Effect of spraying with Biozym* TF growth regulator on the growth and yield of three Cucurbita moschata genotypes

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Abstract

The experiment was carried out in the scientific fields of the Department of Horticulture and Landscaping - College of Agriculture - University of Diyala. The study included two factors, the first factor three concentrations of the growth regulator Biozyme * TF 1,0.5,0 mg.l $^{-1}$ the second factor three genotypes of pumpkin, the local cultivar and hybrid Pumpa 'Charmant' F1 and the hybrid Myskpumpa (butternut) 'Herculs' F1,. The experiment was applied according to Randomized Complete Block Design (R.C.B.D) with Split Plot

The results were as follows:-

The process of spraying with Biozyme * TF growth regulator at a concentration of 1 mg.L^{-1} led to a significant effect on the number of leaves, the number of branches, the length of the plant, the leaves content of chlorophyll, the number of fruits and the total yield, and it gave 57.97 leaf.plant^{-1}, 6.37 branch.plant $^{-1}$, 109.44 cm, 54.80 Spad, 2.13 fruit.plant $^{-1}$, 43.31 tons. ha-1, respectively compared with the Comparison treatment (spraying with water only) which gave the lowest rate in number of leaves, number of branches, plant length, leaf content of chlorophyll, number of fruits and total yield, which gave 47.31 leaf.plant^{-1}, 4.35 branch.plant^{-1} , 94.15 cm, ,49.72 Spad, 1.02 fruit. Plant^{-1}, 14.72 ton. ha^{-1}, respectively.

Cultivars varied in most of the characteristics of vegetative and flowering growth, as well as qualitative and quantitative yield, where the local Cultivar outperformed by giving the highest rate in number of leaves, number of branches, plant length, leaf content of chlorophyll and total yield, which gave 63.55 leaf plant^{-1}, 6.97 branch plant $^{-1}$, 131.41 cm, 56.40 Spad, 34.47 ton. ha^{-1}, respectively, compared with the cultivar Myskpumpa, which gave the lowest average in number of leaves, number of branches, leaf content of chlorophyll and total yield, which gave 45.66 leaf.plant^{-1},3.42 branch.plant^{-1}, ,48.48 Spad, 12.74 ton.ha^{-1}, respectively.

The interaction treatment between the local Cultivar and spraying at a concentration of 1 mg.L^{-1} gave a significant superiority in the number of leaves, number of branches, plant height, leaves content of chlorophyll and total yield.

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Introduction

Cucurbita moschata is an important crop of the Cucurbitaceae family. Cucurbita is widely cultivated and consumed in many countries around the world. (11) There are some cultivars such as C. moschata, C. maxima and C. pepo ranging in color from intense yellow to orange and contains high levels of carotenoids, mainly types of alpha, beta-carotene, beta-cryptoxanthin, lutein and zeaxanthin; (17) (7)The nutritional and medicinal value of pumpkin fruit is the high total content of carotenoids with more than 80% of beta-carotene (6),(12), as well as pectin, sugars, minerals (potassium, phosphorous, magnesium, iron, and selenium), vitamins (C, E, K, thiamine (B1) and riboflavin (B2), pyridoxine (B6), dietary fiber, phenolic compounds (flavonoids, phenolic acids) and other substances beneficial to human health (18),(15),(19) Plant growth stimulants have an effective role in stimulating the physiological processes necessary for plant growth and development in very low concentrations, as the auxins affect and contribute with other hormones to the division, elongation and expansion of cells, and this works to stimulate the decomposing enzymes that are included in some components of the cell wall (5).The gibberellins also work to elongate cells and stimulate division, as well as the production of binary phenols that act as enzymes that oxidize auxin, or as for cytokinins, they work to delay aging and also have a role in stimulating cell division as well as stimulating the growth of lateral buds and inhibiting apical dominance (3). Growth regulators play an important role by controlling some physiological processes related to plant growth. Growth regulators also help in the optimal use of carbohydrates, nitrogen and other nutrients (8). The importance of the pumpkin crop and the expansion of its agricultural area has prompted researchers and specialists in the field of vegetable breeding to devise new hybrids that have high productivity as well as vegetative and fruit specifications that suit a wide range of environmental conditions, as there are wide genetic differences within these hybrids and varieties in terms of the nature of growth and production The introduction or import of hybrids and new varieties is one of the cheapest methods of breeding and genetic improvement, especially in developing countries (10) in the research conducted by(16) on pumpkin when sprayed with IAA at concentrations (50,100,150) mg.l $^{-1}$ They found that there is a significant increase in the number of leaves compared to the comparison treatment. (1) noted that there was a significant increase in the number of branches and plant height when spraying with IAA auxin at a concentration of 200 mg. L^{-1} on zucchini squash. (9) also found in an experiment conducted to study the effect of using aqueous extracts of some medicinal plant seeds and the growth regulator NAA on the germination and growth of eggplant seedlings, where the treatment of soaking seeds with NAA solution excelled compared to soaking with fenugreek extract and sweet bean extract, while they converged with the results Black seed extract in terms of germination time, germination speed, percentage of germination and germination ability, in addition to that the NAA treatment gave significant differences in most of the studied characteristics, (13) explained the effect of mycorrhizal inoculation and

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spraying with biozyme on the nutrients content of leaves and fruits of zucchini squash plant, where spraying with biozyme when treated (spraying for three times) gave a significant superiority in the fruits content of nitrogen 1.32%, phosphorous 0.67% and potassium 0.66% compared to the comparison.

Materials and working methods

A field experiment was carried out for the spring growing season (3-3-2021) in one of the experimental fields of the Department of Horticulture and Landscaping, College of Agriculture - University of Diyala - to study the effect of spraying with the Biozyme* TF growth regulator on the growth, flowering, and yield of three Cucurbita moschata genotypes.
The field land was prepared by plowing orthogonally to a depth of 40 cm and then smoothing and leveling it, and then the process of dividing the land of the open house into three terraces with a length of 25 m for one terrace and the distance between one terrace and another was 2.5 m and the width of one terrace was 1 m. The drip irrigation system was installed and the distance between the dotted And another 40 cm, which is the same distance between one plant and another. Then, different samples were taken from the soil before planting and the necessary analysis were conducted for them. The samples were from different regions and at a depth of (0-30) cm. The analysis was conducted in the laboratory of the Department of Soil Sciences and Water Resources in the College of Agriculture - Diyala University and the following table shows some of its physical and chemical characteristics before planting.

Table 1 Physical and chemical properties of field soil:

Measurements	Value	Unit of measurement
Clay	122.2	g. kg^{-1}
Silt	591.2	g. kg^{-1}
Sand	286.6	g. kg-1
PH 1:1	7.08	-
Ec 1:1	7.45	ds Siemens \ m^{-1}
N	25.08	mg. kg^{-1}
P	15.033	mg. kg^{-1}
K	201.68	mg. kg^{-1}
$CaCO_3$	201.1	g. kg^{-1}
OM	10.7	g. kg^{-1}
Texture of soil	Salty loam	-
field capacity	24 %	-

Studied characteristics:
Number of leaves (leaf.plant^{-1}): The number of leaves was calculated for five plants from the experimental unit at the end of the season and the average was taken for it.

Number of branches (branch. Plant^{-1}): The number of branches of five

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plants from the experimental unit was calculated at the end of the season and the average was taken for them.

Plant length (cm.plant^{-1}): The measurement process was carried out at the end of the growing season by measuring the length of the main stem from the area of contact with the soil to the top of the growing top and taking the average for it using the metric tape measure.

leaves content of Chlorophyll (SPAD): The amount of chlorophyll was measured by a chlorophyll meter of the type (SPAD-504) The measurement was carried out in the field before the end of the season and before the harvesting process.

Number of fruits (fruit. plant^{-1}): This trait was calculated by calculating the total number of fruits in the experimental unit to the number of total plants in it, according to the following equation:
The number of fruits (fruit.plant^{-1}) = the total number of fruits in the experimental unit / the number of plants in the experimental unit.

The total yield: - (ton. ha^{-1}) according to the following equation:

Experimental unit yield ton * hectare area/area of experimental unit

Statistical analysis: The experiment was applied according to Randomized Complete Block Design (R.C.B.D) The results were analyzed using the SAS program and the averages were compared according to Duncan's polynomial test at a probability level of 0.05(4)

Results and discussion

Number of leaves (leaf.plant-1)

The results in Table 1 show that there is a significant effect of the cultivars on the number of leaves, as the local cultivar was distinguished by the highest number of leaves 63.55 leaf.plant^{-1} compared to the Myskpumpa cultivar, which gave the lowest number of leaves 45.66 leaf.plant^{-1} and the pumpa cultivar, which gave 46.71 leaf.plant^{-1} The two of them did not differ significantly between them. As for the effect of spraying, the biozyme * TF had a significant effect on the number of leaves, as the treatment was distinguished with a concentration of 1 ml. L^{-1} with the highest number of leaves 57.97 leaf.plant^{-1} compared with the comparison treatment, which gave the least number of leaves 47.31 leaf.plant^{-1}, which did not differ significantly from the spray treatment with a concentration of 0.5 ml.l^{-1}. The interaction between cultivars and spraying treatments with Biozyme* TF had a significant effect on the number of leaves. If the local cultivar sprayed with a concentration of 1 ml. L^{-1} outperformed in the number of leaves, it gave 67.80 leaf.plant^{-1} compared with pumpa cultivar with concentration of comparison treatment in number of leaves 38.53 leaf. plant^{-1}.

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Table 1: Effect of cultivar and spraying with Biozyme* TF growth regulator and the interaction between them on the number of leaves of pumpkin plant:

treatment	Biozyme* TF Growth Regulator Concentration ($Ml.L^{-1}$)			Mean
	0	**0.5**	**1**	
Local	61.13 ab	61.73 a	67.80 a	63.55 A
Pumpa	38.53 d	44.93 cd	56.66 abc	46.71 B
Myskpumpa	42.26 d	45.26 cd	49.64 cd	45.66 B
Mean	47.31 B	50.64 B	57.97 A	

Averages that take the same letter for each factor or overlap between them do not differ significantly (P≤ 0.05) according to Duncan's polynomial test

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Number of Branches (branch plant $^{-1}$)

It is clear from the results of Table 2 that there are significant differences in the number of plant branches between the cultivars, if the local variety gave the highest number of branches reached 6.97 branch. plant $^{-1}$ compared to the variety Myskpumpa, which gave the lowest number of branches 3.42 plant.branch^{-1}.

The results also showed significant differences in the Biozyme* TF spraying treatments, where the treatment at a concentration of 1 $ml.l^{-1}$ recorded the highest number of branches that reached 6.37 branch.plant $^{-1}$ compared to the comparison treatment where it gave 4.35 branch.plant $^{-1}$. There are also no differences Significant between the treatments of spraying at a concentration of 1 $ml.L^{-1}$ and spraying at a concentration of 0.5 $ml.L^{-1}$.

The interaction between cultivars and spraying treatments with the Biozyme* TF growth regulator had a significant effect on the number of branches, as the local cultivar sprayed with a concentration of 1 $ml.l^{-1}$ was distinguished by the highest number of branches reached 8.33 branch.plant $^{-1}$ compared to the cultivar Myskpumpa sprayed with water only, which gave the lowest number of branches amounted to 3.00 branch.Plant $^{-1}$.

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Table 2: Effect of cultivar and spraying with the Biozyme* TF growth regulator and the interaction between them on the number of branches of the pumpkin plants:

treatment	Biozyme* TF Growth Regulator Concentration ($Ml.L^{-1}$)			Mean
	0	**0.5**	**1**	
Local	5.13 cd	7.46 ab	8.33 a	6.97 A
Pumpa	4.93 de	6.26 cd	7.00 b	6.06 B
Myskpumpa	3.93 f	3.46 f	3.80 ef	3.42 C
Mean	4.35 B	5.73 A	6.37 A	

Averages that take the same letter for each factor or overlap between them do not differ significantly ($P \leq 0.05$) according to Duncan's polynomial test .

plant length (cm)

The results of Table 3 show that there are significant differences between the cultivars in plant height, where the local cultivar had the highest plant height of 131.41 cm compared with pumpa cultivar which gave the lowest plant height of 75.95 cm. The results indicated that spraying the growth regulator Biozyme* TF showed a significant increase in plant height, as the treatment of spraying with concentration 1 ml. L^{-1} was superior in giving it the highest plant height of 109.44 cm compared to the non-spray treatment (the comparison) which gave the lowest plant height of 109.44 cm. 94.15 cm.
The interaction between the cultivars and the Biozyme* TF spraying treatments had a significant effect on plant height, and the local cultivar sprayed with a concentration of 1 $ml.l^{-1}$ in plant height was 138.73 cm compared to pumpa cultivar with the control treatment, the lowest plant height was 67.13 cm.

Table 3: Effect of cultivar and spraying with Biozyme* TF growth regulator and the interaction between them on plant height of pumpkin plants:

treatment	Biozyme* TF Growth Regulator Concentration ($Ml.L^{-1}$)			Mean
	0	**0.5**	**1**	
Local	122.60 ab	132.90 a	138.73 a	131.41 A
Pumpa	67.13 e	75.86 de	84.86 cde	75.95 C
Myskpumpa	92.73 cd	101.20 c	104.73 bc	99.55 B
Mean	94.15 B	103.32 AB	109.44 A	

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The leaves content of chlorophyll (SPAD)

The results in Table 5 indicated that there was a significant effect of the cultivars on the chlorophyll content of leaves, as the local cultivar was distinguished by the highest chlorophyll content of 56.40 Spad compared to the Myskpumpa cultivar which gave the lowest chlorophyll content of 48.48 Spad, while the local cultivar did not differ significantly from the Pumpa cultivar which gave 52.68 SPAD . As for the effect of spraying treatments with Biozyme* TF, it had a significant effect on the chlorophyll content, as it gave the spraying treatment with a concentration of 1 ml. L^{-1} with the highest chlorophyll content reached 58.80 SPAD compared with the comparison treatment which gave the lowest chlorophyll content reached 49.72. SPAD

The interaction between cultivars and Biozyme* TF growth regulator treatments had a significant effect on chlorophyll content. The local cultivar sprayed with Biozyme* TF growth regulator at a concentration of 1 $ml.l^{-1}$ gave the highest chlorophyll content of 58.32 SPAD compared to the Myskpumpa cultivar sprayed with water only, which amounted to 47.16 SPAD

Table 4: Effect of cultivar and spraying with Biozyme* TF growth regulator and the interaction between them on the leaves content of chlorophyll of pumpkin plants:

treatment	Biozyme* TF Growth Regulator Concentration ($Ml.L^{-1}$)			Mean
	0	**0.5**	**1**	
Local	53.60 b	57.26 a	58.32 a	56.40 A
Pumpa	48.42 c	53.08 b	56.56 a	25.68 B
Myskpumpa	47.16 c	48.74 c	49.54 c	48.48 C
Mean	40.72 C	53.02 B	54.80 A	

Averages that take the same letter for each factor or overlap between them do not differ significantly ($P \leq 0.05$) according to Duncan's polynomial test .

The results of tables (1,2,3,4) show that there are significant differences between cultivars in the rate of most vegetative growth characteristics (number of leaves, number of branches, plant length, leaf content of chlorophyll) and the reason for these differences may be due to the effects of special genetic factors each cultivar shows the superiority of any of the above-mentioned characteristics, and the difference in the efficiency of the varietal response to the prevailing environmental conditions in the region

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is one of the reasons that greatly affect the competitiveness of growth, and this is consistent with (2), who showed that the study of the surrounding environmental factors to plants are very important because of their impact on improving growth and production characteristics. The reason for the superiority of the local cultivar over the foreign cultivars in giving the highest rate (number of leaves, number of branches, plant length, and leaf content of chlorophyll) to the plant may be due to the influence of genetic factors specific to the variety as well as its suitability to the weather conditions in the region as well as the effect of treatments on the above mentioned cultivar. As for spraying with the growth regulator, it was found that increasing the average spraying treatments to a known limit led to a significant effect on most vegetative characteristics, as the growth regulator contains in a combination auxins important for plant growth, especially the hormone (IAA) and the most important step for this hormone is to push the growth of seedlings and tops The developing plant, through the important cycle in the process of building (Trypophan), and the auxin is one of the main factors in the activity of the cambium inside the high-end plant and work to increase the cell division of the meristematic cells in a large and fast way. All this has a significant effect in tables (1, 2, 3, 4) Also, auxins help in the synthesis of some important amino and nucleic acids in protein construction and its contribution to enzymatic reactions, making it an assistant in the process of cleavage.(13)

Number of fruits (fruit.plant^{-1})

The results of Table 5 show that there are significant differences between the cultivars in the plant height characteristic, where the Myskpumpa cultivar had the largest number of fruits of 3.11 fruit.plant^{-1} compared with the pumpa cultivar, which gave the lowest number of fruits reached 0.75 fruit.plant^{-1} and this did not differ significantly from The local cultivar, which gave 0.77 fruit. Plant^{-1}. The results indicated that spraying the growth regulator Biozyme * TF led to an increase in the number of fruits and significantly, as the treatment of spraying with the growth regulator Biozyme * TF at a concentration of 1 ml. L^{-1} was superior in giving it the most number of fruits, which reached 2.13 fruit. Plant^{-1} compared to the non-spray treatment, which gave the least number of fruits 1.02. fruit.plant^{-1}. The interaction between the cultivars and the treatments of spraying with growth regulator had a significant effect on the number of fruits, and the superiority of the cultivar Myskpumpa sprayed with the growth regulator Biozyme* TF at a concentration of 1 ml. L^{-1} in the number of fruits reached 4.46 fruit.plant^{-1} Compared to the Pumpa cultivar sprayed with water only, the lowest number of fruits was 0.46.fruit.plant^{-1}

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Table 5: Effect of cultivar and spraying with Biozyme* TF growth regulator and the interaction between them on the number of fruits of pumpkin plants:

treatment	Biozyme* TF Growth Regulator Concentration (Ml.L^{-1})			Mean
	0	**0.5**	**1**	
Local	0.53 e	0.93 de	0.86 de	0.77 B
Pumpa	0.46 e	0.73 de	1.06 d	0.75 B
Myskpumpa	2.06 c	2.80 b	4.46 a	3.11 A
Mean	1.02 C	1.48 B	2.13 A	

Averages that take the same letter for each factor or overlap between them do not differ significantly (P≤ 0.05) according to Duncan's polynomial test

Total yield (ton.ha^{-1})

The results of Table 6 showed the significant differences that appeared in the characteristic of the total yield, as the local cultivar recorded the highest total yield of 43.47 ton.ha^{-1} compared to the Myskpumpa cultivar, which gave the lowest total yield of 12.74 ton.ha^{-1}.

The results of spraying treatments with Biozyme* TF showed significant differences, as it gave the treatment of spraying with Biozyme* TF at a concentration of 1 ml. L^{-1} total yield amounted to 43.31 ton.ha^{-1} compared with the comparison treatment, which gave the lowest total yield amounted to 14.72 ton.ha^{-1}.The interaction between the cultivars and the treatments of spraying with the growth regulator Biozyme* TF had a significant effect on the total yield, where the interaction treatment recorded the local cultivar sprayed with the growth regulator Biozyme* TF at a concentration of 1 ml. L^{-1} had the highest total yield of 46.66 ton. Ha^{-1} compared to the Myskpumpa cultivar sprayed with water only, which gave the lowest total yield of 7.92 ton.ha^{-1}

Table 6: Effect of cultivar and spraying with Biozyme* TF growth regulator and the interaction between them on the total yield of pumpkin plants:

treatment	Biozyme* TF Growth Regulator Concentration (Ml.L^{-1})			Mean
	0	**0.5**	**1**	
Local	23.32 cd	33.44 cd	46.66 a	34.47 A
Pumpa	12.93 de	15.23 de	38.41 ab	22.19 B
Myskpumpa	7.92 e	12.43 de	17.88 de	12.74 C
Mean	14.72 B	20.36 B	34.31 A	

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It is noticed from the results of tables (5, 6) that there are differences with a significant effect between the cultivars in the characteristics of the yield (number of fruits, the total yield). The suitability of the environmental conditions of the superior cultivars led to the presence of significant effects on the characteristics of the yield.. It is noted from the results of tables (6) that the local cultivar outperforms foreign cultivars in the total yield. This may be due to the reason This cultivar outperformed due to the influence of the genetic factor of this cultivar.

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