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Article

Impact of planting dates and potassium levels on sunflower grain yield and fullness (Helianthus annuus L.) Shampoos variety

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Abstract

The study was conducted during the spring season (2022) to determine the effect of early planting for four planting dates (18/1, 2/2, 17/2 and 4/3) and four levels of potassium fertilizer (30, 60, 90 and 120) kg ha^{-1}, on the yield and fullness of sunflower grains, cultivar Shamoos, was carried out by arranging the split panels according to a Randomized Complete Block Design with three replicates. The results of the experiment showed significant effects of planting dates on yield and its components, as the planting date exceeds D1 on the grain filling period, the number of grains filled, the weight of 1000 grains, the yield of the individual plant, the biological yield and the percentage of fertilization, the results of the experiment also showed a significant effect of potassium levels on yield traits, the K4 fertilization treatment gave the highest average of the duration of grain filling and the number of filled grains, whereas, the K2 fertilization treatment gave the highest mean for the 1000 grain weight, regarding the interaction between the two factors of the study, the results showed significant differences between the experimental treatments on the yield, the D1K4 interference treatment gave the highest mean of the grain filling time.

Keywords: planting dates, potassium levels, sunflower grains (*Helianthus annuus* L.), Shamoos cultivar.

Introduction

Helianthus annuus L. sunflower is a crop belonging to the compound family Asteraceae. It is one of the most important oil crops in the world and ranks third after soybean and rape crops in terms of oil content[1,2]. Grains of some varieties used by humans (cherries) were in greater demand as their size increased. Recently, the demand for these items has increased by packaging companies because of their high financial returns and human health benefits; sunflower grains contain vitamins, proteins, and minerals, playing a contributing role in strengthening the immune system in the face of the Coronavirus, sunflower crop fields are used by humans for beekeeping, increases the rate of insemination and fertilization, and reduce the percentage of empty grains[3].

For cultivated sunflower varieties cherries, you need unique agricultural treatments that must be followed to obtain whole and large grains. Therefore, more studies should be conducted aimed at serving the crop properly, to increase and improve the productivity and quality of the dunam, paying attention to the fertilization of the major and minor elements, especially potassium fertilization; potassium is one of the significant mobile nutrients necessary for plants, as the need

of crops, including the sunflower crop, for potassium, outweighs other nutrients, except for nitrogen, it is necessary from the stage of germination to the stage of flowering and filling the grains[4]. The role of K+ in many physiological functions, including control of cellular growth, xylem formation, xylem-phloem water content and movement, and nutrient transport with different plant functions; leaves represent the basic roles of potassium because of its high concentration, the leaves are one of the most active members of the plant[5].
The addition of K+ results in an increase in the growth and activity of antioxidant enzymes in both normal and stressed plants. Several researchers, including [6,7,8, 9], noted that Potassium directly and significantly affects plant photosynthetic ability and growth and complex plant functional mechanisms in response to various stresses and metabolic control.
The decline in the production of the sunflower crop in Iraq is linked to several factors, including genetic factors, agricultural (soil and crop service operations), including planting dates, and a low percentage of pollination and fertilization caused by high temperatures, especially in the spring season, due to the effect of planting date on sunflower yield, the importance of potassium for this crop, this study was proposed, which aims to know the effect of early cultivation in agriculture, and potassium levels on the growth, yield, and fullness of sunflower grains, cultivar Shamoos.

Materials and Methods

Experience site:
The experiment was carried out in the Abu Al-Fadl Forest Nursery of the Diwaniyah Agriculture Directorate, located in the center of the center for the spring season 2022, to find out the effect of early planting and potassium levels on the yield and fullness of sunflower grains, cultivar Shamoos.

Experience factors:
The first factor was planting dates; four dates were used for planting sunflower grains, cultivar Shams:
The first date is 01/18/2022, denoted by the symbol (D1).
The second date is 2/2/2022, denoted by the symbol (D2).
The third date is February 17, 2022, symbolized by the symbol (D3).
The fourth date is 3/4/2022, denoted by the symbol (D4).

The second factor is potassium.
Potassium K was added to the soil at four levels:
The first level: 30 kg K H-1 and symbolized by the symbol (K1)
The second level: 60 kg K H-1 (Summary recommendation) and symbolized by the symbol (K2)
The third level: 90 kg K H-1 and symbolized by the symbol (K3)
Fourth level: 120 kg K H-1 and symbolized by the symbol (K4)

Agricultural operations
The experiment was carried out by arrangement of a splint- plot, according to a randomized complete block design, depending on the Al-Rawi and Khalaf Allah[10] with three replicates, farming dates occupied the Main Plot, the potassium levels were in the sub-plot, and the area of the experimental unit was 3×3 m. Two orthogonal plows plowed the experimental soil before planting using the tip-over plow. Then, disc combs carried out the smoothing process of the soil. After that, the process of leveling and marking was carried out to prepare a suitable cradle for grains. The experimental units were fertilized with urea (46% N) as a nitrogen source by two batches, the first batch after the formation of true leaves and the

second at the stage of flower bud formation[11], triple super phosphate (P_2O_5 46%) was also used as a source of phosphorous, potassium sulfate (K_2O 50%) as a source of potassium, as the fertilizer recommendations were 160 kg N ha^{-1}, 160 kg K_2O ha^{-1} and 100 kg P_2O_5 ha^{-1}, Potassium and phosphorous fertilizers were added to the field when adding the first batch of urea fertilizer[12].

Soil analysis

A sample of the soil of the field designated for the implementation of the experiment was randomly taken by (Ukr), with a depth of 0-30 cm. The soil was dried and ground, then sieved with a sieve with a diameter of 2 mm, and physicochemical analyses were conducted.

	Physical traits			Chemical traits				
Trait	Clay	Silt	Sand	K	P	N	ECe	Ph
Value	46	22	32	121 ppm	12 ppm	14 ppm	2.2	7.1

The analyses were carried out in the soil and water laboratory in the Diwaniyah Agriculture Directorate.
Table 1. Some physical and chemical properties of field soil before planting.

The studied characteristics of the product and its components

Ten plants were harvested from the two average values of the experimental units at full maturity for each treatment in isolation from the other. Then, the grains were manually crushed and air-dried for each grain separately. Then, a study was conducted for the characteristics of the yield and its components:

1. Grain filling period (day): The number of days for each planting date and the potassium level were calculated after 3 days from reaching 50% flowering until the harvest date for each experimental unit and the three replicates.
2. The number of complete grains (grain of a $disc^{-1}$): It was calculated by discarding the grains of the disc and counting them manually, where the total number of whole and empty grains for each grain was calculated.
3. Weight of 1000 grains (gm): A random sample was taken from the whole grains of the middle two hall plants and calculated as an average for each treatment (Al-Sahoki, 1994).
4. The yield of the individual plant, g. Plant-1: the weight of the full grain yield of the middle two halls is then calculated as an average for each treatment.
5. Biological yield (gm): where the plant was weighed above the soil surface in all its parts (stem - leaves - discs, and grains) and then calculated as an average for each treatment.
6. Fertilization percentage: The total number of grains was calculated, then the number of full and empty grains was found[4], and the following equation was applied:

$$Fertilization\ percent = \frac{\text{Fill grain}}{\text{Total grain}} \times 100$$

Results

Table 2 indicates a significant effect of planting dates and potassium levels on the yield characteristics and components of the sunflower crop. The planting date D1 exceeded the yield characteristics (grain fullness period, number of filled grains, weight of 1000 grains, individual plant yield, biological yield and percentage of fertilization). It gave the highest average of these traits (37.5 days, 1281.13 grain $disc^{-1}$, 128.65 g, 165.12 g, 705.00 g, 84.53%), respectively. In contrast, the date D3 gave the lowest average for the traits (number of filled grains, weight of 1000

grains, yield of individual plants and biological yield). It reached (1281.13 grains of Disc^{-1}, 128.65 g, 165.12 g, and 705.00), respectively.
As for the date of planting D4, it recorded the lowest average of the traits, the duration of grain filling and the percentage of fertilization, which reached 31.42 days and 70.85%,
The results of the same table also showed a significant effect of potassium levels on some yield traits.
The 4K fertilization treatment gave the highest average for the two traits, the duration of seed filling and the number of filled seeds, it reached 37.08 days 1047.30 seeds disc^{-1}.

Traits / Treatments	Grain filling time (day)	Full grains No. (grain-disc^{-1})	1000 grains weight (gm)	individual plant yield (gm plant^{-1})	Biological yield (gm plant-1)	Fertilization percent (%)
Planting date						
D1	37.50	1281.13	128.65	165.12	705.00	84.53
D2	36.75	1162.97	117.04	133.05	594.17	77.25
D3	34.00	1125.76	107.50	110.82	471.62	75.67
D4	31.42	1047.30	109.86	115.04	550.57	70.85
LSD$_{0.05}$	*1.232	*52.822	*8.569	*14.090	*124.280	*3.852
Potassium levels						
K1	32.83	1093.24	114.44	131.09	630.25	75.45
K2	33.75	1188.68	120.78	131.19	604.13	77.21
K3	36.00	1132.94	118.82	133.84	543.50	77.57
K4	37.08	1202.29	109.01	127.92	543.47	78.07
LSD$_{0.05}$	*0.521	*77.020	*6.460	N.S	N.S	N.S

Table 2. Effect of planting dates and potassium levels on yield and its components.

Discussion

Table 2 indicates a significant effect of planting dates and potassium levels on the yield characteristics and components of the sunflower crop. This may be due to the short period of stay of the crop in the field and the high temperatures for the dates D3 and D4, which led to the short period of grain filling and the destruction of pollen grains. Consequently, the percentage of grain fertilization is reduced, all of which are factors that lead to zero grain size and a low number of grains filled in the disc, as well as a decrease in the weight of 1000 grains, and as a result of the decrease in the components of the yield for the two mentioned dates, the biological yield in them decreased. This outperforms other levels of fertilization. The reason may be due to the time the seed is full, which led to the consumption of as much potassium as possible. Potassium is an important element that contributes to increasing the volume and fullness of crop seeds, including the sunflower crop. In contrast, the K2 fertilization treatment gave the highest average for the weight of 1000 seeds, which reached 120.78 g. The reason may be because the K2 fertilization treatment is the ideal level for potassium fertilization [14,15,16].

Conclusions

The best date for seed yield is 1/18 for the spring fertilization. The best level of potassium fertilization is the K4 level. Higher temperatures increase the percentage of empty seeds in the disc, negatively reflected in the yield.

Suggestions

It is suggested to enlarge the sunflower crop after the first date (1/18) in the characteristics of the crop and its components, working with this study for more than one site to obtain more comprehensive results.

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