

Abstract

The experiment was applied during the summer season 2021-2022 at College of Agriculture, Wasit University. The aim of study was evaluate the role of adding sulfur at different levels and time of application in the degree of soil interaction and micronutrients (iron, manganese, zinc and copper). As well as, study the impact on the growth of *Zea mays*L. The study included two dates of addition, which were: 30 days before planting, and the second date was 15 days after the first date. Four levels have been used in this study including 500, 1000, 1500, 2000 kg/ha⁻¹. The experiment was applied with a randomized complete block design (R.C.B.D) with three replications for all experimental treatments, which were randomly distributed to the treatments. The number of experimental units was 27 units.

The results showed that the treatment of adding sulfur at the level of 2000 kg/ha⁻¹ for the first date recorded the lowest average of the degree of soil interaction, and the lowest average of the degree of electrical conductivity at the stage of germination, flowering and harvesting, which were 6.43, 6.83 and 6.93 respectively. However, the control treatment gave the highest rate, which were 7.65, 7.68, 7.77, respectively, for the degree of soil interaction. The electrical conductivity has reported 1.97, 1.86, 1.97 dS M⁻¹ compared to the control treatment, which recorded the highest rate 2.57, 2.58, 2.58 dS M⁻¹ respectively. The treatment of adding sulfur at the level of 2000 kg.ha⁻¹ for the first date (30 days before planting) recorded the highest rates of iron, manganese, zinc and copper during the flowering stage. The rate of iron was 56.77 mg/ kg⁻¹ plant, while the control treatment gave the lowest rate as it reached 33.47 mg/ kg plant⁻¹. The manganese rate was 46.8 mg/kg⁻¹ plant, but the control treatment recorded lowest rate 22.33 mg/kg⁻¹ plant. The copper percentage was 6.84 mg/kg⁻¹ plant, compared to the control treatment that gave the lowest rate, which reaching 3.66 mg/kg⁻¹ plant. The rate of zinc was 21.33 mg/kg⁻¹ plant, while the control treatment was 11.77 mg/kg⁻¹ plant. The results showed that there was a significant effect for all levels of sulfur and application times on the sulfur availability of plants at the flowering stage.

The sulfur treatment was significantly superior at the level (2000 kg S.ha⁻¹) for the first date. It has recorded the highest rate of sulfur availability in

the soil at the flowering stage. It has amounted 37.39 mg. S/kg⁻¹ soil while the control treatment was 10.94 mg. S/kg⁻¹ soil. Also, the sulfur addition treatment at the level of 2000 kg S.ha⁻¹ was significantly superior in the harvesting stage. It was the highest rate of sulfur availability of 34.19 mg.S kg⁻¹ soil, compared to the control treatment, which amounted 10.56 mg.S/kg⁻¹ soil. The results of the treatment of adding sulfur at the level of 2000 kg.ha⁻¹ for the first date (30 days before planting) showed the highest percentage of nitrogen, which reached 1.85%, compared to the control treatment, which gave the lowest rate of nitrogen in the plant, which was 0.97%. The phosphorus was 0.29% compared to the control treatment, which has reached 0.06%. Potassium has reached 1.18% while the control treatment gave 0.66% in the plant at the flowering stage. However, the rates of the same treatment were at the harvesting stage, where the nitrogen rate was recorded 1.43%, compared to the control treatment, which gave the lowest rate of nitrogen in the plant, which amounted to 0.94%. The phosphorus has amounted 0.27%, compared to the control treatment, which the percentage of phosphorus reached 0.06%.

The results have showed that increasing the levels of sulfur fertilizer in the soil led to an increase in some growth and yield characteristics. The highest rate of leave area in the plant was achieved in the treatment of adding sulfur at the level of 2000 kg.ha⁻¹. It has reached 6270.48 cm² compared to the treatment without adding 5513.6 cm². The same treatment also achieved the highest rate of dry weight, which reached 293.98 g compared to the control treatment, which amounted to 261.97 g. Also, the treatment achieved the highest average of plant height, which amounted 200.17 cm compared to the control level, which the average height reached 188.27 cm. The sulfur addition plant at the level of 2000 kg/ha⁻¹ achieved the highest average number of grains, which weighed 587.33 grains compared to the control level in which the average was 555.33 grains. The same treatment has achieved the highest average weight of 500 grains, which the weight was 192.35 g, compared to the control level, which the average weight was 164.51 g. The highest rate of chlorophyll content of leaves, which amounted 38.9 SPAD compared to the control treatment, which amounted 28.47 SPAD. The comparison recorded 9.47 tons.ha⁻¹

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**Effect of levels and time application of agriculture sulfer on
some soil chemical characteristic , growth and yield of *Zea
mays* L**

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