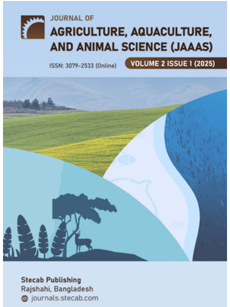

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Research Article

Role of Pinching and Spraying Amino Acid on the Vegetative and Flowering Growth Attributes of Okra Varieties

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About Article

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ABSTRACT

The experiment was conducted in the vegetable field of the Department of Horticulture and Landscape Engineering/College of Agriculture and Forestry/ University of Mosul during the spring season of 2024 to study the effect of fertilization and spraying with the amino acid Ticamin Max on three okra varieties. The experiment included three factors, the first factor is cutting with two treatments: cutting and no cutting, the second factor is the amino acid Ticamin Max with three concentrations (0, 3, 6) ml L^{-1}, while the third factor is the varieties used in the study: Betra, Sultana, and Clemson. Okra seeds were planted on 4/7/2024. The experiment was carried out according to a split-plot design, where treatments were randomly distributed according to the design used in the experiment, and Duncan's test was used to compare the averages at a probability level of 5%. Thus, the number of experimental treatments became 18 factorial treatments (2 cutting treatments * 3 concentrations of amino acid * 3 varieties) with 3 replicates. The results showed that cutting treatments and the spray level of 6 ml L^{-1} were superior in the traits of shoot height, number of branches, number of leaves, leaf area, number of days needed for flowering, and fruit set percentage, while Betra was superior in number of branches and number of days needed for flowering, while Clemson was superior in fruit set percentage.

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1. INTRODUCTION

Okra is a vegetable plant belonging to the Malvaceae family. Its native habitat is Egypt, Sudan, Eritrea and Ethiopia, from where its cultivation spread to all temperate regions of the world (Oppong-Sekyere *et al.*, 2012). In Iraq, okra is an important summer vegetable crop, grown for its pods, which are rich in nutrients such as calcium, magnesium, and phosphorus, as well as vitamins such as vitamin A, vitamin C, riboflavin, and thiamin. Its leaves, pods, and green parts are used in many industries, as its leaves are used in the paper industry, while its pods, roots, and stems are used to extract adhesives such as gum (Deeplata, 2013). Ripe okra seeds are characterized by containing high amounts of high-quality protein compared to other plant protein sources. They are also characterized by containing good amounts of minerals, vitamins, carbohydrates, oils, and dietary fiber (Arapitsas, 2008; Abul Rahman and Nadir, 2018). Okra cultivation is spread over large areas in the world, as the total area used for okra cultivation in the world reaches more than (20,000,000) hectares, and its production reaches. To (9,872,826) tons, in Iraq, the area planted with okra is estimated to be about 12,128 hectares with a productivity of up to (68,451) tons (FAO, 2020).

2. LITERATURE REVIEW

Pinching or pinching is known as removing the growing tip of the plant. It is one of the agricultural processes that has been used recently to improve the vegetative and floral growth characteristics of the plant. It is done by shortening or cutting the terminal part of the stem to improve the growth of lateral branches. This method is widely used in cucurbit varieties as well as in some okra varieties (Ali *et al.*, 2022).

Okra plant has a large and multi-genital vegetative system and remains in the soil for a long time, where it depletes large quantities of nutrients from the soil. This deficiency must be compensated for through fertilization, especially foliar fertilization using amino acids, which are bio-stimulants that are absorbed and quickly transferred within the various parts of the plant because of their direct effect on the enzymatic activity of the plant. They also enter into the formation of nucleotides, vitamins, and growth hormones. Therefore, they are a basic component of living matter and protoplasm and participate in enzymatic reactions within cells. They are also considered the basic units of proteins, and the plant needs them in large quantities. Foliar nutrition is considered an important means of supplying the plant with primary and secondary elements, as well as various growth stimulants, which are effective in increasing vegetative growth and productivity and improving its quality (Kuepper, 2003).

3. METHODOLOGY

The experiment was conducted during the agricultural season of (2024) in the field of vegetable research experiments of the Department of Horticulture and Landscape Engineering / College of Agriculture and Forestry within the campus of the University of Mosul. The soil was prepared by plowing it twice perpendicularly using a rotary plow, then the soil was smoothed. After that, surface samples were taken from a depth of (0-30) cm randomly for the purpose of conducting physical and chemical laboratory analyses. The experiment included (3) factors: The first factor: includes the three varieties (Clemson, Petra, Sultana). The second factor: The cutting: includes two levels (without cutting, cutting of the growing tip). The third factor: the amino acid Tecamin Max at three levels (0, 3, 6) mg L-1. The research was carried out in the field using a factorial experiment (split-split) within a randomized complete block design (RCBD) where the varieties are placed in the main plot of the experiment, while the amino acid is placed under the (subplot), while the cutting is placed within the (sub sub plot) According to (Al-Rawi & Khalaf Allah, 2000), Duncan's test was used to compare means at a 5% probability level. The following data and measurements were recorded: plant height (cm), number of branches (branch/plant), number of leaves (leaf/ plant), leaf area (cm^2), leaf area index, chlorophyll percentage, number of days to first flower, fruit set percentage.

4. RESULTS AND DISCUSSION

4.1. Role of Pruning and Spraying with the Amino Acid on Plant Height (cm) of Okra Varieties

Table (1) shows that the non-pruning treatment significantly outperformed and recorded the highest value for plant height compared to the pruning treatment, which recorded the lowest value for plant height.

The results also demonstrated the presence and effect of the amino acid Ticamin Max on plant height, as all treatments significantly outperformed the control treatment. The highest value for plant height (74.168) cm was recorded in the (6) ml L^{-1} concentration treatment, while the control treatment recorded the lowest value for plant height, reaching (68.778) cm.

No significant effect of cultivars was observed on plant height. As for the two-way interaction between the pricking treatments and cultivars on plant height, the results showed that the "Batrah" cultivar treatment without pricking was superior, recording the highest plant height value of 81.520 cm, while the "Clemson" cultivar treatment with pricking recorded the lowest plant height value of 62.927 cm.

The interaction between cultivars and Tecamine Max spray treatments also had a significant effect on plant height. The "Batrah" cultivar treatment with a spray level of 6 ml L^{-1} recorded the highest plant height value, while the "Clemson" cultivar treatment without spray recorded the lowest value for the trait.

As for the interaction between the treatments of qart and spraying with amino acid, the treatment without qart with spraying at a concentration of (6) ml L^{-1} outperformed the treatment with qart with spraying at a concentration of (3) ml L^{-1} with the best values.

The Triple interference between the treatments showed that the treatment of the un-qarted variety Batra with spraying with Tecamin Max at a concentration of (6) ml L^{-1} was superior, recording the highest value for plant height of (90.003) cm, compared to the treatment of the variety Betra with cutting and spraying with amino acid (3) ml L-1, which recorded the lowest value for plant height of (58.223) cm.

Table 1. Role of pinching and spraying with amino acid on Plant height (cm) of okra varieties.

Treatment cutting	cultivars	amino acid m l^{-1}			cultivars*Cutting	Impact cutting
		Zero	3	6		
Cutting	betra	65.667 f - d	58.223 f	68.443 f-b	64.111 b	67.098 b
	sultana	73.110 b – e	73.553 b – e	76.11 b – e	74.258 a b	
	Clemson	63.443 f e	67.000 f – c	58.337 f	62.927 b	
No cutting	betra	75.333 b – e	79.223 a– c	90.003 a	81.520 a	75.717 a
	Sultana	65.223 d-f	78.233 a - d	71.333 f – b	71.593 a b	
	Clemson	69.89 b – f	71.447 b – f	80.78 a-b	74.039 a b	
amino acid * Cutting	cutting	67.407 c	66.259 c	67.630 c	**Impact cultivars**	
	No cutting	70.149 bc	76.298 ab	80.706 a		
amino acid * Cultivar	betra	70.500 a b	68.723 b	79.223 a	72.816 a	
	sultana	69.167 b	75.888 a b	73.722 a b	72.926 a	
	Clemson	66.667 b	69.223 b	69.558 b	68.483 a	
Impact amino acid		68.778 b	71.278 a b	74.168 a		

**Numbers with similar letters indicate no significant difference at the 5% probability level.*

4.2. The role of pruning and spraying with the amino acid on the number of branches (plant-1 branch) of okra cultivars

Table (2) shows that pruned plants outperformed okra cultivars, recording the highest value for the number of branches trait compared to non-pruned plants, which recorded the lowest value for the number of branches per plant. Spraying with the amino acid also had a significant effect on the average number of branches per plant, as the (6) ml L^{-1} concentration treatment outperformed the (3) ml L^{-1} concentration treatment and the control treatment, which recorded the lowest value for the average number of branches, reaching (2.783) branches per plant.

The results also showed a significant effect of cultivars on the average number of branches per plant, with the "Betra" cultivar significantly outperforming the "Betra" cultivar with the highest average for this trait. No significant differences were found between the "Sultana" cultivar and the "Clemson" cultivar, which recorded the lowest number of branches per plant.

The interaction between the "pruning" treatments and cultivars, the results showed that the "pruning" treatment significantly outperformed the "Betra" cultivar, recording the highest average number of branches, while the "Un-pruning" Sultana cultivar plants recorded the lowest average number of branches per plant.

The interaction between cultivars and amino acid spray treatments, the results showed that the "Betra" cultivar, sprayed at a concentration of (6) ml L^{-1}, recorded the highest average number of branches, while the "Sultana" cultivar, the control treatment (without spray), recorded the lowest average number of branches per plant.

Interaction between the pruning and amino acid spraying treatments significantly affected the average number of branches per plant. The pruning treatment with amino acid spray at a concentration of (6) ml L^{-1} recorded the highest average number of branches per plant, branch-1, compared to the no-pruning treatment with spray at a concentration of (3) ml L^{-1}, which recorded the lowest number of branches per plant.

Triple interference also showed that the "Betra" variety was superior for pruned plants treated with amino acid at a concentration of (6) ml L^{-1}, recording the highest value for the number of branches per plant, compared to the comparison treatment for plants of the "Betra" variety that were not pruned, which recorded the lowest value for the average number of branches per plant, at (1,500) branches per plant.

Table 2. Role of pinching and spraying with the amino acid on the number of branches (plant-1 branch) of okra varieties.

Treatment cutting	cultivars	amino acid m l^{-1}			cultivars*Cutting	Impact cutting
		Zero	3	6		
Cutting	betra	5.443 a b	6.220 a	6.500 a	6.054 a	4.602 a
	sultana	5.443 a b	5.000 a – c	3.443 d	3.530 b	
	Clemson	3.500 b – d	3.667 b – d	5.500 a b	4.222 b	
No cutting	betra	2.553 d	1.890 d	3.000 c d	2.481 c	2.111
	Sultana	1.500 d	1.667 d	2.443 d	1.870 c	
	Clemson	1.553 d	1.890 d	2.500 d	1.981 c	
amino acid * Cutting	cutting	3.697 b	4.962 a	5.148 a	**Impact cultivars**	
	No cutting	1.869 c	1.816 c	2.648 c b		
amino acid * Cultivar	betra	3.400 a – c	4.550 a b	4.750 a	4.268 a	
	sultana	1.823 d	3.333 a – c	2.943 b _d	2.700 b	
	Clemson	2.527 c d	2.778 b – d	4.000 a – c	3.102 b	
Impact amino acid		2.783 b	3.389 a b	3.898 a		

**Numbers with similar letters indicate no significant difference at the 5% probability level.*

4.3. The role of pricking and spraying with the amino acid on the number of leaves (leaf per plant-1) of okra cultivars

The results shown in Table (3) demonstrate the superiority of the pricking treatment, recording the highest average number of leaves, reaching (926,117) leaves per plant-1, compared to the non-pricking treatment, which recorded the lowest average, reaching (556,103) leaves per plant-1.

As for spraying with the amino acid, the (6) ml L^{-1} concentration treatment recorded the highest value for the number of leaves, reaching (462,118) leaves per plant-1, while the control treatment recorded the lowest average for the trait, reaching (102,982) leaves per plant-1.

We did not observe any effect of the cultivars on this trait. The results also showed no significant effect of the two-way interaction between cultivars and qart treatments on the average number of leaves. As for the effect of the interaction between cultivars and amino acid spray treatments, the results showed a significant effect on the average number of leaves.

The Clemson cultivar treatment, sprayed at a concentration of (6) ml L^{-1}, recorded the highest average number of leaves, reaching (388,126) leaves per plant-1, while the Sultana control treatment recorded the lowest average number of leaves, reaching (777,100) leaves per plant-1.

Table 3. Role of pinching and spraying with amino acid and tecamin max on the number of leaves (leaf per plant) of okra cultivars

Treatment cutting	cultivars	amino acid m l^{-1}			cultivars*Cutting	Impact cutting
		Zero	3	6		
Cutting	betra	117.670 a - d	123.110 a - c	131.110 a b	123.960 a	117.926 a
	sultana	111.890 a - d	118.560 a - d	111.550 a - d	114.000 a	
	Clemson	99.890 c d	112.890 a - d	134.670 a	115.810 a	
No cutting	betra	000.90 d	101.000 b - d	111.670 a - d	100.890 a	103.556 b
	Sultana	89.670 d	106.330 a - d	103.660 a - d	99.890 a	
	Clemson	108.780 a - d	102.780 b - d	118.110 a - d	109.890 a	
amino acid * Cutting	cutting	109.814 a - c	118.186 a b	125.778 a	**Impact cultivars**	
	No cutting	96.149 c	103.371 b c	111.147 a - c		
amino acid * Cultivar	betra	103.833 b	112.058 a b	121.390 a b	112.430 a	
	sultana	100.777 b	112.445 a b	107.608 a b	106.940 a	
	Clemson	104.335 b	107.832 a b	125.388 a	112.850 a	
Impact amino acid		102.982 b	110.778 a b	118.462 a		

**Numbers with similar letters indicate no significant difference at the 5% probability level.*

The interaction between cutting treatments and amino acid sprays also had an impact. The qart treatment, sprayed at a concentration of (6) ml L^{-1}, outperformed the cutting treatment, recording the highest average number of leaves, reaching (778,125) leaves per plant-1, compared to the control treatment for cutting plants, which recorded the lowest average number of leaves, reaching (149.96) leaves per plant-1. As for the triple interaction, the Clemson cultivar plants treated with amino acid at a concentration of (6) ml L^{-1} outperformed with the highest values for the number of leaves, amounting to (67,134) leaves per plant-1, while the comparison treatment for the non-cropped Betra cultivar plants recorded the lowest average number of leaves per plant, amounting to (90,000) leaves per plant-1.

4.4. The role of pruning and spraying with the amino acid on leaf area (m^2) of okra varieties.

Table (4) shows that the pruning treatment recorded the highest average leaf area value, reaching (0.21) m^2, outperforming the non- pruning treatment, which recorded the lowest value, reaching (2.51) m^2. The amino acid spray also had an effect, as all spray treatments significantly outperformed the comparison treatment. The spraying treatment at a concentration of (6) ml L^{-1} recorded the highest average leaf area, reaching (0.22) m^2, and did not differ significantly from the spraying treatment at a concentration of (3) ml L^{-1}, which recorded (834.1) m^2. The comparison treatment recorded the lowest average for this trait, reaching (0.71) m^2. The varieties had no effect on the average leaf area per plant. As for the two-way interaction between the sapling treatments and the cultivars, the sapling treatment with the "Betra" cultivar recorded the highest value for the trait, reaching (109.2) m^2, while the lowest value was recorded in the "No-Sapling" treatment for the "Clemson" cultivar, which reached (0.57) m^2.

Meanwhile, the two-way interaction between the cultivars and the amino acid spray was significant in the leaf area trait, which recorded the highest value, reaching (365.2) m^2, in the "Betra" cultivar treatment with a spray concentration of (6) ml L^{-1}, compared to the comparison treatment for the "Clemson" cultivar, which recorded the lowest value, reaching (0.05) m^2. the interaction between the sapling treatments and the amino acid spray, the sapling treatment with the amino acid spray at a concentration of (6) ml L^{-1} outperformed the treatment with the highest average leaf area, reaching (504.2) m^2, compared to the comparison treatment with no sapling, which recorded the lowest average leaf area, (993.0) m^2. The triple interaction achieved the best values in leaf area rate, as the plants of the Maqrouta variety treated with a concentration of (6) ml L^{-1}outperformed the highest value of leaf area, reaching (723.2) m2, while the comparison treatment for the Sultana variety plants, not Maqrouta, recorded the lowest value, reaching (742.0) m^2.

Table 4. Role of pruning and spraying with the amino acid on leaf area (m^2) for okra

Treatment cutting	**cultivars**	**amino acid m l^{-1}**			**cultivars*Cutting**	**Impact cutting**
		Zero	**3**	**6**		
Cutting	betra	0951 d	2.654 a	2.723 a	2.109 a	2.021 a
	sultana	1.456 b - d	2.338 a b	2.321 a b	2.038 a	
	Clemson	1.043 d	2.231 a b	2.469 a	1.914 a b	
No cutting	betra	1.269 c d	1.028 d	2.006 a - c	1.435 a b	1.251 b
	Sultana	0.742 d	1.541 b - d	1.503 b - d	1.262 a b	
	Clemson	0.967 d	1.214 c d	0.989 d	1.0569 b	
amino acid * Cutting	cutting	1.150 b c	2.408 a	2.504 a	**Impact cultivars**	
	No cutting	0.993 c	1.261 b c	1.499 b		
amino acid * Cultivar	betra	1.141 c	1.841 a b	2.365 a	1.772 a	
	sultana	1.099 c	1.939 a b	1.912 a b	1.650 a	
	Clemson	1.005 c	1.723 b	1.729 b	1.486 a	
Impact amino acid		1.071 b	1.834 a	2.002 a		

**Numbers with similar letters indicate no significant difference at the 5% probability level.*

4.5. The role of cutting and spraying with the amino acid on the percentage of chlorophyll in leaves (SPAD) of okra cultivars

The results shown in Table (5) indicate that the cutting treatment outperformed all other spray treatments, with the highest percentage of chlorophyll in leaves, reaching (667.49) SPAD, surpassing the comparison treatment, which recorded (954.35) SPAD. Spraying with the amino acid outperformed all other spray treatments over the comparison treatment. The spraying treatment at a concentration of (6) ml L^{-1} recorded the highest percentage, reaching (789.45) SPAD, which did not differ significantly from the spraying treatment at a concentration of (3) ml L^{-1}, which recorded (100.45) SPAD.

The comparison treatment recorded the lowest percentage, reaching (542.37) SPAD. We did not observe any effect of the cultivars on this trait.

As interaction between cutting and cultivars, the two cultivars, Betra and Clemson, outperformed, recording the highest chlorophyll percentage values, reaching (211.52, 022.49) SPAD for both cultivars, respectively. The non- cutting treatment for the Clemson cultivar recorded the lowest percentage, reaching (233.32) SPAD.

The interaction between cultivars and amino acid spraying yielded the best values when spraying at a concentration of (6) ml L^{-1} with the Betra cultivar, recording (867.51) SPAD, while the non- cutting treatment for the Clemson cultivar recorded the lowest percentage, reaching (833.35) SPAD.

the interaction between the cutting and amino acid spray treatments, the cutting treatment with a spray concentration of (6) ml L^{-1} outperformed, recording the highest percentage of chlorophyll in the leaves, reaching (200.54) SPAD. This did not significantly differ from the cutting treatment with a spray concentration of (3) ml L^{-1}, which recorded (944.51) SPAD. Meanwhile, the comparison treatment recorded the lowest percentage, reaching (228.32) SPAD.

The triple interaction also had a significant effect on the percentage of chlorophyll in the leaves, as the cutting treatment with a spray concentration of (6) ml L^{-1} for the Clemson variety outperformed, recording the highest percentage of chlorophyll in the leaves, reaching (967.58) SPAD, while the comparison treatment for the Clemson variety recorded the lowest percentage, reaching (633.30) SPAD.

Table 5. Role of pruning and spraying with amino acid on percentage of chlorophyll in leaves (SPAD) of okra varieties

Treatment cutting	cultivars	amino acid m l^{-1}			cultivars*Cutting	Impact cutting
		Zero	3	6		
Cutting	betra	45.400 a - f	54.133 a - c	57.100 a b	52.211 a	49.667 a
	sultana	42.133 c - f	54.633 a - c	46.533 a - e	47.767 a b	
	Clemson	41.033 c - f	47.067 a - d	58.967 a	49.022 a	
No cutting	betra	32.750 d - f	40.333 c - f	46.633 a - e	39.906 b c	35.954 b
	Sultana	33.300 d - f	42.567 b - f	31.300 f	35.722 c	
	Clemson	30.633 f	31.867 e f	34.200 d - f	32.233 c	
amino acid * Cutting	cutting	42.856 b	51.944 a	54.200 a	**Impact cultivars**	
	No cutting	32.228 c	38.256 b c	37.378 b c		
amino acid * Cultivar	betra	39.075 b - d	47.233 a - c	51.867 a	46.058 a	
	sultana	37.717 c d	48.600 a b	38.917 b - d	41.744 a	
	Clemson	35.833 d	39.467 b - d	46.583 a - c	40.628 a	
Impact amino acid		37.542 b	45.100 a	45.789 a		

**Numbers with similar letters indicate no significant difference at the 5% probability level.*

4.6. The effect of pinching and spraying with the amino acid on the number of days to first flower appearance (days) for okra cultivars

Table (6) shows no significant difference between the pruning and non- pruning treatments. We did not observe any significant effect of spraying with the amino acid on the number of days to first flower appearance. However, cultivars significantly affected the number of days to first flower appearance, with the Betra cultivar outperforming and recording the lowest number of days (333.55), compared to the Sultana and Clemson cultivars, which recorded (444.60 and 278.59) days, respectively.

The interaction between pruning treatments and cultivars also significantly affected the number of days to first flower appearance, with the non-pricking treatment outperforming the Betra cultivar, recording the lowest average of (333.54) days, compared to the pricking treatment for the Sultana cultivar, which recorded the highest number of days (444.64) days.

As interaction between the cultivars and the amino acid spray treatments, the comparison treatment for the "Bat Betra rah" cultivar outperformed, recording the lowest number of days, at (167.53) days. Meanwhile, the (6) ml L^{-1} spray treatment for the "Sultana" cultivar recorded the highest number of days to first flower appearance, at (833.61) days.

the interaction between the "cutting" and "Amino Acid" spray treatments, the comparison treatment (without cutting and without spray) produced the lowest number of days, at (444.54) days, compared to the "cutting" treatment with spray at (6) ml L^{-1}, which recorded the highest number of days to first flower appearance, at (222.62) days.

The triple interaction achieved a significant effect, as the spraying treatment at a concentration of (6) ml L^{-1} was superior for the un-cropped Betra cultivar plants, and recorded the lowest number of days for the appearance of the first flower, which amounted to (000.51) days, compared to the comparison treatment for the cropped Clemson cultivar plants, which recorded the highest average of (667.65) days.

Table 6. Role of pinching and spraying with amino acid on Number of days to first flower appearance (day) for okra varieties.

Treatment cutting	cultivars	amino acid m l^{-1}			cultivars*Cutting	Impact cutting
		Zero	3	6		
Cutting	betra	54.000 c d	52.000 d	63.000 a - c	56.333 b c	60.370 a
	sultana	64.000 a b	64.667 a b	64.667 a b	64.444 a	
	Clemson	65.667 a	56.333 b - d	59.000 a - d	60.333 a b	
No cutting	betra	52.333 d	59.667 a - d	51.000 d	54.333 c	56.333 a
	Sultana	57.000 a - d	53.333 d	59.000 a - d	56.444 b c	
	Clemson	54.000 c d	63.000 a - c	57.667 a - d	58.222 b c	
amino acid * Cutting	cutting	61.222 a	57.667 a b	62.222 a	**Impact cultivars**	
	No cutting	54.444 b	58.667 a b	55.889 b		
amino acid * Cultivar	betra	53.167 b	55.833 a b	57.000 a b	55.333 b	
	sultana	60.500 a	59.000 a b	61.833 a	60.444 a	
	Clemson	59.838 a	59.667 a	58.333 a b	59.278 a	
Impact amino acid		57.833 a	58.167 a	59.056		

**Numbers with similar letters indicate no significant difference at the 5% probability level.*

4.7. The role of pruning and the amino acid tecamin max on the fruit set percentage of okra cultivars

Table (7) shows a significant effect of the tartar treatment, which recorded the highest fruit set percentage value of (835.0)%, significantly outperforming the non-cutting treatment, which recorded the lowest fruit set percentage of (761.0)%. The spray treatment at a concentration of (6) ml L-1 outperformed the treatment at a concentration of (3) ml L-1, with the highest value for this trait of (816.0)%, outperforming the spray treatment at a concentration of (3) ml L-1 and the control treatment, which recorded the lowest value of (684.0)%.

The cultivars also had a significant effect on the fruit set percentage, with the Clemson cultivar outperforming and recording the highest fruit set percentage of (819.0)%, outperforming the Betra and Sultana cultivars, which recorded (783.0 and 791.0)%, respectively, and between which no significant differences were observed.

As for the interaction between the pricking treatments and the cultivars, the pricking treatment outperformed the Clemson cultivar, recording the highest flower set percentage of 864.0%, while the unprimed Clemson cultivar plants recorded the lowest set percentage of 774.0%.

Table 7. Role of pinching and spraying with amino acid in the contract ratio of okra.

Treatment cutting	cultivars	amino acid m l^{-1}			cultivars*Cutting	Impact cutting
		Zero	3	6		
Cutting	betra	0.700 h	0.810 e	0.900 c	0.803 c	0.835 a
	sultana	0.703 h	0.857 d	0.950 a b	0.8367 b	
	Clemson	0.713 g h	0.920 b c	0.960 a	0.864 a	
No cutting	betra	0.700 h	0.753 f	0.833 d e	0.762 d	0.761 b
	Sultana	0.647 i	0.740 f g	0.850 d	0.746 e	
	Clemson	0.643 i	0.813 e	0.867 d	0.774 d	
amino acid * Cutting	cutting	0.706 d	0.862 b	0.937 a	**Impact cultivars**	
	No cutting	0.663 e	0.769 c	0.850 b		
amino acid * Cultivar	betra	0.700 d	0.782 c	0.867 b	0.783 b	
	sultana	0.675 e	0.798 c	0.900 a	0.791 b	
	Clemson	0.678 d e	0.867 b	0.913 a	0.819 a	
Impact amino acid		0.684 c	0.816 b	0.893 a		

**Numbers with similar letters indicate no significant difference at the 5% probability level.*

The results of the interaction between cultivars and amino acid spraying also showed that the (6) ml L^{-1} spraying treatment for the Clemson cultivar outperformed with the highest set percentage of 913.0%, and did not differ significantly from the (6) ml L^{-1} spraying treatment for the Sultana cultivar, which recorded 900.0%. The comparison treatment for the Sultana cultivar recorded the lowest set percentage of 675.0%.

As for the interaction between the pruning treatments and amino acid spraying, the pruning treatment with a (6) ml L^{-1} spraying recorded the highest set percentage of 937.0%, while the comparison treatment recorded the lowest set percentage of 663.0%.

The triple interaction had a significant effect on the set percentage, as the spraying treatment with a concentration of (6) ml L^{-1} was superior to the Clemson variety plants with a value of (960.0)%, while the comparison treatment for the same variety recorded the lowest value for the set percentage, which amounted to (643.0)%.

4.8. Discussion

The results show that the cutting treatment significantly outperformed most vegetative growth traits, including the number of branches, number of leaves, leaf area, and leaf chlorophyll content. The non-cutting treatment outperformed the non-cutting treatment in plant height. The cutting treatment also outperformed all floral growth traits, with the exception of the number of days until the first flower appears. The superiority of the qart treatment in these traits is attributed to the role of cutting in increasing plant growth, as it stimulates the growth and development of the plant's lateral branches, which increases the leaf area of the plant and the efficiency of photosynthesis. This positively impacts the plant's vegetative and floral growth traits. Furthermore, cutting treatment also plays a role in removing the auxin hormone secreted in the growing tip, which leads to the hormone being transferred to the plant buds, causing an increase in the growth of lateral branches and a decrease in plant height (Chauhan *et al.*, 2024). These results are consistent with the findings of (Al-Jubouri, 2003; Al-Jubouri, 2006; El-Hameed, 2016; Naafe *et al.*, 2022), who observed that cutting led to an increase in Significant differences in the vegetative and flowering growth characteristics of okra plants.

As for the effect of amino acids on vegetative and floral growth traits, it is noted from Tables (1, 2, 3, 4, 5, 6, 7) that the spraying treatment at a concentration of (6) ml L^{-1} significantly outperformed all vegetative growth traits represented by plant height, number of branches, number of leaves, leaf area, chlorophyll percentage in leaves, and percentage of nodes. This is attributed to the effect of spraying with amino acids, which are considered biostimulants that positively affect vegetative growth traits (Kowalczyk & Zielony, 2008), in addition to being important compounds in the process of protein and nucleic acid synthesis, plant tissue formation, and chlorophyll production. This is consistent with what was reached by (Al-Shammari *et al.*, 2019), who noted that spraying with amino acids led to a significant increase in the trait of plant height, number of branches, and leaf area of okra plants. The results also agree with what was reached by (Jaafar & Gleikh, 2020), who found that spraying The amino acid resulted in a significant increase in plant height, leaf number, and leaf chlorophyll content.

the effect of cultivars on vegetative and floral growth traits, Tables 1, 2, 3, 4, 5, 6, and 7 show that the Batrah cultivar significantly outperformed the number of branches, while the Sultana and Clemson cultivars outperformed the number of days to first flower, and the Clemson cultivar outperformed the fruit set percentage. This is attributed to the differences in the genetic makeup of the cultivars and their responsiveness to different environmental conditions (Zidan *et al.*, 2018). This is consistent with the findings of (Shrikant, 2010; Dash *et al.*, 2013; Ullah & Jan, 2024; Manikanta, 2020), who observed differences in vegetative and floral growth traits among okra cultivars.

5. CONCLUSIONS

This study demonstrated the significant effects of cutting, Ticamin Max amino acid foliar spraying, and varietal differences on agronomic traits of okra during the spring 2024 season under field conditions at the University of Mosul. The cutting treatment, combined with the highest Ticamin Max concentration (6 ml L^{-1}), resulted in notable improvements in shoot height, number of branches, number of leaves, leaf area, earlier flowering, and greater fruit set percentage. Among the varieties tested, Betra showed superiority in the number of branches and required fewer days to initiate flowering, while Clemson achieved the highest fruit set percentage. These findings suggest that integrating specific agronomic practices such as cutting and appropriate foliar application of Ticamin Max can effectively enhance growth and yield-related parameters of okra, and that varietal selection further optimizes these benefits. Continued research into the physiological mechanisms underlying these responses and their economic feasibility is recommended for broader adaptation and improved okra production in the region.

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