Effect of two types of foliar fertilizers on the growth and yield of summer squash (Cucurbita pepo L) grown in unheated greenhouses

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Abstract:

The experiment was conducted in the lath house in Babylon province during the 2019 agricultural season to know the effect of two types of foliar fertilizers (Biomin 221 and Fulcist) on the growth and yield of summer squash cultivar Ardendo 174. The experiment included seven treatments, spraying with Biomin 221 foliar fertilizer at a concentration of (1, 1.25, 1.5) ml.L⁻¹ and foliacet at a concentration of (1, 1.5, 2) ml.L⁻¹, in addition to the control treatment. The plants were sprayed three times, the first when flowering, the second after two weeks of the first, and the third after two weeks of the second. The experiment was conducted according to the of randomized complete blocks design (RCBD) and with three replications. The results showed the treatment of foliar fertilizer Fulcist 1.5 ml. L⁻¹ in growth and yield traits(plant length, stem diameter, dry weight of vegetative groweth, fruit length, fruit diameter, fruit weight and number of fruits. Plant⁻¹ and yield per plant) reached (93.67 cm, 23.25 mm, 201.00 g, 7.92 cm, 49.42 mm, 215.2 g, 11,603 fruits, plant⁻¹, 2.493 kg.plant⁻¹) respectively compared to the control treatment that recorded the lowest average for the mentioned traits.

Key words: summer squash, foliar spray, Biomin 221, phulcet.

تأثير نوعين من الاسمدة الورقية في نمو وحاصل قرع الكوسة . <i>Cucurbita pepo</i> L المزروع في البيوت البلاستيكية غير المدفأة					
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الخلاصة :

نفذت التجربة بالبيت البلاستيكي في محافظة بابل خلال الموسم الزراعي 2019 لمعرفة تأثير نوعين من الاسمدة الورقية (البيومين 221 والفولسيست) في نمو وحاصل قرع الكوسة صنف Ardendo174 . وتضمنت التجربة سبع معاملات ، الرش بالسماد الورقي البيومين 221 بتركيز (1، 5، 1، 2) مل . لتر⁻¹ والفولسيست بتركيز (1، 1.5، 2) مل . لتر⁻¹ بالإضافة الى معاملة المقارنة. وتم رش النبيومين 221 بتركيز (1، 5، 1، 2) مل . لتر⁻¹ والفولسيست بتركيز (1، 1.5، 2) مل . لتر⁻¹ والفولسيست بتركيز (1، 1.5، 2) مل . لتر⁻¹ بالإضافة الى معاملة المقارنة. وتم رش النبيومين 211 بتركيز (1، 5، 1، 2) مل . لتر⁻¹ بالإضافة الى معاملة المقارنة. وقل رش النبيومين 121 بتركيز (1، 5، 2) مل . لتر⁻¹ بالإضافة الى معاملة المقارنة. وقل رش النبيومين النباث مرات ،الاولى عند الاز هار ، الثانية بعد اسبوعين من الاولى ، الثالثة بعد اسبوعين من الثانية ، نفذت التجربة وفق تصميم القطاعات العشوائية الكاملة (RCBD) وبثلاث مكررات . أظهرت النتائج تفوق معاملة السماد الورقي الفولسيست 5.1 مل لتر⁻¹ في صفات النمو والحاصل (طول النبات وقطر الساق والوزن الجاف للمجموع الخضري وطول الثمرة وقطر الثمرة ووزن الثمرة وعن من الاولى . التمانة بعد الماد الورقي الغولسيست 5.1 مل لتر⁻¹ في صفات النمو والحاصل (طول النبات وقطر الساق والوزن الجاف للمجموع الخضري وطول الثمرة وقطر الثمرة وعدد الثمرة وعدد الثمار . نبات⁻¹ وحاصل النبات الواحد) بلغ (3.6% سم 32.2% مام ، 2010هم معاملة المقارنة التي سجات ادنى معدل للصفات المذكورة. ، 1.6% معاملة المقارنة التي سجات ادنى معدل للصفات المذكورة.

الكلمات المفتاحية : (قرع الكوسة ، الرش الورقي ، البيومين 221 ، الفولسيست) .

Introduction

summer squash(Cucurbita pepo L). It belongs to the Cucurbitaceae family, and it is one of the important vegetable crops, and this importance comes from its use as food for humans, in addition to its multiple medicinal purposes (21). It is considered a summer vegetable and is grown in all regions of Iraq in the spring and autumn seasons, in addition to its cultivation in winter greenhouses (17). The fresh fruits are eaten cooked at the stage of maturity and before the seeds are formed inside them. They are easy to digest and have low thermal energy. They contain a percentage of dry matter ranging between 5-8%, and the percentage of sugars in it is about 3-5%, and proteins are 1% (6). Among its medicinal uses is the treatment of dermatitis and wounds and as a diuretic treatment (5). The statistics of the Central Statistics Organization (2020) indicate a low production of summer squash crop in Iraq for the year 2018, reaching $(10,028 \text{ tons. ha}^{-1})$ when compared to the production rate of some countries of the world producing this crop in the same year (19).In order to advance the reality of squash cultivation in Iraq, it is necessary to pay attention to the various agricultural service operations, including providing the plants with the necessary nutrients. Therefore, the importance of foliar feeding emerged, because it provides the plant's needs of nutrients during critical growth stages, in addition to being easy, economical and fast, and there are no soil problems with it, as well as being positive with micro and macronutrients due to the many problems of some of these elements when added to the soil, which causes a reduction availability for vegetation (16). It is one of the successful methods to treat the deficiency of elements, especially the small ones because many of the nutrients that are added to the soil are not used by the plant except in small quantities as a result of their sedimentation, stabilization, or washing, and then reducing their readiness, which negatively affects the growth of the plant (18, (20). Adding fertilizers by spraying on the vegetative total of plants is one of the

modern methods, using diluted solutions several times, and it is one of the important and successful methods to treat nutrient deficiencies, especially the small ones (14). It was reported (2) that spraying the organic nutrient Terrasub on summer squash plants led to a significant increase in the number of leaves and the dry weight of the plant compared to the control treatment. and (10) that the spraving of organic fertilizer vit-org on summer squash plant led to a significant increase in the number of leaves, the concentration of chlorophyll, the leaf area and the yield of one plant. It was found (1) that Algaton organic fertilizer was sprayed with three concentrations of $0.1,2 \text{ ml.L}^{-1}$ on summer squash plant Ardendo cultivar, it gave the concentration 2 ml.L^{-1} had the highest average in plant height, N,P,K ratio in leaves, number of fruits and yield of one plant compared to the control treatment.(12) stated that spraying the nutrient solution Fetrilon combi 2 in three concentrations was 0.0.25 and 0.5 g. L^{-1} on two cultivars of summer squash (the foreign Tokay and the local Mulla Ahmed), the foreign cultivar Tokay was superior at the concentration of 0.5 g. L^{-1} significantly in the number of fruits and the yield of one plant compared to the control treatment and it was studied (15) that the cucumber plant Omega cultivar was sprayed with foliar nutrient for two days 221 at a concentration of 1, 1.25, 1.5 ml.L⁻¹ of water, and with a foliar nutrient at a concentration of 1, 1.5, 2 ml.L^{-1} water in addition to the control treatment (without spraving) for three sprays at the flowers and over a period of two weeks between one spray and another grown in the greenhouse, where the nutrient Fulcist at a concentration of 1.5 ml. L^{-1} gave a significant increase in plant height, number of leaves, dry weight of the vegetative group and fruit length, its weight, the number of fruits and the yield of one plant. It was found (8) that spraying the foliar feeding PIO20 at a concentration of 0, 1.5, 2, 2.5 $ml.L^{-1}$ of water for two and three sprays on cucumber plants, a beautiful variety when flowers, and over a period of two weeks between one spray and another planted in the plastic

house, where the treatment of spraying for three times was superior at the concentration of 2 ml.L⁻¹significantly in the average plant height, number of leaves, dry weight of the vegetative, fruit length and weight, number of fruits, and yield per plant compared to the control treatment(9) indicated that spraying bean spray fertilizer at a concentration of 2,2.5,3 g.L⁻¹water for three sprays on two varieties of cucumber, Karima and Grass when flowering and at intervals of 10 days between one spray and another planted in the greenhouse, where the concentration gave 2.5 g. L⁻¹Significant increase in mean plant height, number of leaves, stem thickness, fruit length and weight, number of fruits and yield per plant compared to the control treatment and studied (13) that spraying the nutrient solution Janet at a concentration of 2 ml.L⁻¹ for four sprays on three crosses of Watermelon has led to a significant increase in the weight, diameter, length and thickness of the fruit and the total yield. The aim of the research was to know the effect of foliar spraying with the

nutrients Biomin 221 and Fulcist on the growth and yield of Ardendo 174 summer squash grown in unheated greenhouses.

Materials and methods:

The field experiment was conducted in the 2019 agricultural season in one of the greenhouses in the Al-Azawiya region, north of the center of Babylon province. The experiment included seven treatments: spraying the foliar nutrition with Biomin 221 at a concentration of 1, 1.25, 1.5 ml. L^{-1} , produced by the American company JIBiotech.lnc and Fullist at a concentration of 1, 1.5, 2 ml.L^{-1} produced by the Italian company Biolchim, in addition to the control treatment (spraying with water only) on the summer squash plant Ardendo 174, produced by the Dutch company Enzazaden. The first and second sprays were sprayed on flowers two weeks after the first and the third two weeks after the second, and the experiment was applied according to the Randomized complete block design (RCBD) and three replicates.

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Table (1)	Components	of the	foliar	nutrient	Biomin e 2	21

Bio stimulants%	Co%	Mo%	B%	Cu%	Mg%	Zn%	Mn%	Fe%	S%	N%
0.005	0.0002	0.025	0.25	0.5	0.5	1.2	2.4	2.4	3.6	2.4

 Table (2) Components of Fulcist foliar nutrient

Peptine%	K ₂ O%	C%	N%
10	6.1	11	1.5

Table (3) Physical and chemical traits of the greenhouse soil.

	Traits								
soil	Silt	sand	Clay	V		mana N	Organic	/ Ece	pН
texture	%	%	%	ppm K	ppm P	om P ppm N	matter %	ds.m ⁻¹	
Sandy loam	15.80	80.20	4	360	8.7	52.5	1.13	3.7	7.4

Random samples were taken from the soil of the greenhouse at a depth of (0-30 cm) from several locations, and the soil was analyzed in the Agricultural Research Laboratory - affiliated to the Directorate of Agriculture in Babylon (Table 3). The soil of the plastic house was tillage twice perpendicular, smoothed and leveled, then divided into three lines, the distance between one line and another is 1.25 cm and a width of 50 cm. Then it was divided into experimental units amounting to 21) experimental units, as the seeds were planted in the nursery on 2/1/2019 and then transferred to the greenhouse on 1/15/ Where they were planted on both sides of the line and alternately, and the distance between one plant and another was 40 cm, and the number of plants in each experimental unit was 10 plants. The distance between the experimental units is 40 cm. The plants were sprayed when flowering on February 28.All the recommended agricultural operations were conducted during the growth period in the field, such as irrigation, hoeing, weeding, and controlling diseases and insects in the same methods for all experimental units. Reaping the fruits began on 3/6 and continued until 28/5/2019. The process of pollination of plants was conducted manually.

Studied traits:

A- Traits of vegetative growth:

1. Plant height (cm): It was measured using a tape measure and an average length of five plants was taken from each experimental unit and for each replicate.

2. The diameter of the stem (mm): It was measured using the micro vernia about 5 cm from the soil surface and the average diameter of five plants was taken from each experimental unit and for each replicate.

3. The dry weight of the vegetative (g): This trait was calculated after five plants were uprooted, washed and dried in an electric oven

at 70 $^{\circ}$ C for 72 hours until the weight was stable.

b- fruit growth traits:

1. Average fruit length (cm): The average fruit length was calculated using the standard ruler for three fruits from each experimental unit and for each replicate.

2. Average fruit diameter (mm): The average fruit diameter was measured using the micro vernia for three fruits from each experimental unit and for each replicate.

3. Average weight of the fruit (gm): It was estimated on the basis of the total yield of each experimental unit divided by the total number of fruits of that experimental unit throughout the season.

4. Average number of fruits. Plant 1-: This trait was calculated from all the harvest throughout the harvest period for each experimental unit and for all replicates, then the total number of fruits in each experimental unit was divided by the number of plants in that unit.

5. Yield per plant (kg): It was estimated on the basis of the yield of each experimental unit throughout the growing season divided by the number of plants in the experimental unit.

The results were analyzed according to the adopted design, and L.S.D was used to compare the means at the probability level of 0.05 (3). GenStat (22) was used.

Results and discussion:

1. Vegetative Growth traits:

The results in Table (4) indicate the spraying with Fulcist 1.5 ml. L-1 excelled giving it the highest rate in plant height, stem diameter, and dry weight of the vegetative group amounted to (93.67 cm, 23.25 mm, 201.00 g) followed by spraying with Biomin 221 at a concentration of 1.5 ml.L^{-1} It is (88.00 cm, 21.17 mm, 198.00 g)

compared to the control treatment. The reason for this is that the availability of nutrients and what the plant needs during the process of cell division and elongation, especially N, which enters the construction of chlorophyll, protein and nucleic acids, and then increases the ability of the plant to carry out the process of photosynthesis and also contributes to the manufacture and accumulation of nutrients, which leads to an increase in dry weight plant and contribute to increasing the speed and efficiency of absorption and transmission of the remaining elements (11). This increase may also be due to the fact that the foliar nutrient contains micronutrients such as copper, manganese, and zinc. Copper activates the enzymes necessary for the plant, such as Oxidase, Cytochrom Phenolase and Ascorbic Acid Oxidase in the plant. Zinc is necessary for the manufacture of the amino acid tryptophan, which is the main material for the manufacture of IAA, a hormone. Important for plant growth, while manganese is an essential element in the reactions of respiration and nitrogen assimilation (4), and these results agree with what was found ((2, (10), (1), (15), (8), (9).

Table (4) Effect of spraying with Biomin 221 and Fulcist on the vegetative growth traits of. summer squash cultivar Ardendo 174

Treatments	Vegetative dry weight (g)	Stem diameter(mm)	plant length (cm)
control treatments(without spraying)	149.00	17.20	66.67
Biomin 1 ml. L ⁻¹	158.33	18.32	71.00
Biomin 1.25 ml.L ⁻¹	183.33	19.45	76.00
Biomin 1.5 ml.L ⁻¹	189.00	21.17	88.00
Fulcist 1 ml.L ⁻¹	179.33	19.49	78.00
Fulcist 1.5 ml.L ⁻¹	201.00	23.25	93.67
Fulcist 2 ml.L ⁻¹	191.67	20.90	81.00
L.S.D 0.05	6.17	1.20	4.02

2. fruit growth traits:

The results in Table (5) indicate that the treatment of spraying with Fulcist 1.5 ml.L^{-1} significantly excelled in the average length of the fruit, the number of fruits, the diameter of the fruit, the weight of the fruit, and the yield of one plant, where it gave the highest average of (17.92 cm, 49.42 mm, 215.2 g, 11,603 fruits.plant⁻¹, 2.493 kg. plant⁻¹) respectively, followed by Biomin spraying treatment at a concentration of 1.5 ml.L⁻¹ , which is (16.70

cm, 47.06 mm, 212.1 g, 11.217 fruits. plant ⁻¹, 2.380 kg, plant 1-) compared to the control treatment. The increase in the traits of fruit growth may be due to the abundance of macroand micro-nutrients in the foliar spray solutions, whose effect is positively reflected on the number of fruits, their average weight, and the yield of one plant (7). Also, the increase in the total yield is due to the fact that the sprayed elements gave abundant vegetative growth and a strong root system to control the absorption of elements, as well as the role of the elements in the activity of enzymes and the regulation of vital activities, and this is reflected in the development of the growth of the fruit and its increase in weight, thus increasing the yield. These results agree with (10), (1), (12), (15), (8), (9).

Table (5) Effect of spraying with Biomin 221 and Fulcist on the fruiting growth traits of summer. squash cultivar Ardendo 174

Treatments	plant yield (kg)	Number of fruits. plant ⁻¹	Fruit Weight (g)	Fruit diameter (mm)	Fruit length (cm)
control treatments(without spraying)	1.402	7.937	177.1	40.71	14.79
Biomin 1 ml. L ⁻¹	1.447	8.353	190.5	42.71	15.99
Biomin 1.25 ml.L ⁻¹	1.570	8.943	176.0	46.99	15.37
Biomin 1.5 ml.L ⁻¹	2.380	11.217	212.1	47.06	16.70
Fulcist 1 ml.L ⁻¹	1.967	9.667	203.5	46.53	15.41
Fulcist 1.5 ml.L ⁻¹	2.493	11.603	215.2	49.42	17.92
Fulcist 2 ml.L ⁻¹	1.782	10.197	208.1	45.24	16.31
L.S.D 0.05	0.393	0.738	8.66	0.91	0.89

Conclusions:

We conclude from this study that the best treatments were the Fulcist treatment at a concentration of 1.5 ml.L^{-1} in the vegetative and fruitful growth characteristics, followed by the Biomin spray treatment at a concentration of 1.5 ml.L^{-1} during the growing season.

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