Response of some Summer Squash cultivars grown in greenhouses to the addition of cobalt and its effect on growth and yield

Jamal Kamel Kassar, Abdullah Abdel Aziz Abdullah, AqilHadi Abdel Wahed

University of Basrah - College of Agriculture - Department of Horticulture and Landscape Engineering

Abstract:

The experiment was conducted during both seasons 2021-2022 and 2022-2023 in one of the greenhouses affiliated with the Agricultural Research Station, College of Agriculture, Basrah University, in Karmat Ali, in order to study the effect of cobalt addition on the growth and yield of some summer cultivars. It included 18 factorial treatments consisting of combinations of six varieties: AL nahrain, Alexandria F1, Seminis, Eskandrany2, Khatoon F1, Mullah Ahmed, and three concentrations of cobalt in the form of cobalt sulfate, CoSo4, which are 0, 0.75, and 1.5 mg. L^{-1}. It was coundected as a one-time split factorial experiment, according to the randomized complete block design and with three replicates. The results showed that the AL nahrain hybrid was significantly superior in increasing plant height, number of leaves and leaf area. The number of female flowers, the sexual ratio, the number of fruits, and the yield of one plant, for both seasons of the experiment, were superior in fruit weight in the first season only, while the cultivar Khatoon F1 was significantly excelled in increasing the number of male flowers for both seasons of the experiment and in fruit weight in the second season.The plants were treated with cobalt at a concentration of 0.75 mg. L^{-1} significantly increased plant height and number of leaves Leaf area, number of female flowers, sexual ratio, weight of one fruit, number of fruits, yield of one plant, and significantly reduced the number of male flowers for both seasons.The interaction between the study factors showed a significant effect on most of the traits under study, as the hybrid plants gave AL nahrain and the cobalt treatment at a concentration of 0.75 mg. L^{-1} had the highest yield per plant for both seasons of the experiment, which was (1.671 and 1.537) kg, respectively.

Keywords: summer squash plant, hybrid, cobalt element, greenhouses, growth, yield.

introduction.

The summer squash plant (Cucurbitapepo L.) is one of the important summer vegetable crops in Iraq. Its juicy fruits are eaten cooked at the stage of horticultural maturity. They are easy to digest and have low thermal energy. The dry matter percentage is 5-8% in the form of sugars with about 3-5 %, proteins 1%, and vitamin C from 20-30 mg. 100 g^{-1} fresh weight and vitamin E from 30-40 mg. 100 g^{-1} (19).It has medical uses in the treatment of the stomach as a laxative. Its seeds are rich in oils 46%, proteins 34%, carbohydrates 15%, and fibers 2.8% (18, 1) It is grown in Iraq in the spring and autumn seasons, exposed, and in the winter season it is protected inside greenhouses (12)The plant is monoecious, dioecious, and the male flowers appear first, and with the continuation of growth, an exchange occurs in the production of male and female flowers, then only female flowers are formed (14). The ratio between the number of female flowers to the number of male flowers is called the sex ratio.(12) The higher this percentage, the more it indicates an increase in the number of female flowers and an increase in the number of sets of flowers, and then an increase in yield, and this percentage is affected by many factors, including genetic, hormonal, environmental and nutritional, and varies from one variety to another due to genetic factors related to the same variety (5)As he noticed (2) the differences between

ISSN 2072-3857

the varieties of summer Mulla Ahmed Al-Mahalli, Al-Moustaqbal Al-Suri, Tala, Eibethor, and Bather genetically in the sexual ratio, and between (3) a significant difference between the two hybrids, Amjad and Jamila, grown in the plastic house, in terms of sexual ratio, with the superiority of the Jamila hybrid compared to the Amjad hybrid.There was (9) a significant difference between the two hybrids of squash Carisma and Alexandria in the ratio of the number of male flowers to the number of female flowers, as it increased in the Alexandria hybrid.Cobalt is an essential element for the synthesis of vitamin B12 required for human and animal nutrition (16 , 20), unlike other heavy metals, cobalt is considered safer for human consumption and up to 8 mg can be consumed on a daily basis without the occurrence of any health risks,The cobalt element is considered essential in the plants of the legume family because of its use by microorganisms in fixing the nitrogen element from the atmosphere (20)It was found that the use of cobalt in low concentrations less than 0.5 mg. L^{-1} significantly increased the production of ethylene, which plays an important role in increasing the sexual ratio of the cucurbit family (20),It was observed (4) when soaking summer squash seeds with three concentrations of cobalt (0.25, 0.50, and 1.00) ppm added to distilled water and AOA solution for 48 hours, the concentration exceeded 1.00 ppm in the percentage of the number of female flowers compared to the number of male flowers, with a significant difference for all concentrations. and parameters used in the experiment

MATERIALS AND METHODS

The experiment was conducted in one of the greenhouses affiliated to the Agricultural Experiment Station at the College of Agriculture - University of Basra for autumn season 2021/2022 and 2022/2023 under the greenhouses. The land was plowed three times perpendicularly, smoothed and flattened Then, random samples were taken from the soil of the field at a depth of 0-30 cm to analyze the physical and chemical traits of the soil and the irrigation water before starting the study (Table 1). Eskandrany2, Khatoon F1, Mullah Ahmed, and three concentrations of cobalt element irragation at the stage of 3-4 true leaves, one time in the form of cobalt sulfate, CoSo4, which is 0, 0.75, and 1.5 mg. L^{-1}

Table (1) Chemical and physical properties of field soil and irrigation water.

units	Traits
7.45	pH
2.75	E.C (DS. m-1)
0.24	Total nitrogen(g. kg-1)
0.022	Ready phosphorus (g. kg-1)
45.6	Ready potassium mg/kg
2.8	The organic matter (g. kg-1)
Soil separate	
112	sand (g. kg-1)
400	silt (g. kg-1)
488	Clay(g. kg-1)
Silty Clay	texture

Then, on 9/25/2021, the beginning of the experiment was divided into six lines with a length of 48 m and an interval of 37 cm between the experimental units and between

each concentration of the cobalt element and the varieties. The distance between the passer is 1.30 m.The lines were opened at a depth of 30 cm in the direction of the winds from north to south to avoid damage caused by the plastic sheeting from the wind. They were fertilized with decomposed animal manure (cow waste) at a rate of 15 tons. ha^{-1} (12).Divide the single line into nine experimental units, the length of each experimental unit is 5 m, leaving a separator between the experimental units to prevent interaction between treatments .All the agricultural service operations used to produce the crop were carried out inside the plastic houses, including hoeing, weeding, irrigation, fertilization, control, and manual pollination in the early morning, and covering the house with transparent polyethylene with a thickness of 150 microns on 12/10/2021.It was carried out as a split plot design for one time, and according to the randomized complete plot design with three replications, camel was counted as a main factor, and cobalt concentrations as a sub plot, where each two adjacent lines were adopted as one sector, and hybrid were randomly distributed, as well as cobalt concentrations within the units.The readings were taken at the end of the season, including measurement of vegetative growth indicators based on a random sample of 5 plants, in which the average plant length (cm), the number of total leaves, and the leaf area (dm^{-2}) were calculated. The leaf area was measured by a device (Leaf Area Meter Portable Laser Cl). - 202)and calculate the average area for it and multiply it by the average number of plant leaves, and it includes the number of male and female flowers and the sexual ratio by dividing the number of female flowers by the number of male flowers, according to what was stated in (12),As for the characteristics of the yield, it includes the number of fruits per plant, the average weight of one fruit, and the yield per plant in kg. $Plant^{-1}$ The results were analyzed statistically using the Gensatat statistical program, and the arithmetic means of the coefficients were compared according to the Least Significant Difference L.S.D test at a probability level of 0.05.

Results and discussion :

It is clear from Table (2) that the study factors had a significant effect on the plant height characteristic, as the AL nahrain hybrid excelled with a significant difference from the rest of the hybrids, with an increase rate of 14.80, 1.58, 1623, and 21.16.While there was no significant difference compared with the hybrid Mullah Ahmed for the first season, the Alexandria F1 hybrid excelled with a significant difference from some hybrids with an increase of 11.64, 7.87 and 13.02, while there was no significant difference compared to the hybrids AL nahrain and Mullah Ahmed.As for the addition of cobalt, the concentration exceeded 0.75 mg. L^{-1}, with a significant difference from both concentrations, with an increase rate of 3.70 and 3.37, respectively, for the first season, and the concentration exceeded 1.5 mg. L^{-1} with a significant difference from the control treatment with an increase rate of 2.75, while there was no significant difference compared to the concentration of 0.75 mg. L^{-1} .As for the interaction between cultivars and cobalt, no significant effect was shown on this trait in the first season, while in the second season it showed a significant effect, as Alexandria F1 hybrid plants were recorded at a concentration of 0.75 mg. L^{-1} had the highest plant height of 72.33, while Seminis hybrid plants recorded the lowest plant height of 62.33 in control treatment.It is clear from the data of Table (2) that the hybrids used in the study also differed significantly in the number of leaves, as the Al-Nahrain hybrid outperformed the two rivers with a significant difference from the rest of the hybrids, with an increase rate of 6.28, 17.27, 7.95, 25.94, 31.64 for the first season, and an increase rate of 17.10, 7.59, and 9.34. And 28.39 and 26.77 for the second consecutive season, As for the addition of cobalt, the concentration exceeded 0.75 mg. L^{-1}, with a significant difference from the control treatment, with an increase rate of

4.98, and it did not differ significantly from the comparison of the concentration of 1.5 mg. L^{-1} for the first season, 5.26 and 4.05, respectively.As for the bi-interaction between the hybrid and the cobalt element, the interaction showed a significant effect, as the AL nahrain hybrid was recorded at a concentration of 0.75 mg. L^{-1} the highest number of leaves reached 23.00, while the cultivar Mullah Ahmed was recorded at a concentration of 1.5 mg. L^{-1} The lowest number of Leaves was 17.00 for the first season In the second season, Al nahrain hybrid plants were recorded at a concentration of 0.75 mg. L^{-1} had the highest number of leaves reaching 22.67, while Khatoon F1 hybrid plants recorded the lowest possible number of leaves when compared to 16.33 plant^{-1}.Through the data of Tabl2 it is clear that the crosses had a significant effect on this trait, as the AL nahrain hybrid excelled on the crosses Eskandrany2, Khatoon F1 and Mullah Ahmed, with a significant difference compared to the crosses Eskandrany2, Khatoon F1 and Mullah Ahmed, with an increase of 46.96, 28.83 and 66.94%.While it did not differ significantly compared to the Seminis and Alexandria F1 hybrids in the first season, and the same hybrid excelled significantly with an increase rate of 16.64 and 13.92% compared to the Khatoon F1 and Mullah Ahmed hybrid, while it did not differ significantly compared to the rest of the hybrid. As for the addition of cobalt, the concentration of 0.75 mg L^{-1} was significantly excelled, with an increase rate of 14.04 and 48.18% for both seasons compared to the control treatment, and it did not differ significantly with the concentration of 1.5 mg L^{-1} for both seasons.As for the bi-interaction between the hybrid and the cobalt element, it had a significant effect for both seasons, as the hybrid AL nahrain with a concentration of 0.75 mg L^{-1} recorded the highest leaf area of 1.961 dm2, while the hybrid Escandrany2 with a concentration of 0 mg L^{-1} recorded the lowest leaf area of 0.906 dm2 for the first season.While the hybrid Alexandria F1 at the same concentration recorded the highest leaf area of 1.351 dm^2 , while the cultivar Mullah Ahmed with a concentration of 0 mg L^{-1} recorded the lowest leaf area of 0.849 dm^2 .

ISSN 2072-3857

Table (2) the effect of cobalt and cultivars and the interaction between them on vegetative growth indicators

Leaf area		number of leaves		plant height		treatments		
second season	first season	second season	first season	second season	first season			
1.121	1.621	22.11	22.67	70.44	71.97	V_1		average effect of cultivar
1.022	1.470	18.88	21.11	63.89	62.69	V_2		
1.113	1.544	20.55	19.33	71.33	70.85	V_3		
1.076	1.103	20.22	21.00	66.12	61.92	V_4		
0.961	1.309	17.22	18.00	63.11	59.40	V_5		
0.984	0.971	17.44	17.22	70.44	71.51	V_6		
0.119	0.208	0.766	0.886	1.448	1.068	L.S.D 0.05		
0.968	1.046	19.00	19.39	66.39	65.51	0		cobalt effect average
1.104	1.550	20.00	20.33	68.06	67.94	1		
1.067	1.413	19.22	20.06	68.22	65.72	2		
0.084	0.147	0.542	0.626	1.024	0.755		L.S.D 0.05	
1.092	1.138	21.67	22.00	66.33	69.96	0	V_1	interaction between hybrid and cobalt
1.147	1.961	22.67	23.00	71.67	73.94	1		
1.124	1.763	22.00	23.00	70.33	72.00	2		
0.974	1.264	18.67	20.67	62.33	62.14	0	V_2	
0.998	1.489	19.67	22.67	65.00	64.47	1		
1.135	1.656	18.33	20.67	64.33	61.46	2		
1.034	1.058	19.67	18.67	70.33	70.65	0	V_3	
1.351	1.835	21.67	19.67	72.33	72.25	1		
0.954	1.739	20.33	19.67	71.33	69.65	2		
0.986	0.906	20.33	19.33	63.33	61.17	0	V_4	
1.119	1.264	21.33	22.00	65.67	62.73	1		
1.123	1.140	19.00	21.67	69.33	61.85	2		
0.914	0.940	16.33	18.33	63.67	58.50	0	V_5	
1.031	1.752	17.33	17.33	63.00	60.87	1		
0.937	1.236	18.00	18.33	62.67	58.85	2		
0.849	0.969	17.33	17.33	69.33	70.67	0	V_6	
0.977	1.001	17.33	17.33	70.67	73.37	1		
1.130	0.943	17.67	17.00	71.33	73.37	2		
0.207	0.631	1.327	1.534	2.508	N.S		L.S.D 0.05	

The results of Table (3) indicate that the hybrids used in the study differed significantly in the number of male flowers, where the Khatoon F1 cultivar was significantly excelled in comparison to all cultivars, with an increase rate of 66.6, 30.83, 50.06, 27.59, and 4.13% for the first season, with an increase rate of 37.74, 19.23, and 47.63. %Compared to all cultivars except cultivar Millat Ahmed, it did not differ significantly in the second season. As for the effect of the cobalt element, the control treatment recorded the highest number of male flowers with a significant difference compared to the concentration of 0.75 mg L^{-1}, with an increase of 8.23% for the first season and 11.94% for the second season in While it did not differ significantly with the concentration of 1.5 mg L^{-1}.As for the

ISSN 2072-3857

interaction between the two factors of the study, it showed a significant effect for the first season only, as the Khatoon F1 and Mullah Ahmed cultivar plants gave at concentration 0. mgL^{-1} the highest number of male flowers was 11.60.While AL nahrain plants recorded at a concentration of 0.75 mg L^{-1} the lowest possible number of male flowers amounted to 5.40. As for the interaction of the second season, there was no significant effect on the number of male flowers.It is clear from Table (3) that all study factors showed a significant effect on the trait of the number of female flowers of the plant, where the AL nahrain hybrid plants were distinguished significantly for both seasons, with an increase of 50.69 and 64.00%.Compared to the Khatoon F1 and Mullah Ahmed hybrids for the first season, it did not differ significantly compared to the rest of the hybrids, with an increase rate of 47.71 compared to the Khatoon F1 hybrid, while it did not differ significantly compared to the rest of the hybrids. As for the effect of cobalt, the concentration of 0.75 mg L^{-1} recorded the highest possible number of female flowers. With a significant difference, with an increase rate of 19.95%.compared with the control treatment, while it did not differ significantly with the concentration of 1.5 mg L^{-1} in the first season, with an increase rate of 21.81 and 13.31%, compared with both concentrations in the second season.As for the interaction between the study factors, it showed a significant effect for both seasons, where the AL nahrain and Alexandria F1 hybrid plants at a concentration of 0.75 mg L^{-1} gave the highest average number of female flowers, which reached 15.33 and 14.00.While the Khatoon F1 hybrid plants and the Mullah Ahmed cultivar at a concentration of 0 mg L^{-1} gave the lowest average number of female flowers, which amounted to 6.33 for both the hybrid and the cultivar in the first season, while for the second season, the Khatoon F1 hybrid plants at a concentration of 1.5 mg L^{-1} recorded less The average number of female flowers was 6.67 $plant^{-1}$.The data of Table (23) indicate that the hybrid differed significantly in the sexual ratio of the summer squash plant, where the AL nahrain hybrid plants recorded the highest sexual ratio and a significant difference from the rest of the hybrid, with an increase rate of 73.33, 30.81, 63.77, 197.14, and 215.15% in the first season.The Alexandria F1 hybrid excelled morally and by a significant difference compared to the hybrid Khatoon F1 and the Mullah Ahmed variety, with an increase rate of 107.31 and 60.37%, and it did not differ significantly compared to the rest of the hybrids.As for the addition of the cobalt element, the concentration of 0.75 mg L^{-1} was significantly excelled, with an increase rate of 42.85% compared to the control treatment, and it did not differ significantly compared to the concentration of 1.5 mg L-1 in the first season, with an increase of 33.00 and 23.38%. Compared with both concentrations in the second season. It appears from the same table that the bi-interaction between the study factors showed a significant effect for both seasons, where the AL nahrain hybrid plants at a concentration of 0.75 mg L^{-1} recorded the highest sexual ratio of 3.30, while the hybrid Khatoon F1 and Mullah Ahmed cultivars recorded the lowest sexual ratio of 0.53 in the season. the first As for the second season, Alexandria F1 hybrid plants at a concentration of 0.75 mg L^{-1} recorded the highest sex ratio of 2.33, while Khatoon F1 hybrid plants at a concentration of 1.5 mg L^{-1} recorded the lowest sex ratio of 0.65.

ISSN 2072-3857

Table (3) the effect of cobalt and cultivars and the interaction between them on flowering growth indicators

Sexual ratio		Number of female flowers		number of male flowers		treatments		
second season	first season	second season	first season	second season	first season			
1.64	2.08	11.33	11.89	7.02	6.80	V_1		average effect of cultivar
1.23	1.20	9.78	10.22	8.11	8.66	V_2		
1.70	1.59	10.67	11.89	6.55	7.55	V_3		
1.38	1.27	9.78	11.11	7.33	8.88	V_4		
0.82	0.70	7.67	7.89	9.67	11.33	V_5		
1.06	0.66	9.67	7.22	9.34	10.88	V_6		
0.47	0.813	1.808	1.930	0.484	0.639	L.S.D 0.05		
1.15	1.05	8.94	9.17	8.34	9.33	0		cobalt effect average
1.53	1.50	10.89	11.00	7.45	8.62	1		
1.24	1.19	9.61	9.94	8.22	9.11	2		
0.19	0.332	1.278	1.365	0349	0.451		L.S.D 0.05	
1.35	1.20	8.67	9.33	6.85	7.66	0	V_1	interaction between hybrid and cobalt
1.93	3.30	13.67	15.33	7.09	5.40	1		
1.63	1.74	8.67	11.00	7.12	7.33	2		
1.07	1.51	8.00	12.67	7.83	8.66	0	V_2	
1.38	1.07	11.00	9.33	8.05	8.66	1		
1.23	1.01	10.33	8.67	8.45	8.66	2		
1.22	1.28	8.67	9.67	7.17	7.66	0	V_3	
2.33	1.89	13.67	14.00	6.07	7.33	1		
1.57	1.59	9.67	12.00	6.43	7.66	2		
1.59	1.25	11.33	10.67	7.49	8.66	0	V_4	
1.20	1.16	8.33	10.67	7.06	9.33	1		
1.34	1.40	9.67	12.00	7.45	8.66	2		
0.80	0.53	8.00	6.33	10.18	11.66	0	V_5	
1.02	0.83	8.33	8.67	8.39	10.66	1		
0.65	0.74	6.67	8.67	10.43	11.66	2		
0.85	0.53	9.00	6.33	10.54	11.66	0	V_6	
1.30	0.76	10.33	8.00	8.04	10.33	1		
1.04	0.68	9.67	7.33	9.45	10.66	2		
0.270	0.469	3.131	3.343	N.S	1.106		L.S.D 0.05	

The data in Table (4) indicate that the hybrids differed significantly in the number of fruits, where the hybrid AL nahrain excelled with a significant difference compared to the hybrids Seminis, Khatoon F1, and the local cultivar Mullah Ahmed, with an increase rate of 52.91, 59.39, and 110%, while it did not differ significantly with the Alexandrian F1 hybrid. and Eskandrany2 in the first season, The Alexandria F1 hybrid was significantly excelled compared to some hybrids with an increase rate of 35.45, 66.74 and 66.74, while it did not differ significantly with the hybrids AL nahrain and Seminis in the second season. As for the addition of the cobalt element, the concentration of 0.75 mg L^{-1} was significantly excelled, with an increase rate of 52.25% compared to the control treatment, and it did

ISSN 2072-3857

not differ significantly from the concentration of 1.5 mg L^{-1} in the first season, with an increased rate of 44.70 and 26.71%.Compared with both concentrations in the second season. As for the interaction between the study factors, the interaction did not show any significant effect in the first season. In the second season, a significant effect was recorded, where AL nahrain plants, at a concentration of 0.75 mg L^{-1}, recorded the highest number of fruits amounting to 9.67, while the plants of the local cultivar Mullah Ahmed, when compared with the treatment, recorded the lowest possible number of fruits, amounting to 4.00 fruits. $Plant^{-1}$.It is clear from the data in Table (4) that the hybrids differed significantly in the weight of the fruit, where the hybrid AL nahrain excelled by a significant difference compared to the rest of the hybrids, with an increased rate of 12.86, 3.83, 12.91, 7.02, and 6.00% in the first season, and the Alexandria F1 hybrid excelled significantly compared to some hybrids. With an increase of 8.66, 9.29, 9.76 and 7.97.While there was no significant difference with AL nahrain camels in the second season. As for the addition of the cobalt element, it had a significant effect on the weight of the fruit, where the concentration was significantly higher than 0.75 mg L^{-1} compared to the control treatment for the two seasons, respectively, with an increased rate of 9.24 and 7.56%, while it did not differ significantly with the concentration of 1.5 mg L^{-1}. As for the interaction between the factors of the study, the interaction in the first season showed a significant effect, as AL nahrain plants recorded at the concentration 0.75 mg L^{-1} the highest fruit weight of 138.01 g. $Plant^{-1}$, while the plants of the local cultivar Mullah Ahmed recorded the lowest weight of the fruit, amounting to 115.23 g. $Plant^{-1}$, and the interaction between the factors in the second season did not record any significant effect on this trait.The data of Table (4) indicate that the hybrids differed significantly in the yield of one plant, as the hybrid AL nahrain excelledWith a significant difference compared to the rest of the crosses, with an increased rate of 77.72, 28.41, 72.94, and 128.10%, except for the Alexandria F1 hybrid, it did not differ significantly within the first season, and with an increased rate of 41.14, 73.24, and 69.55, except for the Alexandria F1 and Seminis hybrids, it did not differ significantly in the second season.As for the addition of the cobalt element, it had a significant effect on the yield of one plant, where the concentration (0.75 mg L^{-1}) was significantly higher compared to the control

ISSN 2072-3857

Table (4) The effect of cobalt and cultivars and the interaction between them on yield indicators and its components

Yield per plant kg. Plant-1		Fruit weight g. Plant-		number of fruits		treatments		
second season	first season	second season	first season	second season	first season			
1.036	1.157	148.0	130.36	6.89	8.67	V_1		average effect of cultivar
0.807	0.651	139.6	115.50	5.78	5.67	V_2		
0.980	0.975	151.7	125.55	7.22	7.67	V_3		
0.734	0.901	138.8	115.91	5.33	7.78	V_4		
0.598	0.669	183.2	121.80	4.33	5.44	V_5		
0.611	0.507	140.5	122.98	4.33	4.11	V_6		
0.287	0.227	8.00	4.620	1.853	1.744	L.S.D 0.05		
0.589	0.591	136.20	115.56	4.72	5.11	0		cobalt effect average
1.008	0.998	146.5	126.24	6.83	7.78	1		
0.786	0.842	145.7	124.24	5.39	6.78	2		
0.203	0.161	5.660	3.267	1.310	1.254		L.S.D 0.05	
0.673	0.679	135.70	117.33	5.00	5.67	0	V_1	interaction between hybrid and cobalt
1.537	1.671	157.1	138.01	9.67	12.11	1		
0.897	1.122	151.20	135.75	6.00	8.33	2		
0.545	0.680	136.0	114.13	4.00	6.00	0	V_2	
0.996	0.702	140.4	117.50	7.33	6.00	1		
0.880	0.573	142.6	114.86	6.00	5.00	2		
0.570	0.580	142.0	116.07	6.33	5.00	0	V_3	
1.410	1.311	158.1	131.11	9.00	10.00	1		
0.960	1.035	154.9	129.48	6.33	8.00	2		
0.677	0.685	138.1	114.61	5.00	6.00	0	V_4	
0.827	0.819	137.9	117.04	6.00	7.00	1		
0.698	1.99	142.2	116.09	5.00	10.33	2		
0.526	0.464	132.6	116.01	4.00	4.00	0	V_5	
0.699	0.801	141.4	125.95	5.00	6.33	1		
0.567	0.741	140.7	123.45	4.00	6.00	2		
0.541	0.459	134.70	115.23	4.00	4.00	0	V_6	
0.579	0.682	144.3	127.85	4.00	5.33	1		
0.713	0.379	142.6	125.85	5.00	3.00	2		
0.298	0.394	N.S	8.003	3.209	N.S		L.S.D 0.05	

treatment in the first season, with an increased rate of 68.86%, and an increased rate of 71.13 and 28.24% compared to both concentrations in the second season.As for the interaction between the study factors, the interaction in the first season showed a significant effect, as AL nahrain plants recorded at a concentration of 0.75 mg L^{-1} the highest early yield of the plant amounted to 1.671 kg. $Plant^{-1}$, while the plants of the local cultivar, Mullah Ahmed, recorded the lowest weight of the fruit, which amounted to 0.459 kg. $Plant^{-1}$, and the interaction between the factors in the second season did not have a significant effect on this trait.

ISSN 2072-3857

Tables (2-3) show that the variation between hybrids in plant height, number of leaves, leaf area, number of male and female flowers, and sex ratio may be attributed to the genetic factors of the cultivar and the extent to which they are affected by the prevailing environmental conditions.Since the environmental conditions of the experiment inside the plastic house may have provided the environmental needs of some varieties while they did not meet the needs of other cultivars, which affected positively and negatively the nature of vegetative and flowering growth (9), and these results are consistent with what was reached (10,13),As for the significant effect of the cobalt element on some indicators of vegetative growth, table (2-3), represented by plant height, number of leaves, and leaf area, since low concentrations of cobalt have important physiological roles in plants, including increasing and stimulating growth in different plant stages through its indirect effect on growth regulators (auxins and cytokinins) and improving the available of the movement of nutrients from the roots to the vegetative parts, which positively affected traits of the vegetative system (8), and these results are consistent with the findings of (7 ,15). As for the effect of the cobalt element on the flowering growth indicators, the number of male and female flowers and the sexual ratio, it appears that the low concentration of the cobalt element is 0.75 mg L^{-1}. It had a significant effect on flowering traits more than the concentration of 1.5 mg L^{-1} Table (3) because the low concentration of cobalt element works to stimulate the activity of the enzyme ACC oxidas (17,) which is the main key to ethylene, and these results are consistent with the findings of (21 and 4).) which plays an important role in determining the sex ratio in cucurbits, which reflects positively on quantitative yield indicators.As for the significant effect of adding the cobalt element in the indicators of yield, quantity, number of fruits, the weight of the fruit, and yield of one plant for the summer squash plant, the reason may be due to the role of cobalt in increasing plant growth by increasing growth indicators, plant height.The number of leaves and the leaf area Table (2-3), where the plants treated with cobalt were characterized by a large vegetative group compared to the plants in the control treatment, which caused an increase in the characteristics of the yield, where the supply of nutrients in sufficient quantities and balanced proportions is very important to obtain the highest yield (11).

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