallet diameter and one thousand seed weigh. In spite of its less weight of one thousand seed ,the cultivar of Master demonstrated a higher performance because of having the highest pallet diameter. On the other hand, in spite of having a high weight of one thousand seed, the cultivar of Lakumka showed on the whole a less performance than the cultivar of Master due to its less pallet diameter.

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