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Effect of planting dates and potassium levels on the growth and yield of sunflowers

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Abstract

The study was conducted during spring season (2022), to determine the effect of early planting for four planting dates (18/ 1, 2/ 2, 17/ 2 and 4/3/2022), 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 growth, yield and quality traits, as the D_4 planting date was superior to vegetative growth traits (50% flowering and plant height) by giving it the highest average of these two traits, which amounted to 84.58 days and 274.30 cm. giving it the highest average for the trait, which reached 4.35% As for the yield traits and its components, the planting date D_1 exceeded the characteristics (number of full seeds, weight of 1000 seeds and yield of individual plant) as it gave the highest average of these traits amounted to (1281.13 seeds $disc^{-1}$, 128.65 g and 165.12 g) respectively.

The results of the experiment showed a significant effect of potassium levels on the characteristics of vegetative growth, yield and quality, as the K_4 fertilization treatment gave the highest average for the traits (50% inflorescence and the number of full seeds), which reached (84.58 days and 1047.30 seeds $disc^{-1}$) respectively, while the K_2 fertilization treatment gave The highest mean of potassium content in leaves and weight of 1000 seeds was 4.29% and 120.78 gm.

Key words: planting dates; potassium levels; sunflower grains (*Helianthus annuus* L.); Shamoos cultivar

Introduction

The specialists in the field of poultry 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

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packaging companies, because of their high financial returns and human health benefits. Sunflower grains contain vitamins, proteins, and minerals, making it a contributory role in strengthening the immune system in the face of the Coronavirus. Sunflower crop fields are used by humans for beekeeping, increasing the rate of insemination and fertilization, and reducing the percentage of empty grains[3].

The cultivated sunflower varieties, for cherries, you need special agricultural treatments that must be followed to obtain full 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 major 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 primary roles of Potassium because of its high concentration, and 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, and in recent studies by some researchers including (Tränker *et al.*[6]; Sustr[7]; Dreyer et al.[8]; Cuin et al.[9], they noted Potassium has a direct and significant effect on 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), –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 Effect of planting dates and potassium levels on the growth and yield of sunflowers, 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 of 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 18.01.2022, denoted by the symbol (D1).

The second date: is 02.02.2022 and is denoted by the symbol (D2).

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The third date: -17.02.2022, symbolized by the symbol (D3).

The fourth date: is 04.03/2022 and is denoted by the symbol (D4).

The second factor is Potassium

Where 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-Raw and Khalid 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, the smoothing process of the soil was carried out by disc combs; after that, the leveling and marking process was carried -out to prepare a suitable cradle for grains. The experimental units were fertilized with urea (46% N) as a nitrogen source, in 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 physic-chemical analyzes were conducted.

Table (1) Some physical and chemical properties of field soil before planting.

	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

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The analyzes were carried out in the soil and water laboratory in the Diwaniyah Agriculture Directorate

The studied characteristics

Characteristics of vegetative growth

The readings of the growth characteristics of the mesophyll plants were taken from each experimental unit at 50% flowering

1-Number of days from planting up to 50% flowering: The number of days for each planting date and the level of potash fertilization from planting up to 50% flowering for each experimental unit were calculated for the three replicates

2-Plant height (cm): The height of the plant was measured from the surface of the soil (the base of the stem) to the base of the flowering disc

Results

Where ten plants were harvested from the average mezzanine of the experimental units at full maturity for each treatment in isolation from the other, then the seeds were manually sown and air-dried for each tablet separately, then a study was conducted for the characteristics of the yield and its component

1-The number of full seeds (seed of a disk^{-1}): It was calculated by discarding the

seeds of the disk and counting them manually, where the total number of full and empty seeds for each disk was calculated

2-Weight of 1000 seeds (g): A random sample was taken from the full seeds of the mid-grain tablets and calculated as an average for each treatment, Al-Sahoki[13]

3-The yield of the individual plant, g. Plant-1: the weight of the total seed yield of the harvested average mezzanine, then calculated as an average for each treatment

Determination of potassium content in leaves

Ten newly developed leaves were taken randomly for each experimental unit and from the middle the two lines plants at the stage of 50% flowering, cleaned of dust and air-dried, then placed in the oven at a temperature of 68 °C until the weight was stable, then crushed and then weighed 0.2 g and digested using concentrated sulfuric and acid The pyro chloric acid was used at a ratio of 1:4 to each of them by a thermal stirrer, and the sample was filtered by filter paper. The percentage of Potassium in the leaves of the filtrate was estimated by a

Adjectives **transaction**	**Number of days from planting up to 50% flowering**	**Plant height (cm)**	**The number of full seeds (seed of a disk^{-1})**	**The yield of the individual plant, g. Plant^{-1}**	**Weight of 1000 seeds (g.)**	**Determination of potassium content in leaves**
planting dates						

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D1	100.63	241.93	1281.13	165.12	128.65	3.67
D2	91.13	262.46	1162.97	133.05	117.04	3.79
D3	88.00	256.37	1125.76	110.82	107.50	4.28
D4	84.58	274.30	1047.30	115.04	109.86	4.35
$LSD_{(0.05)}$	1.142*	14.512*	52.822*	14.090*	8.569*	0.304*
Potassium levels						
K1	93.17	251.38	1093.24	131.09	114.44	4.03
K2	92.29	255.58	1188.68	131.19	120.78	4.29
K3	89.92	262.09	1132.94	133.84	118.82	3.92
K4	88.96	266.01	1202.29	127.92	109.01	3.85
LSD $_{(0.05)}$	0.450*	N.S	77.020*	N.S	N.S	0.207*

Flame photometer Page et al. [14]

Results and discussion

The results of Table (2) indicate that there is a significant effect of planting dates and potassium levels on growth characteristics and yield of sunflower crop, as the date of planting D_4 exceeded in the traits (potassium percentage in leaves and number of days from planting up to 50% flowering and plant height) as it gave an average of these traits. It reached (4.35 and 84.58 days and 274.30 cm) respectively, and the planting date D_1 was superior in yield characteristics (number of filled seeds, individual plant yield and weight of 1000 seeds) as it gave the highest average of these traits reached (1281.13 seed $disc^{-1}$, 165.12 and 128.65 gm.).), while the date D_3 gave the lowest average for the characteristics (the number of filled seeds, the weight of 1000 seeds and the yield of the individual plant) as it reached (1125.76 seeds $disc^{-1}$, 110.82 and 107.50 g).

The results of the same Table also showed a significant effect of potassium levels on some growth and yield traits, as the K_4 fertilization treatment recorded an average number of days from planting to 50% flowering that amounted to 88.96 days, while the K_1 fertilization treatment recorded an average number of days of 93.17 days.

The K_4 fertilization treatment gave the highest mean for the characteristic of the number of filled seeds amounted to 1202.29 $disc^{-1}$ seeds, which did not differ significantly from the levels K_2 and K_3 as they recorded an average of 1188.68 and 1132.94 $disc^{-1}$ seeds, respectively, while the K^1 level gave the lowest mean for the trait amounting to 1093.24 $disc^{-1}$ seeds.

As for the percentage of Potassium in the leaves, the K_2 fertilization treatment gave the highest average of 4.29%, while the K_4 level gave the lowest average of 3.85%, which did not differ significantly from K_3, which recorded an average of

3.92%, and the reason for this is that the K_2 level is the ideal for fertilization With Potassium.

Conclusions

The best date for seed yield is 1/18 for 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.

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