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EFFECT OF POTASSIUM FERTILIZATION LEVELS ON GROWTH, YIELD AND QUALITY OF SUNFLOWER CULTIVARS (*Helianthus annuus* L.)

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ABSTRACT

The study included two field experiments for sunflower crop conducted during spring growing season of 2008 in two locations. The first was in AL-Rashidia (20 km) west north Mosul city, the second ones was in AL-Hamdanea (30 Km) east of Mosul city. The main objective was to find out the effect of potassium fertilization levels on growth, yield and quality of three sunflower cultivars. Each experiment was conducted according to factorial experiment in a randomized completely block design with three replications. It included three levels of potassium (0, 30 and 60 kg k per hectare^{-1}) were applied to the soil during the sowing period, with three cultivars of sunflower crop (Saturn, Gordis and Majak).

The results could be summarized as follows:

The cultivar Gordis gave a high level for most growth, yield and quality parameters in both locations. Application of 30 kg K per hectare^{-1} led to a significant increase in plant height, leaf area, disc diameter, number of seeds per head, weight of thousand seed, seed yield, oil percentage and oil yield, while increasing concentration of potassium up to 60 kg K per hectare^{-1} caused a significant increase in protein percentage in AL-Rashidia and AL-Hamdanea locations. The interaction between the cultivars and potassium fertilization levels was significant in some growth, yield and quality parameters, the Gordis cultivar with potassium application to the soil with concentration 30 kg k.ha^{-1} was superior and gave highest values for plant height, stem diameter, leaf area, number of seeds.head^{-1}, weight of thousand seed, oil percentage, oil yield, protein percentage and protein yield in AL-Rashidia location only, while the interaction between cultivars and potassium fertilization levels was significant in number of seeds per head and weight of thousand seed in AL- Hamdanea location only.

Key words: Potassium Fertilization, Sunflower Cultivars, *Helianthus annuus*.
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INTRODUCTION

Sunflower *(Helianthus annuus L.)* is an important edible oil crops, ranking next to soybean (Khan, 1999). It is a drought tolerant and short duration crop and has a wider range of adaptability. Therefore, more care should be given to this crops to improve the productivity to meet the shortage of vegetable oil (Ibrahim *et al*., 2003). Its seed contain high oil content ranging from 40-50 percent and it is rich in protein 23 percent (Mohamed *et al*., 1992 and Sangoi and Kruse, 1993). Moreover, its oil quality is better due to higher percentage of linoleic acid and low percentage of linolenic acid which is the most desirable character, lacking in other

oils (Annaduri *et al*., 1994). Nitrogen, phosphorous and potassium are major elements essential for plant growth and development. To date the use of chemical fertilizers has been confined mainly to the application of nitrogen, phosphorous and potassium. There role are well documented in photosynthesis, increasing enzyme activity, improving synthesis of protein, carbohydrates and fats, translocation of photosynthetic, enabling their ability to resist pests and diseases. Potassium also plays key role in increasing crop yield and improving the quality of product (Tisdale *et al*., 1985 and Soleimanzadeh *et al*., 2010).

In addition to the other factors that are responsible for increasing yield per hectare, is the application of potassium which plays a remarkable role in boosting up production (Blamey *et al*., 1979). The effect of potassium application on sunflower plant growth, yield and quality was reported by some investigators, who found that increasing potassium level led to a significant increase in plant height (Sirbu and Ailincai, 1992), no. of leaves, leave area and head diameter (Lewis *et al*., 1991). Response of sunflower to potassium application was studied by many investigators: Carter, (1978); Shinde *et al*., (1993); Khan, (1999) and Ahmad *et al*., (2001) who reported that the application of 150 kg potassium. ha^{-1} increased sunflower no. of seeds.$head^{-1}$, weight of thousand seed, fertility, and total yield.

So, the objective of this trial was to study the effect of three potassium fertilization levels on growth, yield and certain quality traits of three sunflower cultivars.

METERALS AND METHODS

Tow filed experiments were carried out during 2008 season at the experimental farm, the first was in AL-Rashidia 20 km west north Mosul city, the second was in AL-Hamdanea 30 Km east of Mosul city at Nineveh province, to investigate the effect of three levels of potassium fertilization (0, 30 and 60 kg k $hectare^{-1}$) on the growth, yield and certain quality traits of three sunflower cultivars (Saturn, Gordis and Majak). Each experiment included nine treatments comprising the combinations of three cultivars and three potassium levels with three replications.

Seeds of these cultivars were obtained from the crops industrial company, Baghdad. The experimental design was factorial experiment in a Randomized Completely Block Design with three replications according to Steel and Torrie, (1980). Then Duncan's multiple range test (Duncan, 1955) was used to compare among means (SAS, 2001). A representative soil sample (0-30 and 30-60cm) was taken before planting, (table1) to study some physical, chemical and nutritional properties using the methods described by Black, (1965); Jackson, (1973); Page *et al*., (1982) and Tandon, (1999).

Seeds were sown in April 2^{nd} and 6^{th} and harvested in August 4^{th} and 8^{th} for 2008 season for the two locations respectively, in hills 30 cm apart on ridges 40 cm apart to attain a plant density of 83.333 plants.ha^{-1}. Super phosphate 120 kg per $hectare^{-1}$ (45% P_2O_5) and potassium levels (48%K_2O) were applied to the soil during the sowing period, Nitrogen fertilizers was applied in the form of urea 80 kg.$hectare^{-1}$ (46% N) in two equal doses, prior to the first and second irrigation. Each plot 14.4 M^2 (6*2.4) included six rows and six meters long. The plant were

thinned to one plant per hill 14 days after sowing. The external two rows were left as border. Two of the remaining rows were devoted for estimating plant growth and some characteristics. The first irrigation was applied after 5 days from sowing and then irrigation was scheduled at about four days intervals. Normal cultural practices of growing sunflower were conducted in the usual manner followed by the farmers of the district. At heading, the heads of the two inner rows were bagged early to seed development to avoid birds damage until maturity. The following data were recorded: plant height (cm), stem diameter (cm), leaf area, and head diameter (cm). At harvest, ten plants were taken randomly from the two inner rows of each experimental plot and left for two weeks until fully air dried, then the following data were calculated; number of seeds per head, weight of thousand seed, hulls percentage, fertility percentage, yield and oil yield (ton.hectare^{-1}). Oil seed content was determined using Soxhlet method (Anonymous , 1980) and seed nitrogen concentration was measured by microkjeldahl method, then protein percentage was calculated via multiplying the nitrogen percentage by the converting factor 6.25 (Agrawal *et al.*, 1980).

Table (1): Physical and chemical characters of soil experiments at both locations.

physical characters				
Locations	AL-Rashidia		AL-Hamdanea	
Depth (cm.)	0-30	30-60	0-30	30-60
Sand (%)	57.00	50.00	47.00	39.00
Silt (%)	25.00	30.00	33.00	33.00
Clay (%)	18.00	20.00	20.00	28.00
Texture	Sandy loom	Sandy loom	Silty sand	Silty sand loom
chemical characters				
O.M. (g.kg^{-1})	1.24	0.82	1.46	0.98
Available N (ppm)	44.20	34.90	40.50	20.90
Available P (ppm)	12.85	9.12	11.72	10.54
Available K (ppm)	144.00	138.00	134.00	122.00
Total $CaCo_3$ (g.kg^{-1})	23.50	21.80	16.20	12.10
pH	7.20	7.33	7.62	7.68
E.C. (mmhos.cm^{-1})	0.92	0.41	0.76	0.48

RESULTS AND DISCUSSION

1- Effect of cultivars: Data in table (2) revealed that Gordis cultivar had taller (114.10, 115.87 cm) and thicker (2.11, 2.56 cm) plant then those of Saturn and Majak in both locations AL-Rashidia and AL-Hamdanea respectively. The result of leaf area showed that Gordis cultivar significantly exhibited higher leaf area (3160, 3298 cm^2.plant) than those of Majak and Saturn cultivars in the two locations respectively. The differences among the three cultivars in the leaf area may be attributed to the general varietals differences in the plant height and number of internodes per plant (Mohamed *et al*., 1992; Sangoi and Kruse, 1993 and Abd EL-Samie *et al*., 1995). In this concern, Salama (1996) showed that taller cultivars had more leaves and leaf primordial than the others sunflower cultivars. It can be also noted that the head diameter of Gordis cultivar was greeter than Saturn and Majak cultivars at both locations. Mean values of seed yield, yield components and some related traits for the three tested cultivars are presented in table (2). The data

revealed that Gordis cultivar surpassed Saturn and Majak cultivars in the head characteristic (head diameter, no. of seeds.head^{-1}, weight of thousand seed), Moreover, Saturn surpassed Majak in those traits in both locations. This means that Gordis plants were more efficient to accumulate dry mater in their head. Regarding to the seed characters studied i.e. weight of thousand seed, hulls, fertility and oil percentage, data showed that there were a significant variations among the three tested sunflower cultivars in both locations. Gordis cultivar surpassed significantly Saturn and Majak cultivars in no. of seeds.head^{-1} (1152.66, 1181.00), weight of thousand seed, yield and oil yield (2.89, 2.82, 1.25, 1.23 ton.hectare^{-1}) in both locations, respectively. However, fertility seeds percentage showed fluctuated direction in the two locations, where Gordis cultivar was the highest in both locations. On the other hand, Majak cultivar was the medium in both locations. The superiority of Gordis cultivar in the most seed characters may be due to that Gordis cultivar had better vegetative growth and hence photosynthetic area which led to more carbohydrates which was translocated from the source (leaves and stem) to the sink (seeds) (Carter, 1978 and Mengel and Kirkby, 1982). The results showed that the number of seeds per head, weight of thousand seed and yield, oil yield (ton.hectare^{-1}) were always significantly higher for Gordis than that for Saturn and Majak varieties.

2- Effect of potassium fertilization: Data presented in table (3) showed that increasing potassium level from 0 to 30 (Kg k ha^{-1}) significantly increased stem diameter, leaf area and head diameter at the both locations, While these traits appeared to have negative response to 60 kg k ha $^{-1}$. This could be attributed to the highly available potassium in the experimental site in both locations (table 1) also showed that the available potassium in the soil is in the average of medium level which is ranged from 128-141ppm, and these results are in agreement with the classification of Bergmann, (1965), although sunflower required a high quantity of potassium, this reflected the response of the crop to this element when increasing the concentration from 0 to 30 kg k ha^{-1}. The beneficial effect of potassium on plant height may be due to its role in enhancing photosynthesis. In this concern, increasing potassium fertilizer levels increased plant height as was found by Sirbu and Ailincai, (1992) and Shinde *et al*., (1993). The leaf area was increased significantly by adding potassium fertilizer up to 30 kg k.ha^{-1} as compared to the check and the high level of potassium in both locations. However, increasing potassium level up to 60 kg k ha^{-1} had low significant effect on these traits. These results means that potassium application up to 30 kg k ha^{-1} was enough to increase the leaf area. These findings confirmed the results obtained by Shinde *et al*., (1993); Annaduri *et al*., (1994) and Khan, (1999) who found that the application of 150 kg k ha^{-1} increased sunflower area.plant^{-1} and number of leaves per plant. The stimulatory effect of potassium in sunflower plant may be due to its role in enhancing metabolic process. These results are in harmony with those obtained by Pervaiz *et al*., (1999); Ahmad *et al*., (2001); Karim and Hassain, (2002) and Mohammad *et al*., (2008). Data reported in table (3) demonstrated that the number of seeds per head significantly increased by increasing potassium application levels from 0 to 30 kg k ha^{-1} in both locations. Many researchers concluded that increasing potassium application rates increased number of seeds per head (Shinde *et al*., 1993

and Ahmad *et al*., 2001). The obtained data showed that weight of thousand seed, hulls, fertility, total yield and oil yield were increased significantly as the potassium application levels was increased from 0 to 30 kg k hectare^{-1} in the two locations. These results are in agreement with those reported by Roga *et al*., (1984); Lewis *et al*., (1991); Harmati, (1993); and Annaduri *et al*., (1994) who reported that potassium application increased seed yield to 40%. Soleimanzadeh *et al*., (2010) found that the increases in yield through potassium application may be due to its key role in increasing crop yield and improving the quality of product and hence, the transport of nutrients is essential to metabolism in active areas. Similar results were obtained by Ahmad *et al*., (2001) who found that head diameter, weight of thousand seed and oil yield were increased with increasing potassium application rates from 0 to 150 kg k ha^{-1}. On the contrary, the fertility percentage and seed oil percentage were decreased with increasing potassium application up to 60 kg k. ha^{-1}. The decrease in the fertility seed may attributed to more light translocation to the seeds by increasing potassium level. However, the decrease in seed oil contents by potassium fertilizer may be due to the increase in seed protein content (Chitdeshwari *et al*., 2002). In this concern, Many researchers reported that the potassium application to sunflower caused a reduction in seed oil percentage (Nazakat *et al*., 2003).

3- Effect of interaction between cultivars and potassium fertilization: Interaction between the studying factors (cultivars and potassium fertilization) showed significant effects on some growth characters, yield components and quality in both locations as illustrated in table (5). The interaction between the cultivars and potassium fertilization for the other investigated traits were not statistically significant in both locations, therefore the data were excluded.

Data illustrated in table (4) show generally that Saturn, Gordis and Majak cultivars appeared to be clearly affected by increasing rate of potassium fertilization levels up to 30 kg k ha^{-1} for the traits of plant height (120cm), stem diameter (2.4cm), leaf area, number of seeds.head^{-1}, weight of thousand seed, oil percentage (43.7%), oil yield, protein percentage and protein yield only in AL-Rashidia location, while the interaction between cultivars and potassium fertilization levels was significant in number of seeds.head^{-1} and weight of thousand seed only in AL-Hamdanea location, while they appeared to be little response to 60 kg k ha^{-1} for those traits. On the other hand, Gordis cultivar reflected the greatest response to potassium fertilization levels up to 30 Kg k ha^{-1} for these traits, with this regard, Prunty, (1981); Faizani, *et al*., (1990); Sarmah, *et al*., (1994); Conley and Barta, (2003) and Khan, (1999) found that fertilization with 150 kg k ha^{-1} produced maximum weight of thousand seed (53.71g) and seed yield (4153 kg ha^{-1}). On the other hand, the response rate of Saturn and Majak cultivars to potassium fertilizer was low with increasing potassium fertilization levels more than 60 kg k ha^{-1} for the most of these traits. It could be concluded that the tallest cultivars i.e. Gordis responded positively to high potassium fertilization levels compared with the shorter cultivars Saturn and Majak. (Osman and Abolila, 1984; Ibrahim *et al*., 2003; Govt 2004; Brar, 2007 and Rathika *et al*., 2008). The insignificant effect between cultivars and potassium fertilization levels on other characteristic showed that each of these two factors acted independently on these traits.

Table (2): Means number of some growth characters, yield components and quality as affected by cultivars in both locations.

locations	cultivars	plant height (cm)	stem diameter (cm)	leaf area (cm^2.plant)	head diameter (cm)	no. of seeds per head	1000 seed weight	hulls (%)	fertility (%)	yield ($ton.ha^{-1}$)	oil (%)	oil yield ($ton.ha^{-1}$)	protein (%)	protein yield ($ton.ha^{-1}$)
AL-Rashidia	Saturn	106.22b	1.88b	2613.72b	19.47b	1062.53b	69.16b	51.78b	83.24b	2.18b	42.18b	0.923b	13.57c	0.296b
	Gordis	114.10a	2.11a	3160.68a	21.25a	1152.66a	74.97a	54.64a	86.07a	2.89a	43.15a	1.250a	13.85b	0.402a
	Majak	103.41c	1.76c	2526.55c	18.76c	1030.36c	65.28c	50.32c	82.13c	2.08c	41.54c	0.865c	14.14a	0.294b
AL-Hamdanea	Saturn	108.00b	2.13b	2724.17b	19.29b	1064.09b	71.00b	52.23b	83.03b	2.21b	41.29b	0.915b	14.07b	0.312b
	Gordis	115.87a	2.56a	3298.35a	21.73a	1181.00a	75.50a	53.43a	85.49a	2.82a	43.63a	1.234a	14.11b	0.399a
	Majak	104.97c	1.96c	2596.22c	18.59c	1033.69c	65.99c	50.66c	81.75c	2.02c	41.23c	0.836c	14.63a	0.295b

* The mean values within column followed by the different letter are significant at 0.01 and 0.05 probability levels, respectively.

Table (3): Means number of some growth characters, yield components and quality as affected by potassium fertilization levels in both locations.

locations	K levels ($kg.ha^{-1}$)	plant height (cm)	stem diameter (cm)	leaf area (cm^2.plant)	head diameter (cm)	no. of seeds Per head	1000 seed weight	hulls (%)	fertility (%)	yield ($ton.ha^{-1}$)	oil (%)	oil yield ($ton.ha^{-1}$)	protein (%)	protein yield ($ton.ha^{-1}$)
AL-Rashidia	0	99.99c	1.49c	2582.61c	18.98c	1011.02c	65.60c	50.65c	82.18b	2.07c	41.62b	0.863c	13.42c	0.277b
	30	114.64a	2.28a	2993.70a	20.77a	1166.05a	72.97a	53.65a	84.91a	2.59a	42.90a	1.117a	13.65b	0.354a
	60	109.10b	1.98b	2724.64b	19.72b	1068.48b	70.84b	52.44b	84.35a	2.49b	42.35a	1.058b	14.48a	0.361a
AL-Hamdanea	0	100.88c	1.79c	2703.73c	19.21b	1025.69c	67.07c	51.38b	82.17c	2.13b	41.33b	0.886c	13.60c	0.288b
	30	117.20a	2.66a	3037.03a	20.43a	1164.39a	73.71a	52.78a	84.42a	2.55a	42.48a	1.087a	14.02b	0.356a
	60	110.77b	2.20b	2877.98b	19.98a	1088.71b	71.71b	52.16a	83.67b	2.38a	42.33a	1.012b	15.19a	0.361a

* The mean values within column followed by the different letter are significant at 0.01 and 0.05 probability levels, respectively.

Table (4): Means number of some growth characters, yield components and quality as affected by interaction between cultivars and potassium fertilization levels in both locations.

cultivars	K levels ($kg.ha^{-1}$)	plant height (cm)	stem diameter (cm)	leaf area (cm^2.plant)	head diameter (cm)	no. of seeds per head	1000 seed weight	hulls (%)	fertility (%)	yield ($ton.ha^{-1}$)	oil (%)	oil yield ($ton.ha^{-1}$)	protein (%)	protein yield ($ton.ha^{-1}$)
AL-Rashidia location														
Saturn	0	97.28f	1.44g	2422.17h	18.59	986.05d	63.49e	50.18	81.35	2.00	41.42cd	0.831ef	13.31d	0.267c
	30	113.00bc	2.24b	2895.29d	20.25	1128.96b	72.94c	53.08	84.48	2.26	42.66ab	0.964c	13.46cd	0.303b
	60	108.39d	1.96d	2523.71e	19.57	1072.59c	71.05c	52.09	83.90	2.29	42.47bc	0.974c	13.93b	0.319b
Gordis	0	108.20d	1.76f	2977.23c	20.62	1071.23c	70.94c	52.60	84.99	2.31	42.59b	0.984c	13.29d	0.307b
	30	120.38a	2.44a	3295.66a	22.12	1251.94a	78.60a	56.26	86.71	3.30	43.72a	1.445a	13.54cd	0.447a
	60	113.71b	2.14c	3209.15b	21.03	1134.83b	75.39b	55.07	86.51	3.06	43.14ab	1.320b	14.73a	0.451a
Majak	0	94.48f	1.27h	2348.43i	17.75	975.78d	62.38e	49.18	80.20	1.89	40.84d	0.773f	13.67bc	0.258c
	30	110.55cd	2.16c	2790.14e	19.96	1117.25b	67.38d	51.63	83.54	2.22	42.32bc	0.941cd	13.96b	0.310b
	60	105.21e	1.85e	2441.07g	18.57	998.05d	66.09d	50.16	82.66	2.12	41.45cd	0.880de	14.79a	0.314b
AL-Hamdanea location														
Saturn	0	98.28	1.68	2521.17	18.60	1000.72d	65.56e	51.44	81.82	2.04	40.42	0.825	13.38	0.272
	30	115.67	2.64	2907.63	19.64	1107.29c	75.07b	52.73	84.06	2.34	41.42	0.970	13.89	0.325
	60	110.06	2.08	2743.72	19.62	1084.25c	72.38c	52.53	83.21	2.26	42.03	0.951	14.93	0.338
Gordis	0	108.87	2.13	3208.23	21.22	1083.23c	72.27c	52.42	84.05	2.53	43.10	1.091	13.44	0.340
	30	122.38	2.93	3379.66	22.35	1287.94a	78.13a	54.57	86.47	3.06	44.07	1.348	13.70	0.419
	60	116.37	2.62	3307.15	21.64	1171.83b	76.09b	53.29	85.94	2.88	43.72	1.263	15.21	0.439
Majak	0	95.48	1.57	2381.77	17.81	993.11d	63.38f	50.27	80.64	1.82	40.48	0.741	13.99	0.253
	30	113.55	2.41	2823.81	19.29	1097.92c	67.93d	51.04	82.74	2.25	41.97	0.944	14.48	0.325
	60	105.87	1.90	2583.07	18.67	1010.05d	66.67de	50.67	81.87	1.99	41.24	0.823	15.42	0.307

* The mean values within column followed by the different letter are significant at 0.01 and 0.05 probability levels, respectively.

Table (5): Analysis of variance F values for some growth characters, yield and yield components and quality in AL-Rashidia and AL-Hamdanea locations.

S.O.V	D.f	M.S. for AL-Rashidia location												
		plant height (cm)	stem diameter (cm)	leaf area (cm^2.plant)	head diameter (cm)	no. of seeds per head	weight of thousand seed (g.)	hulls (%)	fertility (%)	yield ($ton.ha^{-1}$)	oil (%)	oil yield ($ton.ha^{-1}$)	protein (%)	protein yield ($ton.ha^{-1}$)
Replications	2	107.20	0.00271	16.25	0.5559	1516.037	1.463	2.2777	0.01444	0.1193	0.66333	0.019	0.6192	0.0028
C	2	276.05**	0.29015**	1063322.67**	14.8801**	36176**	214.2407**	43.41721**	37.028**	1.755337**	5.9364**	0.38785**	0.736**	0.03391**
K	2	492.75**	1.44973**	392333.96**	7.28973**	55284.6**	129.4141**	20.55657**	18.750**	0.698781**	3.7510**	0.15954**	2.814**	0.01933**
C × K	4	7.7645*	0.01090**	18941.49**	0.1753$^{n.s.}$	1414.8**	5.0679037*	0.49550$^{n.s.}$	0.605$^{n.s.}$	0.13241$^{n.s.}$	0.1103**	0.02601**	0.152**	0.00293**
Error	16	2.67444	0.0010023	63.884	0.3105092	209.1620	1.3871704	1.1216167	0.583611	0.00988704	0.357500	0.0020915	0.03124	0.0001782
Total	26													
S.O.V	D.f	M.S. for AL-Hamdanea location												
Replications	2	69.5559	0.5714925	79615.593	1.1945148	246.2593	6.9076704	4.01352593	20.06703	0.15007778	9.505170	0.0516340	0.67694	0.00192
C	2	285.20**	0.86247**	1258560.2**	24.5269**	54436**	203.3534**	17.33207**	32.433**	1.588344**	16.866**	0.399519**	0.8745**	0.02801**
K	2	608.32**	1.69638**	250136.5**	3.40028**	43404**	104.5393**	4.447125**	11.847**	0.397511**	3.5077**	0.093688**	6.0592**	0.01487**
C × K	4	5.993$^{n.s.}$	0.01432$^{n.s.}$	15944.1$^{n.s.}$	0.1458$^{n.s.}$	3573.2**	5.3727148*	0.47580$^{n.s.}$	0.093$^{n.s.}$	0.01495$^{n.s.}$	0.423$^{n.s.}$	0.0039$^{n.s.}$	0.071$^{n.s.}$	0.00058$^{n.s.}$
Error	16	4.17259	0.0184884	7249.093	0.3034398	545.6343	1.1626745	0.58128843	0.814612	0.02899861	0.616062	0.0052077	0.15615	0.0007076
Total	26													

*, ** Significant at the 0.05 and 0.01 probability levels, respectively. and n.s. not Significant.

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تأثير مستويات التسميد البوتاسي في نمو وحاصل ونوعية أصناف من زهرة الشمس *(Helianthus annuus* L.*)*

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الخلاصة

تضمنت الدراسة تجربتين حقليتين لمحصول زهرة الشمس نفذتا أثناء الموسم الربيعي من العام 2008 في موقعين مختلفين. الأول في الرشيدية (20 كم) شمال غرب مدينة الموصل والثاني في الحمدانية (30 كم) شرق مدينة الموصل. كان الهدف الرئيس معرفة تأثير مستويات التسميد بعنصر البوتاسيوم في نمو وحاصل ونوعيه ثلاثة أصناف من زهرة الشمس. نفذت كل تجربة وفق نظام التجارب العاملية بتصميم القطاعات العشوائية الكاملة بثلاث مكررات. وتضمنت ثلاث مستويات من البوتاسيوم (0 ، 30 و 60 كغم k هكتار$^{-1}$) أضيفت إلى التربة عند الزراعة وثلاثة أصناف من محصول زهرة الشمس (ستيورن، كوردس وماجك). ويمكن تلخيص النتائج كالأتي:-

أعطى الصنف كوردس أعلى معدل لمعظم صفات النمو والحاصل والنوعية في موقعي الرشيدية والحمدانية. أدى إضافة 30 كغم بوتاسيوم.هكتار$^{-1}$ إلى زيادة معنوية في ارتفاع النبات، المساحة الورقية، قطر القرص الزهري، عدد البذور.قرص$^{-1}$، وزن الألف بذرة، حاصل البذور ونسبة وحاصل الزيت، بينما سببت زيادة تركيز البوتاسيوم إلى 60 كغم.هكتار$^{-1}$ إلى زيادة معنوية في نسبة البروتين في موقعي الرشيدية والحمدانية. كان التداخل بين الأصناف ومستويات السماد البوتاسي معنوياً في البعض من صفات النمو والحاصل والنوعية، فقد تفوق الصنف كوردس عند إضافة البوتاسيوم إلى التربة بتركيز 30 كغم.هكتار$^{-1}$ بإعطائه أعلى قيمة لكل من ارتفاع النبات، قطر الساق، المساحة الورقية، عدد البذور.قرص$^{-1}$، وزن الألف بذرة، نسبة وحاصل الزيت ونسبة وحاصل البروتين في موقع الرشيدية فقط. بينما كان التداخل بين الأصناف ومستويات السماد البوتاسي معنوياً في عدد البذور.قرص$^{-1}$ ووزن الألف بذرة في موقع الحمدانية فقط.

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