Influence of different K fertilizer sources on sunflower production

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Abstract
The use of chemical fertilizers is one of the ways for increasing agricultural productions. The objective of this study was to investigate the influence of different K sources (KCl and K_2SO_4) on sunflower yield. For this purpose, a randomized block experimental design with K_2SO_4 and KCl sources was established in the greenhouse. The treatments were consisted of 0 (standard), 50, 100, 150 and 200 kg/ha fertilizers each with four replicates. After development, plants were harvested. The heights and weights of each plant was obtained and dried in the oven. The potassium content of each plant was measured, using flame photometer apparatus. The obtained results indicated that by increasing potassium concentration in soil, its accumulation in plant tissues was also increased. So that the best yield was in 200kg/ha level of K2SO4 treatment and the lowest yield was in the 50kg/ha of the KCl treatment. Also, the sulphur content was increased by increasing $K2_SO_4$ fertilizer.

Key Words
fertilizer, K_2SO_4, KCl, Sunflower, yield

Introduction
Sunflower (*Helianthus annus*) is one of the most important oil plants in the world. Sunflower oil contains large amount of A, D, E, K vitamins and considerable proteins (20-40%) (Connor and Hall 1997). By fertilizing and increasing the soil fertility, the seed yield and its oil content are increased (Egli 1998). The objective of this study was to assess the influence of KCl and K_2SO_4 fertilizer levels on sunflower yield. Consequently, an experiment was conducted to recognize the efficiency of using KCl and K_2SO_4 fertilizer with different levels of K in soil.

Methods
A randomized block experimental design with two K sources (K_2SO_4 and KCl) and four replicates was established in the greenhouse under uncontrolled environmental conditions. The treatments were consisted of 0 (standard), 50, 100, 150 and 200 kg/ha fertilizer. First, the sunflower seeds were put in washing detergent 20% for 15 minutes for disinfectant and after that, seeds washed with water for acquiring the necessary wet for budding. The soils were carefully packed in the pots to obtain a uniform bulk density of 1.35 gr/cm^3.The soil fertilization process was performed until the target concentrations were achieved. In order to obtain a reliable set of data, four replicates for each treatment was established. Content of N and P that used were in arrangement 100 and 150 kg/ha and the amount of K in different level of K_2SO_4 and KCL fertilizers was assessed in this study. After 48 hours, the seeds were seeded in the pots. Three seeds were first seeded and after 20 days with comparing the plant growth, separated the weak shoots and thinned to 1. Having a standard treatment, the soil water content was always held at field capacity to prevent any water stress during the whole growth period. When plants were fully developed, after measuring plant height, sunflowers were harvested. Also, weight of each sample in different fertilizer levels was measured (Tables1 and 2) and (Figures 2 and 3).

Table 1. The average of plant weight and height in K_2SO_4 treatment.

Treatment	Average of height (cm)	Average of weight(g)
0	126	395
50	131	400
100	135	420
150	138	435
200	142	490

The plants were then washed with distilled water and dried in an oven for 48 hours (at 85 ^{oc}). The potassium content of each plant was measured, using flame photometer (Table 3) (Gupta 2000). Finally, the effect of two fertilizers of K_2SO_4 and KCl was assessed on sunflower yield.

Table 2. The average of plant weight and height in KCl treatment.

Treatment	Average of height (cm)	average of weight (g)
0	126	395
50	128	398
100	130	407
150	133	420
200	137	447

Table 3. Potassium concentration in the experimental plants.

Treatment	K (ppm)
standard	10
A1	14
A2	30
A3	41
A4	50
B1	11
B2	28
B3	39
B4	45

Results

To distinguish the influence of different soil fertilizer levels on sunflower yield, different amounts of potassium were measured. The results of these chemical analyses are given in Table 3. As can be seen in this table, the lowest potassium concentrations belong to the treatment with 50 kg/ha KCl fertilizer. Also, the highest potassium concentrations belong to the treatment with 200 kg/ha K_2SO_4 fertilizer. The relationship between soil potassium concentrations and amount of potassium in sunflower are presented in Figure 1. It was further observed that by increasing the potassium concentration in the soil, its concentration in plant tissues was also increased. The maximum yield obtained for the treatment with 200 kg/he K_2SO_4 and the minimum yield was in treatment with 50kg/he KCl (Figure 1).

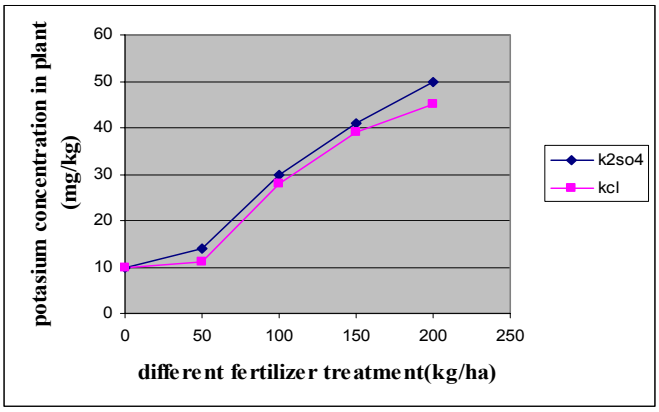

Figure 1. Comparing the concentration of potassium in sunflower after using KCL and K_2SO_4 fertilizers.

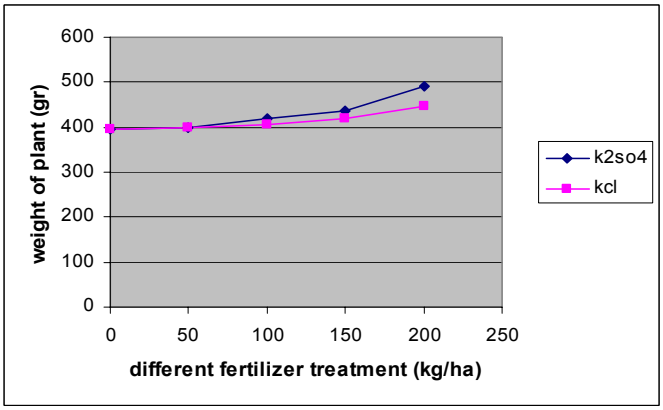

Figure 2. The influence of different KCl and K_2SO_4 fertilizer levels on sunflower weight

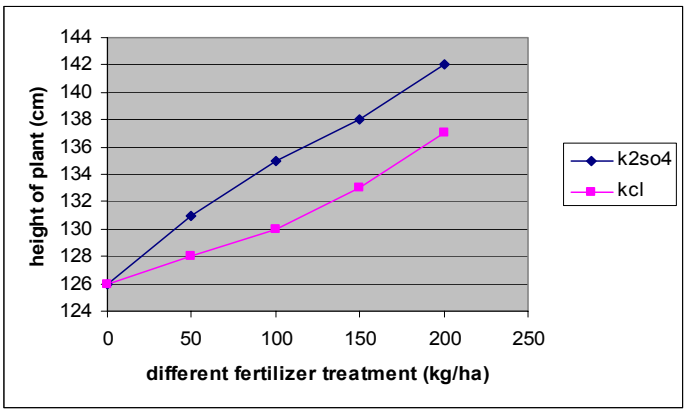

Figure 3. The influence of different KCl and K_2SO_4 fertilizer levels on sunflower height

Conclusion

Since the amount of sulphur is increasing with the K_2SO_4 fertilizer to the soil that has an important role on oil production, the influence of K_2SO_4 is better and more than the KCl fertilizer that have Cl. Thus, when both of them with attention to the yield increasing, we can use K_2SO_4 fertilizer with 200 kg/ha and if it doesn't exist, KCl fertilizer with 200 kg/ha has shown better results compared to the conditions that we don't use any fertilizers.

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