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The Effect Of Adding Sulfur And Klipak Bio-Stimulant On Yield Of (Cucurbita Pepo L.)

Zahraa Jassim Al-Budairy[1] , Anwar Hassan Jawad[2] and Qasim Jameel Talib[2]

[1]Department of Soil and Water Resources Sciences, College of Agriculture, University of Al-Qadisiyah, Iraq.
[2]Department of Horticulture and Landscape Engineering, College of Agriculture, University of Al-Qadisiyah, Iraq.

Email: Zzaah94@gmail.comanwerrrtrt@gmail.com , gquickq1px69k1@gmail.com

Abstract

A field experiment was conducted during the spring season of 2021 in Al-Sadeer district - Al-Diwaniyah governorate / Iraq to study the effect the effect of adding sulfur and bio-stimulant on the yield of Cucurbita pepo L. The factorial experiment according to randomized completely blocks design at three replicates was used. The experiment included two factors, the first factor included the adding of sulfur fertilizer at four levels (0, 600, 1200 and 1800 Kg ha^{-1}), while the second factor included adding of Klipak bio-stimulant at four levels (0, 2.5, 5.0 and 7.5 ml L^{-1}). The results showed that the adding of sulfur fertilizer at a 1200 Kg ha^{-1} was significantly superior and achieved a highest mean of number of fruits per plant (14.74 fruit $plant^{-1}$), fruit weight (170.58 g) and plant fruit yield (2.730 Kg ha^{-1}). Also, the adding of bio-stimulant at a 7.5 ml L^{-1} was significantly superior and gave a highest mean of number of fruits per plant(14.07 fruit $plant^{-1}$), fruit weight (169.04 g)and plant fruit yield (2.986 Kg ha^{-1}).The interaction between two factors had a significant effect on the all studied traits.

Keywords: Cucurbita pepo L., sulfur fertilizer, bio-stimulant

Introduction

Cucurbita pepo L. is one of the vegetable crops belonging to the Cucurbitaceae family, which is widely cultivated in Iraq in order to obtain the fruits. The productivity of C. pepo L. is relatively low in Iraq, and the increase of yield can be achieved through the application of some agricultural processes that improve plant growth and development, which will be reflected on the plant yield. The most prominent of these processes is the addition of sulfur, which is one of the soil conditioners and an acidic fertilizer as a result of to oxidize it to sulfuric acid by reviving the microscopic soil, which leads to an increase the availability of nutrients (Rahi, 1995).Also, sulfur is an important element in plant nutrition, as it is associated with nitrogen in the formation of sulfur-containing amino acids such as cysteine and methionine (Havlin et al., 2005). Crop productivity can also be improved by adding bio-stimulants, as bio-stimulants are organic plant extracts that contain a wide range of biologically active compounds such as vitamins, amino acids and growth regulators that are used to improve soil properties, stimulate plant growth and increase its tolerance to various

environmental stresses (Al-Zubaidi, 2010). This study aims to know the effect of adding sulfur and bio-stimulant on the yield of C. pepo L.

Materials and Methods

A field experiment was conducted during the spring season of 2021 in Al-Sadeer district - Al-Diwaniyah governorate / Iraqin soil as shows their physical and chemical properties at table (1)to study the effect the effect of adding sulfur and bio-stimulant on the yield of Cucurbita pepo L.

Table (1) Physical and chemical properties of soil

Trait	Value	Unit
Sand	275.1	g Kg^{-1} soil
Loam	350.6	
Clay	374.3	
pH 1:1	7.68	-----
Ec 1:1	2.94	ds m^{-1}
CEC	22.13	$Cmol_c$ Kg^{-1} soil
Bulk density	1.27	mg m^{-3}
Ca^{+2}	13.24	$Cmol_c$ L^{-1}
Mg^{+2}	11.43	
Na^{+1}	23.20	
K^{+1}	1.52	
Cl^{-1}	27.00	
HCO_3^-	17.00	
SO_4^{-2}	16.10	
CO_3^{-2}	Nill	
$CaCO_3$	248.00	g Kg^{-1} soil
Organic matter	1.63	%
Available N	22.11	mg Kg^{-1} Soil
Available P	12.57	
Available K	128.00	

The factorial experiment according to randomized completely blocks design at three replicates was used. The experiment included two factors, the first factor included the adding of sulfur fertilizer at four levels (0, 600, 1200 and 1800Kg ha^{-1}), while the second factor included adding of Klipakbio-stimulant at four levels (0, 2.5, 5and 7.5ml L^{-1}).Soil management were carried out as required, the plot area was 4 m^2(2 m x2 m)which contained 4 rows, 0.50 m apart and 0.40 m within the plants. Recommended phosphorus fertilizer at a 120 Kg P_2O_5 ha^{-1} as super triphosphate (48% P_2O_5) wasadded at the time of planting, whereas the potash fertilizer at a 100 Kg K_2O ha^{-1} as a potassium sulfate (41.5% K) wasadded at flowering stage, while the nitrogen fertilizers at a 120 Kg N ha^{-1}as a urea (46% N) was applied in two equal doses (1/2 after 21 days of emergence and 1/2 after 30 days of first dose). The seeds of C. pepo L. were sown on 15 March 2021.Crop management was

carried out as needed and the plants were harvested after the appearance of maturity signs.At harvest stage, the following traits were measured:

1. Number of fruits per plant
2. Fruit weight (g)
3. Plant fruit yield (Kg plant^{-1})

The data were statistically analyzed using Gnestat program, and least significant difference (LSD) test at 0.05 probability level was used to compare the treatment means (Steel and Torrie, 1980).

Results and Discussion

Number of fruits per plant

The results in table (2) indicate that the adding of sulfur fertilizer at a 1200 Kg ha^{-1}was significantly superior and achieved a highest mean of number of fruits per plant (14.74 fruit plant^{-1}) compared withhe adding of sulfur fertilizer at a 600 Kg ha^{-}whichrecordeda lowest (11.99fruit plant^{-1}).The reason of increase when adding the sulfur fertilizer at a 1200 Kg ha^{-1} may be due to the role of sulfur in improving the physical and chemical properties of the soil, which will positively reflect on increasing the readiness of many nutrients for the plant as a result improving plant growth, raising the efficiency of the photosynthesis and increasing its metabolic products transferred to the reproductive parts,which lead to an increasing the percentage of fruit set and then their number per plant (Al-Rubaie, 2010).Also, the adding of bio-stimulant at a 7.5 ml L^{-1} was significantly superior and gave a highest mean of this trait(14.07fruit plant^{-1})compared withcontrol treatment which gave a lowest (12.05 fruit plant^{-1}) without significant difference with the adding of bio-stimulant at a 2.5 ml L^{-1} which gave 12.05 fruit plant^{-1} (Table 2).The reason of increase when adding the bio-stimulant at a 7.5 Kg ha^{-1}may be attributed to its role in encouraging the growth of root as a result of its content of biologically active compounds, i.e. amino acids, nutrients and growth regulators that work an integrated way in stimulating the metabolic processes and increasing the photosynthesis, which leads to an increase the vegetative and reproductive growth (Kadhum and Kadhum, 2013).The interaction between two factors had a significant effect on this trait (Table 2), theadding of sulfur fertilizer at a 1200 Kg ha^{-1} with 7.5 mg L^{-1} of bio-stimulant had a highest value (15.87 fruit plant^{-1}), while the control treatment had a lowest (8.79 fruit plant^{-1}).

Table (2) Effect of sulfur and bio-stimulant on number of fruits per plant

bio-stimulant (ml L^{-1})	Sulfur fertilizer (Kg ha^{-1})				Mean
	0	600	1200	1800	
0	8.79	10.60	15.10	13.69	12.05
2.5	11.03	11.75	13.17	12.23	12.05
5.0	13.42	12.42	14.83	14.00	13.67
7.5	14.73	13.02	15.87	12.64	14.07
Lsd .05	**0.72**				**0.36**

Mean	11.99	11.95	14.74	13.14	
Lsd .05	**0.36**				

Fruits weight (g)

The results in table (3)show that the adding of sulfur fertilizer at a 1200 Kg $ha^{-1}$was significantly superior and recordeda highest mean of fruit weight (170.58 g) compared with the adding of sulfur fertilizer at a 600 Kg ha-whichrecordeda lowest (160.12 g).The reason of increase when adding the sulfur fertilizer at a 1200 Kg ha^{-1}may be due to the role of sulfur when added at appropriate amounts in increasing the readiness of many nutrients to the plant, which leads to raising the efficiency of the photosynthesis process and increasing the dry matter transmitted to the reproductive parts and then increasing the weight of the fruits (Farahbakhsh et al., 2006).Also, the adding of bio-stimulant at a 7.5 ml L^{-1} was significantly superior and gave a highest mean of this trait(169.04 g)compared withthe adding of bio-stimulant at a 2.5 ml L^{-1}which gave a lowest (161.68 g) without control treatment which gave 164.68 g (Table 3).The an increasingof the fruit weight when adding the bio-stimulant at a 7.5 ml L^{-1}could be related to an increase the amino acids and activation of the synthesis of proteins in the plant. From other hand, bio-stimulant improves soil composition through their effect on the number and activity of soil microorganisms, which may have a significant impact on plant growth (Kadhum and Hussein, 2015).The interaction between two factors had a significant effect on this trait (Table 3),theadding of sulfur fertilizer at a 1200 Kg $ha^{-1}$with 0 mg L^{-1} ofbio-stimulant had a highest value (186.30g), while the control treatment had a lowest (144.33g).

Table (3) Effect of sulfur and bio-stimulant on fruits weight (g)

bio-stimulant (ml L^{-1})	**Sulfur fertilizer (Kg ha^{-1})**				**Mean**
	0	**600**	**1200**	**1800**	
0	144.33	151.80	186.30	176.27	164.68
2.5	174.62	158.70	156.33	157.07	161.68
5.0	166.14	161.96	163.98	170.27	165.59
7.5	172.43	168.00	175.72	160.00	169.04
Lsd .05	**6.40**				**3.20**
Mean	164.38	160.12	170.58	165.90	
Lsd .05	**3.20**				

Plantfruits yield (Kg $plant^{-1}$)

The results in table (4)reveal that the adding of sulfur fertilizer at a 1200 Kg $ha^{-1}$was significantly superior and achieveda highest mean of plant fruit yield(2.730 Kg ha^{-1}) compared with the adding of sulfur fertilizer at a 600 Kg ha-whichrecordeda lowest (2.178 Kg ha^{-1}).The reason of increase may be attributed to an increase the number of fruits per plant (Table 2) and the weight of the fruit (Table 3) when adding the sulfur fertilizer at a 1200 Kg ha^{-1}.Also, the adding of bio-stimulant at a 7.5 ml L^{-1} was significantly superior and gave a highest mean of this trait(2.986 Kg ha^{-1})compared withthe adding of bio-stimulant at a 2.5 ml L^{-1} which gave a lowest (1.923 Kg ha^{-1}).The reason of the superiority of adding a bio-stimulant at a 7.5 mg L^{-1} may be attributed to the superiority of the same treatment in the

number of fruits per plant and the weight of the fruit (Tables 2 and 3).The interaction between two factors had a significant effect on this trait (Table 4), theadding of sulfur fertilizer at a 1200 Kg ha^{-1} with 7.5 mg L^{-1} of bio-stimulant had a highest value (3.240 Kg ha^{-1}) while the control treatment had a lowest (1.420 Kg ha^{-1}).

Table (4) Effect of sulfur and bio-stimulant on plant fruits yield (Kg $plant^{-1}$)

bio-stimulant (ml L^{-1})	Sulfur fertilizer (Kg ha^{-1})				Mean
	0	600	1200	1800	
0	1.420	1.457	2.977	2.857	2.178
2.5	1.827	1.910	2.000	1.957	1.923
5.0	2.800	2.523	2.703	2.773	2.700
7.5	2.900	2.820	3.240	2.983	2.986
Lsd .05				**0.062**	**0.031**
Mean	2.237	2.178	2.730	2.643	
Lsd .05				**0.031**	

Conclusions

We conclude that the adding of sulfur fertilizer at a 1200 Kg ha^{-1} and/or the Klipakbio-stimulant at a 7.5 mg L^{-1}led to an improvement in the growth of the Cucurbita pepo L. plant, which was positively reflected on the improvement of fruits set and increased their weight, and then increased the yield of the plant's fruits.

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