International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 1s, 2025
https://www.theaspd.com/ijes.php

Importance of pinching and spraying with amino acid on the yield quantitative and qualitative attributes of okra varieties.

Elias Khader Saleh Al-Taie[1] Amer Abdullah Hussein Al-Jubouri[2]
College of Agriculture and Forestry, University of Mosul, Mosul, Iraq
E-mail: amer_ah_juboori@uomosul.edu.iq

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 the pinching treatments in the yield traits, the pinching treatment was superior in the trait of the percentage of setting, while the non- pinching treatment was superior in the trait of the number of days from planting to the first harvest. The pinching treatment was superior in the traits of the pod diameter and the weight of the pods, while the spray treatments with amino acid were superior in the traits of the pod length and the percentage of dry matter of the pods, while the spray treatments at a concentration of (3) ml L-1 and (6) ml L-1 were superior in the traits of the pod length, pod weight, number of pods per plant, number of days from planting to the first harvest, yield per plant, total yield, and marketable yield. The Clemson variety was superior in the traits of pod length, number of pods per plant, yield per plant, total yield, and marketable yield, while the Betra variety was superior in the early yield of the plant, while the Sultana variety was superior in the number of days from planting to the first harvest.

Keywords: okra , pinching , amino acid , varieties.

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, and in Iraq the area planted with okra is estimated at about 12,128 hectares with a productivity of up to (68,451) tons **(FAO, 2020)**.

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)**.

In a study on the effect of pinching on three okra cultivars (GO-2, Parbhani Kranti, and VRO-6), which included pinching plants 20 and 30 days after planting, it was found that pinching plants 20 days after planting significantly affected the number of branches per plant, number of fruits, and weight of 100 seeds.

However, pinching 30 days after planting delayed the appearance of the first flower, number of days until the first harvest, and number of days to maturity. The non-pinching treatment was superior in the characteristics of fruit length and number of seeds per fruit (Shrikant 2010).

MANIKANTA, (2020) found that removing the growing tip of okra plants resulted in a significant increase in the number of leaves per plant-1 (21.38), leaf area (1124.87 cm2), number of fruits per plant-1, fruit diameter, yield per plant, total yield, number of seeds per pod-1 and weight of 100 seeds, while the control treatment recorded the highest value for plant height, number of flowers per plant-1, fruit length and fruit weight. The control treatment also recorded the lowest number of days until the first flower appeared on the plant and the lowest number of days until 50% of the plants flowered.

El-Hameed et al. (2016) showed that okra-cutting plants significantly outperformed in the following traits: number of leaves, dry weight of leaves, dry weight of plant, number of branches per plant, number of pods per plant, yield per plant, and total yield. Cropped squash plants significantly outperformed in the following traits: number of branches per plant, percentage of fruit set, number of fruits, fruit weight, and fruit length (Naafe 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)**.

Kowalczyk and Zielony (2008) showed that amino acids are biostimulants that positively affect plant growth and that the amount of amino acids inside the plant varies from one plant to another depending on the metabolic process. Al-Shammari et al. (2019) studied the effect of spraying with the amino acid Tekamin Max on two okra cultivars. The study included the use of 3 levels of amino acid (0, 2.5, 5) mm L-1. The results of the study showed that the level (2.5) mm L-1 was superior to the other levels in the characteristics of plant height (110.75) cm, number of branches per plant (14.25) branches/plant-1, total leaf area per plant (529.33 dm2.plant-1), number of pods per plant (48) pods/plant-1 and total yield (1.056) kg m-2. While Rahman et al., (2012) found a comparison between five okra cultivars (Arka Anamika, Puja, Anmol, Sabz-Par, Sharmeeli) and found that the cultivar Arka Anamika was superior to the other cultivars in the characteristics of number of days to flowering (45.67) days, plant height (91.33) cm, number of pods plant-1 (17.10) pods plant-1, pod weight plant-1 (156.8) g plant-1 and total yield (9.900) tons ha-1, while the cultivar Sabz-pari was superior in the characteristics of pod length (9.70) cm and average pod weight (10.13) g.

Dash et al. (2013) in a study on the effect of planting dates on (3) okra cultivars (BARI Dherosh-1, Arka Anamica, Annie Oakley) concluded that the Arka Anamica cultivar was superior in plant height compared to the BARI Dherosh-1 cultivar, which recorded the lowest value for plant height. The Annie Oakley cultivar was superior in the number of days to the appearance of the first flower and the number of branches per plant, which reached (2.56) branches per plant, compared to the two cultivars Arka Anamica and BARI Dherosh-1, which gave the lowest value for the number of branches per plant. The same cultivar was also superior in the number of days to the first harvest, the number of pods per plant, pod length, pod weight, and pod diameter, compared to the BARI Dherosh-1 cultivar, which gave the lowest value for the same traits.

MATERIALS AND METHODS

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 and Khalaf Allah, 2000**), Duncan's test was used to compare means at a 5% probability level. The following data and measurements were recorded: number of days from planting to first harvest, pod length (cm), pod weight (g), number of seeds per pod, number of pods (pod/plant), early yield (tons ha^{-1}), yield per plant (kg), total yield (tons ha^{-1}), and marketable yield (tons ha^{-1}).

RESULTS AND DISCUSSION

1 - Effect of pinching and amino acid on the number of days to first harvest (day) for okra varieties .

Table (1) shows The results showed a significant effect of the non- **pinching** treatment, which recorded the lowest number of days, amounting to (57.704) days, while the pricking treatment recorded the highest value for the number of days from planting to the first harvest, amounting to (61.444) days.

the treatment sprayed at a concentration of (6) ml L-1 outperformed and recorded the lowest value, amounting to (56.611) days, compared to the comparison treatment, which recorded the highest value for the trait, amounting to (62.222) days.

the "Betra" variety outperforming and recording the lowest value for the trait, at 55.333 days, compared to the "Sultana" variety, which recorded the highest value, at 62.889 days.

the interaction between the " **pinching** " and varieties, the results showed that the "No **pinching** " was superior for the "Betra" variety, recording the lowest number of days, at 53.333 days, compared to the " **pinching** " for the "Sultana" variety, which recorded the highest number of days at 65.667 days.

interaction between varieties and amino acid. The concentration of (6) ml L-1 and the "betra" variety outperformed and recorded the lowest average for the trait, at 53.500 days, compared to the comparison treatment (no spray) for the "Sultana" variety, which recorded the highest value, at 65.667 days.

The non- **pinching** treatment with spraying concentration of (6) ml L^{-1} outperformed, recording the lowest value of (53.222) days, compared to the control treatment (without **pinching** and without spraying), which recorded the highest value of (63.222) days.

The **tri** interaction between concentration of (6) ml L^{-1} and no- **pinching** with Clemson cultivar plants outperformed, recording the lowest average of (54.333) days, compared to the spraying treatment at concentration of (0) ml L^{-1} for the Sultana cultivar plants, which recorded the highest average of (67.333) days.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 1s, 2025
https://www.theaspd.com/ijes.php

Table (1) Importance of pinching and amino acid on the number of days from planting to first harvest (day) for okra varieties.

Treatment cutting	cultivars	amino acid m l $^{-1}$			*Cutting cultivars	Impact cutting
		Zero	3	6		
Cutting	betra	58.333 d – f	57.000 e – g	56.667 e – g	57.333 c	61.444 a
	sultana	67.333 a	65.667 a b	64.000 a – c	65.667 a	
	Clemson	64.000 a – c	60.667 c d	59.333 d e	61.333 b	
No cutting	betra	56.000 e – g	53.667 g	50.333 e	53.333 d	57.704 b
	sultana	64.000 a – c	61.333 c d	55.000 f g	60.111 b	
	Clemson	63.667 b c	61.000 c d	54.333 g	59.667 b c	
amino acid*Cutting	cutting	63.222 a	61.111 b	60.000 b c	Impact cultivars	
	No cutting	61.222 b	58.667 c	53.222 d		
amino acid*Cultivar	betra	57.167 c	55.333 c d	53.500 d	55.333 c	
	sultana	65.667 a	63.500 a	59.500 b	62.889 a	
	Clemson	63.833 a	60.833 b	56.833 c	60.500 b	
Impact amino acid		62.222 a	59.889 b	56.611 c		

2- Effect of pinching and the amino acid on pod length (cm) of okra cultivars

The results Table (2) indicated no significant difference between the **pinching** treatment, which recorded (8.341) cm, and the non-priming treatment, which recorded (9.699) cm. the spraying treatment at a concentration of (6) ml L^{-1} recording the highest value for the trait, reaching (9.416) cm.Clemson recording the highest value of 11.238 cm, outperforming all other varieties., while Betra recorded the lowest value of 5.447 cm.

The interaction between **pinching** and varieties, the non- **pinching** with Clemson treatment recording the highest value of pod length of 12.306 cm, while the **pinching** with Betra recorded the lowest value of 4.840 cm. The interaction between the varieties and the amino acid had a significant effect on the pod length, as the

spray treatment with a concentration of (6) ml L^{-1} for the Clemson variety recorded the highest average pod length of (11.785) cm, while the lowest average for the trait was recorded in the comparison treatment for the Betra variety, which reached (5.100) cm.

but interaction between the **pinching** and amino acid. without **pinching**, and spraying at concentration of (6) ml L^{-1} and (3) ml L^{-1}, recorded the highest values for the trait, reaching (10.168 and 9.893) cm, respectively. The **pinching** treatment with concentration of (0) ml L^{-1} recorded the lowest value, reaching (7.910) cm.

The results of tri interaction The pod length treatment with concentration of (6) ml L^{-1} was superior for the un- **pinching** Clemson cultivar plants, recording the highest value for pod length, reaching (12.880) cm, while the control treatment and **pinching** with cultivar, betra, recorded the lowest value, reaching (4.577) cm.

Table (2) Importance of pinching and amino acid on pod length (cm) of okra cultivars

Treatment cutting	cultivars	amino acid m l^{-1}			*Cutting cultivars	Impact cutting
		Zero	3	6		
cutting	betra	4.577 f	4.810 f e	5.133 f e	4.840 d	8.341 a
	sultana	9.610 d	10.257 c d	10.170 c d	10.012 b	
	Clemson	9.543 d	10.277 c d	10.690 c d	10.170 b	
No cutting	betra	5.623 f e	6.280 e	6.257 e	6.053 c	9.699 a
	sultana	10.170 c d	10 .677 c d	11.367 b c	10.738 b	
	Clemson	11.313 b c	12.723 a – b	12.880 a	12.306 a	
amino acid*Cutting	cutting	7.910 c	8.448 b c	8.664 b c	Impact cultivars	
	No cutting	9.036 b	9.893 a	10.168 a		
amino acid*Cultivar	betra	5.100 d	5.545 d	5.695 d	5.447 c	
	sultana	9.890 c	10.467 b c	10.768 a – c	10.375 b	
	Clemson	10.428 c	11.500 a b	11.785 a	11.238 a	
Impact amino acid		8.473 b	9.171 a	9.416 a		

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 1s, 2025
https://www.theaspd.com/ijes.php

3 - Effect Of Pinching And Amino Acid On Pod Diameter (Cm) Of Okra Varieties

The results shown in Table (3) indicate a significant effect of the pod diameter trait, where the **pinching**, recording the highest value of 2.757 cm, compared to the no-pod treatment, which recorded 1.961 cm. Amino acid concentration of (6) ml L^{-1} recorded the highest value of 2.789 cm, while the control treatment (without spray) recorded the lowest value of 1.794 cm. As for the effect of varieties, the results showed that there was no significant effect of varieties on the pod diameter trait. The interaction between **pinching** and cultivars, the results showed a significant effect on pod diameter, as **pinching** treatments for all cultivars significantly outperformed non- **pinching** treatments, recording values of (2.896, 2.684, and 2.690) cm for the cultivars Betra, Sultana, and Clemson, respectively. Non- **pinching** treatments recorded values of (2.020, 1.938, and 1.924) cm for the cultivars Betra, Sultana, and Clemson, respectively.

The interaction between cultivars and amino acid, concentration of (6) ml L^{-1} for the Betra cultivar , recording the highest value of (2.960) cm, compared to the control treatment (without **pinching)** for the Clemson cultivar, which recorded the lowest value of (1.780) cm.

. The **pinching** treatment with spraying at a concentration of (6) ml L^{-1}, recording the highest value for the trait, reaching (3.296) cm, while the comparison treatment (without **pinching** and without spraying) recorded the lowest value for the trait, reaching (1.323) cm.

Tri interaction, the results showed that the spraying treatment at a concentration of (6) ml L^{-1} was superior for the plants of the cultivar Betra **pinching**, recording the highest value, reaching (3.520) cm, while the comparison treatment (without **pinching** and spraying) for the cultivar Betra recorded the lowest value, reaching (1.230) cm.

Table (3) Importance of pinching and amino acid on pod diameter (cm) of okra cultivars

Treatment cutting	cultivars	amino acid m l - 1			*Cutting cultivars	Impact cutting
		Zero	3	6		
cutting	betra	6.793 e – g	8.313 b – d	9.240 a - c	8.116 a b	8.581 a
	sultana	7.223 d – g	8.113 c –f	9.690 a -b	8.342 a b	
	Clemson	8.173 c – e	9.430 a – c	10.250 a	9.284 a	
No cutting	betra	6.500 g	7. 400 d – g	7.013 d - g	6.971 b	7.177 a
	sultana	7.587 d – g	7.707 d –g	6.640 f g	7.311 b	
	Clemson	7.603 d – g	6.890 d – g	7.257 d – g	7.250 b	
amino acid*Cutting	cutting	7.397 c	8.619 b	9.727 a	Impact cultivars	

	No cutting	7.230 c	7.332 c	6.970 c	
amino acid*Cultivar	**Betra**	6.647 c	7.857 a b	8.127 a b	7.543 a
	Sultana	7.405 b c	7.910 a b	8.165 a b	7.827 a
	Clemson	7.888 a b	8.160 a b	8.753 a	8.267 a
Impact amino acid		7.313 b	7.976 a	8.348 a	

4 - Effect Of Pinching And Amino Acid On The Number Of Seeds Per Pod (Pod^{-1} Seed) Of Okra Cultivars

The results indicated no significant effect of **pinching** and amino acid , cultivars on the average number of seeds per pod.As for the interaction between the **pinching** and cultivars, The non- **pinching** treatment for the Sultana cultivar recording the highest value for the trait, amounting to **56.186** pod seeds. This did not significantly differ from the non-pod treatment for the Clemson cultivar, which recorded **51.702** pod seeds. while, the **pinching** treatment for the Clemson cultivar recorded the lowest value for the trait, amounting to **39.259** pod seeds.

The interaction between cultivars and amino acid. The control treatment (no spray) for the Sultana cultivar, recording the highest value for the trait, amounting to **57.112** pod seeds, compared to the control treatment (no spray) for the Clemson cultivar, which recorded the lowest value, amounting to .42.443 pod seeds.

Interaction between **pinching** and amino acid spraying on the number of seeds per pod, the treatment without **pinching**, combined with spraying at a concentration of (3) ml L^{-1}, recorded the highest value for the trait, amounting to **(51.778)** seeds pod, while the treatment with **pinching**, combined with spraying at a concentration of (6) ml L^{-1}, recorded the lowest value, amounting to **(43.519)** seeds pod. The Tri interaction between effect on the number of seeds per pod, the control treatment (without **pinching** and without spraying) for the Sultana cultivar recorded the highest value, amounting to **(61.113)**, while the control treatment with spraying at a concentration of (3) ml L-1 for Clemson cultivar plants recorded the lowest value, amounting to **(37.333)** seeds pod.

Table (4) Importance of pinching and amino acid on the number of seeds per pod (seed pod^{-1}) of okra cultivars.

Treatment cutting	**Cultivars**	**amino acid** m l^{-1}			***Cutting cultivars**	**Impact cutting**
		Zero	**3**	**6**		
cutting	**Betra**	42.110 c – e	51.443 a – e	44.890 b – e	46.148 a b	44.049 a
	Sultana	53.110 a – c	44.110 b – e	43.000 b – e	46.740 a b	

	Clemson	37.777 d e	37.333 e	42.667 b - e	39.259 b	
No cutting	**Betra**	44.113 b - e	48.447 a – e	44.557 b – e	45.706 a b	51.198 a
	Sultana	61.113 a	55.667 a – c	51.777 a – d	56.186 a	
	Clemson	47.110 a – e	51.220 a – e	56.777 a b	51.702 a	
amino acid*Cutting	**cutting**	44.332 a b	44.296 a b	43.519 b	**Impact cultivars**	
	No cutting	50.779 a b	51.778 a	51.037 a b		
amino acid*Cultivar	**betra**	43.112 b	49.945 a b	44.723 b	43.112 b	
	sultana	57.112 a	49.888 a b	47.388 b	57.112 a	
	Clemson	42.443 b	44.277 b	49.722 a b	42.443 b	
Impact amino acid		47.556 a	48.037 a	47.278 a		

5 - effect of pinching and the amino acid on the number of pods per plant (pod plant^{-1}) for okra cultivars

The results of Table (18) show that **pinching** treatments did not significantly affect the number of pods per plant,. The spraying treatment at a concentration of (6) ml L-1 recorded the highest average pod number, reaching **(11.861)** pods per plant, and did not differ significantly from the spraying treatment at a concentration of (3) ml L-1, the control treatment (without spraying) recorded the lowest average pod number, reaching **(10.406)** pods per plant.Clemson cultivar, recording the highest average pod number, reaching **(12,972)** pods per plant, the cultivars "Betra" and "Clemson," which showed no significant differences, recording **(10.706** and **10.217)**, respectively.

The interaction between the **pinching** treatments and the cultivars significantly affected the number of pods per plant, with **pinching** treatment for the Clemson cultivar recording the highest value of **(14.867)** pods per plant, compared to the no- **pinching** treatment for the Sultana cultivar of **(8.633)** pods per plant.The interaction between the cultivars and the amino acid spray with concentration of (3) ml L^{-1} and Clemson cultivar, recording the highest average value for the number of pods, reaching **(13.700)** pods per plant, while the control treatment (without spraying) for the Sultana cultivar recorded the lowest value for the trait, reaching **(8.600)** pods per plant.

interaction between **pinching** and amino acid with spraying at a concentration of (3) ml L^{-1} recorded the highest value for the number of pods, amounting to **(14.011)** pods plant-1, and did not differ significantly from the **pinching** treatment with spraying at a concentration of (6) ml L^{-1}, which recorded **(13.611)** pods plant^{-1}, while the treatment without **pinching** with spraying at a concentration of (3) ml L^{-1} recorded the lowest value, amounting to **(9.244)** pods plant^{-1}.

the triple interaction, that the **pinching** treatment with spraying at a concentration of (3) ml L^{-1} **and Clemson** recording the highest value, amounting to **(16.333)** pods plant-1, compared to the **pinching** treatment with spraying at a concentration of (3) ml L^{-1} for the Sultana variety, which recorded the lowest value, amounting to **(7.967)** pods $plant^{-1}$

Table (5) Importance of pinching and amino acid on the number of pods (pod per plant) of okra cultivars.

Treatment cutting	cultivars	amino acid m l - 1			*Cutting cultivars	Impact cutting
		Zero	3	6		
cutting	betra	7.967 g	13.067 b – d	13.333 b - d	11.456 b	12.707 a
	sultana	8.667 f g	12.633 b – d	14.100 a – c	11.800 b	
	Clemson	14.867 a b	16.333 a	13.400 b - d	14.867 a	
No cutting	betra	11.700 c – e	8.700 f g	9.467 e - g	9.956 b c	9.889 a
	sultana	8.533 f g	7.967 g	9.400 e - g	8.633 c	
	Clemson	10.700 d – g	11.067 d – f	11.467 c - e	11.078 b c	
amino acid*Cutting	cutting	10.500 b	14.011 a	13.611 a	Impact cultivars	
	No cutting	10.311 b	9.244 b	10.111 b		
amino acid*Cultivar	betra	9.833 f e	10.883 c – e	11.400 b - e	10.706 b	
	sultana	8.600 f	10.300 d – f	11.750 d - b	10.217 b	
	Clemson	12.783 a b	13.700 a	12.433 a - c	12.972 a	
Impact amino acid		10.406 b	11.628 a	11.861 a		

6 - Effect of pinching and Amino Acid on Early Yield (tons h^{-1}) of Okra Varieties .

Table (6) shows The results indicated that there was no significant effect of **pinching** treatments on the early yield of the plant. also amino acid indicated that there was no significant effect on the early yield of the plant.As for the Betra cultivar recording the highest value of (0.270) tons ha^{-1}, compared to the Sultana cultivar, which recorded the lowest value of (0.166) tons ha^{-1}.

The interaction between the **pinching** and the cultivars that Betra cultivar with non- **pinching**, recording the highest value of (0.357) tons ha^{-1}, while the **pinching** treatment for the Sultana cultivar recorded the lowest value of (0.120) tons ha^{-1}.

Interaction between cultivars and amino acid that concentration of (6) ml L^{-1} for the Betra cultivar, recording the highest value of (0.322) tons h^{-1}, while the comparison (without spraying) for the Sultana cultivar recorded the lowest value for the trait, reaching (0.162) tons h^{-1}.

the interaction between **pinching** and amino acid the **pinching** treatment with concentration of (6) ml L^{-1} recording the highest value of (0.296) tons h^{-1}, while the **pinching** with comparison recorded the lowest value, reaching (0.104) tons h^{-1}.

The triple interaction on the early yield, the treatment of non- **pinching** with concentration of (6) ml L^{-1} for the Betra variety recorded the highest value of (0.385) tons h^{-1} compared to the **pinching** treatment with comparison for the Clemson variety, which recorded the lowest value of (0.099) tons h^{-1}.

.Table (6) Importance of pinching and amino acid on the early yield (t h^{-1}) of okra varieties.

Treatment cutting	cultivars	amino acid m l^{-1}			*Cutting cultivars	Impact cutting
		Zero	3	6		
cutting	betra	0.107 b c	0.187 a – c	0.258 a – c	0.184 b	0.174 a
	sultana	0.106 b c	0.134 c b	0.121 c b	0.120 b	
	Clemson	0.099 c	0.268 a- c	0.286 a – c	0.218 b	
No cutting	betra	0.369 a	0.317 ab	0.385 a	0.357 a	0.259 a
	sultana	0.218 a – c	0.181 a –c	0.237 a - c	0.212 b	
	Clemson	0.235 a – c	0.125 b c	0.265 a - c	0.208 b	
amino acid*Cutting	cutting	0.104 b	0.196 a b	0.222 a	Impact cultivars	
	No cutting	0.274 a	0.207 a b	0.296 a		
amine acid*Cultivar	betra	0.238 a b	0.252 a b	0.322 a	0.270 a	
	Sultana	0.162	0.157	0.179	0.166	

		b	b	a b	b
	Clemson	0.167 b	0.197 a b	0.276 a b	0.213 a b
Impact amino acid		0.189 a	0.202 a	0.259 a	

7 - Effect of pinching and the Amino Acid Ticamin Max on the Yield Per Plant (g) of Okra Varieties

Table (7) shows the effect of **pinching** on the yield per plant. The results showed that **pinching** treatments did not significantly affect the early yield per plant. **Amino Acid** affected on the yield per plant, concentration of (6) ml L^{-1} recording the highest yield per plant, reaching (101.801) g. It did not differ significantly from the spray treatment at a concentration of (3) ml L^{-1}, which recorded (94.747) g. The control treatment (without spray) recorded the lowest yield per plant, reaching (0.77) g . The Clemson cultivar recording the highest value for the trait, reaching (109.904) g, surpassing the betra cultivar, which recorded (81.868) g, and Sultana cultivar, which recorded (858.81) g. As for the interaction between cultivars and **pinching** treatments, the **pinching** treatment for the Clemson cultivar recorded the highest value for the per-plant yield, reaching (137.870) g, while the comparison treatment (without earring) for the Sultana cultivar recorded the lowest value for the trait, reaching (62.930) g.

Interaction between cultivars and amino acid the Clemson cultivar treatment with concentration of (3) ml L^{-1} recorded the highest value of (116.317) g, compared to the comparison treatment (without spraying) for the Sultana cultivar, which recorded the lowest value of (63.435) g.

The interaction between the qart treatments and amino acid spray also had a significant impact on the yield per plant, as the **pinching** treatment with a spray concentration of (6) ml L^{-1} recorded the highest value of (132.614) g, and did not differ significantly from the **pinching** treatment with a spray concentration of (3) ml L^{-1}, which recorded (122.049) g, while the comparison (without **pinching)** with concentration of (3) ml L^{-1} recorded the lowest value of (67.455) g.

Triple interaction show the **pinching** treatment with spraying at a concentration of (3) ml L^{-1} for the Clemson variety was superior the highest value reaching (154.000 g, while the treatment without **pinching** with spraying at a concentration of (3) ml L^{-1} for the Sultana variety recorded the lowest value, reaching (61.240) g.

.Table (7) Importance of pinching and amino acid on the yield per plant (g) of okra cultivars.

Treatment cutting	**cultivars**	**amino acid** m l $^{-1}$			***Cutting cultivars**	**Impact cutting**
		Zero	**3**	**6**		
cutting	**betra**	54.430 g	108.810 c d	123.130 b c	95.460 b c	111.370 a
	sultana	61.750 f g	103.340 c – e	137.270 a b	100.790 b	
	Clemson	122.180 b c	154.000 a	137.440 a b	137.870 a	

No cutting	**betra**	76.000 f g	62.470 f g	66.370 f g	68.280 c d	71.050 a
	sultana	65.120 f g	61.240 f g	62.430 f g	62.930 d	
	Clemson	83.000 d – f	78.630 e – g	84.170 d – f	81.930 b – d	
amino acid*Cutting	**cutting**	79.455 b	122.049 a	132.614 a	**Impact cultivars**	
	No cutting	74.707 b	67.455 b	70.989 b		
amino acid*Cultivar	**betra**	65.217 e	85.637 c d	94.750 b – d	81.868 b	
	sultana	63.435 e	82.288 d	99.851 a – d	81.858 b	
	Clemson	102 .591 a – c	116.317 a	110.803 a b	109.904 a	
Impact amino acid		77.081 b	94.747 a	101.801 a		

8 - Effect of pinching and the amino acid on the total yield (tons h-1) of okra cultivars

The results shown in Table (21) indicate no significant effect of **pinching** treatments on the total yield of the okra cultivars. The spray treatment at a concentration of (6) ml L^{-1} outperformed, recording the highest value of (3.733) tons h^{-1}. It did not differ significantly from the spray treatment at a concentration of (3) ml L^{-1}, which recorded (3.512) tons h^{-1}, while the control treatment (without spray) recorded the lowest value of (2.826) tons h^{-1}.Clemson variety recording the highest value, reaching (4.030) tons h^{-1}, while the Sultana variety recorded the lowest value, reaching (3.002) tons h^{-1}.

As for interaction between varieties and **pinching** treatments, the **pinching** treatment for the Clemson variety, recording the highest total yield value, reaching (5.055) tons h^{-1}, while the comparison treatment (without **pinching)** for the Sultana variety recorded the lowest value for the trait, reaching (2.307) tons h^{-1}.Interaction between varieties and amino acid spray treatments the Clemson variety the treatment with spray at a concentration of (3) ml L^{-1}, recording the highest value, reaching (4.265) tons h^{-1}, compared to the comparison treatment (without spray) for the Sultana variety, which recorded the lowest value, reaching (2.326) tons h^{-1}.

The interaction between the treatments of **pinching** and spraying with amino acid as the **pinching** treatment with spraying at a concentration of (6) ml L^{-1} was superior and recorded the highest value of (4.863) tons h^{-1} and did not differ significantly from the **pinching** treatment with spraying at a concentration of (3) ml L^{-1} which recorded (4.551) tons h^{-1}, while the comparison treatment (without **pinching)** with spraying at a concentration of (3) ml L^{-1} recorded the lowest value of (2.473) g.

Tri interaction between the varieties, **pinching** and spraying with amino acid on the total yield, the **pinching** treatment with spraying at a concentration of (3) ml L^{-1} for the Clemson variety was superior with the

highest value of (5.647) tons h^{-1}, while the **pinching** treatment with comparison for the Betra variety recorded the lowest value of (1.996) tons h^{-1}.

Table (8) Importance of pinching and amino acid on the total yield (t h^{-1}) of okra cultivars

Treatment cutting	cultivars	amino acid m l - 1			*Cutting cultivars	Impact cutting
		Zero	3	6		
cutting	betra	1.996 f	4.217 b c	4.515 b c	3.576 b c	4.109 a
	sultana	2.265 f e	3.789 c d	5.033 a b	3.696 b	
	Clemson	4.480 b c	5.647 a	5.039 a b	5.055 a	
No cutting	betra	2.787 f e	2.290 f e	2.433 f e	2.504 c – d	2.605 a
	sultana	2.388 f e	2.245 f e	2.289 f e	2.307 d	
	Clemson	3.043 d e	2.883 d -f	3.086 d e	3.004 b - d	
amino acid*Cutting	cutting	2.914 b	4.551 a	4.863 a	Impact cultivars	
	No cutting	2.739 b	2.473 b	2.603 b		
amino acid*Cultivar	betra	2.391 f e	3.254 c d	3.474 b –d	3.040 b	
	sultana	2.326 f	3.017 d e	3.661 a – d	3.002 b	
	Clemson	3.762 a – c	4.265 a	4.063 a b	4.030 a	
Impact amino acid		2.826 b	3.512 a	3.733 a		

9 - Effect of pinching and the Amino Acid on the Marketable Yield (tons h-1) of Okra Varieties

The results showed on Table (9) no significant effect of the **pinching** treatment on the marketable yield. Amino Acid treatment achieving the highest value for the trait, reaching (3.191) tons h^{-1}, It did not differ significantly from the spray treatment at a concentration of (3) ml L^{-1}, which recorded (2.897) tons h^{-1}. The comparison treatment (without spraying) recorded the lowest value, reaching (2.222) tons h-1. Clemson Variety recording the highest marketable yield of (3.413), outperforming on varieties Betra and Sultana, which recorded (2.526 and 2.371) tons ha-1, respectively.

the interaction between the **pinching** treatments and the varieties on marketable yield, the **pinching** treatment for Clemson was superior, recording the highest value of (4.307) tons ha^{-1}, while the comparison treatment (without **pinching**) for Sultana recorded the lowest value of (1.701) tons ha^{-1}.interaction between the varieties and the amino acid, as the spray treatment with a concentration of (3) ml L^{-1} for the Clemson variety outperformed and recorded the highest value of (3.570) tons h^{-1} and did not differ significantly from the spray treatment with a concentration of (3) ml L^{-1} for the Clemson variety, which recorded (3.514) tons h^{-1}, while the comparison treatment (without spraying) for the Sultana variety recorded the lowest value for the marketable yield of (1.673) tons h^{-1}.

The interaction between the treatments of **pinching** and spraying with amino acid the **pinching** treatment with spraying at a concentration of (6) ml L^{-1} was superior and recorded the highest value of (4.291) tons h^{-1} and did not differ significantly from the **pinching** treatment with spraying at a concentration of (3) ml L-1 which recorded (3.895) tons h^{-1}, while the treatment without **pinching** with spraying at a concentration of (3) ml L^{-1} recorded the lowest value of (1.898) tons h^{-1}.Triple interaction the **pinching** treatment with spraying at a concentration of (3) ml L-1 for the Clemson variety was superior the highest value of (4.798) tons h^{-1}, while the **pinching** treatment with comparison for the Betra variety recorded the lowest value of (1.526) tons h^{-1}.

.Table (9) Importance of pinching and amino acid on the marketable yield (t h^{-1}) of okra cultivars .

Treatment cutting	cultivars	amino acid m l^{-1}			*Cutting cultivars	Impact cutting
		Zero	3	6		
cutting	betra	1.526 g	3.680 b c	4.083 a –c	3.096 b	3.481 a
	sultana	1.591 f g	3.209 d c	4.322 a – c	3.041 b	
	Clemson	3.657 b c	4.798 a	4.467 a b	4.307 a	
No cutting	betra	2.146 g – e	1.731 g – e	1.988 g – e	1.955 b c	2.058 a
	sultana	1.756 g – e	1.622 f g	1.725 e – g	1.701 c	
	Clemson	2.654 d e	2.342 d – g	2.560 d – f	2.519 b c	
amino acid*Cutting	cutting	2.258 b	3.895 a	4.291 a	Impact cultivars	

	No cutting	2.186 b	1.898 b	2.091 b	
amino acid*Cultivar	**betra**	1.836 d e	2.705 c b	3.035 a – c	2.526 b
	sultana	1.673 e	2.415 c d	3.024 a – c	2.371 b
	Clemson	3.156 a b	3.570 a	3.514 a	3.413 a
Impact amino acid		2.222 b	2.897 a	3.191 a	

DISCUSSION

It is clear from the tables that the pinching treatment significantly outperformed some of the yield traits, namely pod diameter and non-marketable yield. This may be due to the fact that pinching the growing tip of the plant increases the vegetative growth indicators and thus increases the number of branches, the number of leaves, and the leaf area, which has a positive impact on the yield traits (Al-Jabouri, 2006). This is consistent with the findings of (SAHU and BISWAL, 2017), who found that pinching the okra plant led to a significant increase in yield traits. Regarding the effect of spraying with amino acid on the characteristics of the crop, it is clear from Tables that spraying with a concentration of (6) ml L-1 significantly outperformed the two characteristics of pod diameter. The two spraying treatments with a concentration of (3) ml L-1 and (6) ml L-1 also outperformed the control treatment (without spraying) in the characteristics of pod length, pod weight, number of pods, yield per plant, total yield, and marketable yield. This may be attributed to the positive effect of spraying with amino acid on the characteristics of vegetative growth and increased photosynthesis products, which was positively reflected on the characteristics of the crop (Abdul Hussein and Muhammad, 2016) and is consistent with (Ramadan and El Mesairy, 2015, Jaafar and Gleikh, 2020, Eksi and Sonme, 2022) who found that spraying with amino acid led to an increase in Significant differences in yield traits.

As for the effect of cultivars on yield traits shown in the tables, the cultivar Betra outperformed in early yield, while the cultivar Clemson outperformed in pod length, number of pods, yield per plant, total yield, and marketable yield. The reason for the superiority of some cultivars over others in some traits may be due to genetic variation among cultivars. The environment in which cultivars grow may also play an important role, especially when interacting with the genetic makeup. Alternatively, the difference may be due to the fact that these traits are determined by the nature of the cultivar's genetic makeup and the variation in these cultivars' auxin and gibberellin content, which leads to increased internodes length and, consequently, stem length, leading to differences in growth and yield traits (Mohammed, 1985). This is consistent with the findings of (Zidan et al., 2018; Rahman, 2012; Aliyu and Ajala, 2016; Sadiq et al., 2017), who observed significant differences in yield traits among cultivars. Okra.

REFERENCES

Abdul Rahman, F. A. and Nadir, H. A. (2018).Effect of water stress on okra Abelmoschus esculentus L. yield at vegetative stage. AGRIC,30(2): 111-116.

Ali, A., Nabi, G., Irshad, M., Khan, M. N., Israr, M., Ali, S., ... & Ali, W. (2022). Pinching effects on growth and yield of okra. *Pure and Applied Biology*, *11*(1), 135-145.

Aliyu, U., & Ajala, A. A. (2016). Effect of variety and plant density on growth and yield of okra. *Journal of Agriculture and Veterinary Science*, *9*(2), 38-42.

Al-Jubouri, Razzaq Kazim Rahman. (2003). Effect of foliar spraying with some plant extracts and zinc and iron on vegetative growth, yield and seed quality of two okra cultivars. Technical Research Journal, Baghdad. 25 (3): 93-105.

Al-Jubouri, Razzaq Kazim Rahman. (2006). Effect of foliar spraying with growth regulator (Atonik) and cutting the growing tip on vegetative growth and yield of okra (Abelmoschus esculentus L.). Technical Journal. 19 (3): 1-10.

Al-Shammari, A. M. A., Abood, M. A., & Hamdi, G. J. (2019). Foliar application of Tecamin max® to alleviate water deficit on vegetative growth and yield of okra. *International Journal of Vegetable Science*, *25*(3), 278-284.

Arapitsas, P. 2008. Identification and quantification of polyphenolic compounds from okra seeds and skins. Food Chemistry,110(4): 1041-1045.

Chauhan, S., Basnet, B., Adhikari, S. K., Budhathoki, P., & Shrestha, A. K. (2024). Innovative farming techniques for superior okra yield in Chitwan, Nepal: The benefits of plastic film mulch and pest exclusion net on soil properties, growth, quality and profitability. Ecological Frontiers, 44(1), 23-32.

Dash, P. K., Rabbani, M. G., & Mondal, M. F. (2013). Effect of variety and planting date on the growth and yield of okra. *International Journal of Bioscience*, *3*(9), 123-131.

Deeplata , S. and D.V. Rao . (2013) . Study of melabolites of okra (Ablemoschuss esculentus L.) after infection of pest. Int .J.Pharm .Sci . Rev . Res ., 21(2):347-350.

Ekşi, H. S., & Sönmez, İ. (2022). Effects of amino acid applications on yield, growth and mineral nutrition of greenhouse tomato. Journal of Elementology, 27(3), 545-557.

El-Hameed, A., Nawar, D. A., Gad, A. A., & Bardisi, A. (2016). GROWTH AND GREEN PODS YIELD OF OKRA PLANTS AS INFLUENCED BY PLANT SPACING AND APICAL BUD PINCHING. Zagazig Journal of Agricultural Research, 43(6), 1907-1918.

FAO. 2020. FAOSTAT Agriculture Data. Agriculture Production Crop. Available from. http://www.fao.org/faostat/ar/#data

Jaafar, H. S., & Gleikh, S. A. M. (2020). Response of two cultivars of okra (Abelmochus esculentus L.) moench to spraying with amino acids on some growth and yield parameters. *Plant Archives*, *20*(2), 1834-1837

Kowalczyk, K., Zielony, T., & Gajewski, M. (2008, February). Effect of Aminoplant and Asahi on yield and quality of lettuce grown on rockwool. In Conf. of biostimulators in modern agriculture (pp. 7-8).

Kuepper, G. .(2003). Foliar Fertillization appropriate technology transfer for rural arcas (ATTRA) National Sustainable agriculture Service WWW.attra.ncat.org .

MANIKANTA, R. R. (2020). EFFECT OF GROWTH REGULATORS AND PRUNING ON GROWTH, YIELD AND QUALITY OF OKRA (Abelmoschus esculentus L. Moench) (Doctoral dissertation, Sri Konda Laxman Telangana State Horticulture University, Mulugu, Siddipet (Dist.), College of Horticulture, Rajendranagar, Hyderabad-30). International Journal of Current Microbiology and Applied SciencesS . 9(12), 330-343.

Muhammad, Abdul-Azim Kazim (1985). Plant Physiology (Part Two). Ministry of Higher Education and Scientific Research. University of Mosul.

Naafe, M., Nabi, G., Irshad, M., Khan, M. N., Ali, S., & Hayat, R. (2022). Influence of pinching on growth and yield of bottle gourd (Lagenaria siceraria). Pure and Applied Biology, 11(4), 891-901.

Oppong -sekyere , D.; R., Akromah , E . Y., Nyamah , E. , Brenya , S, Yeboah .2012. Evaluation of some okra *(Abelmoschus spp* .L) . germplasm in Ghana . Afircan Journal of Plant Science ,6(5) : 166-178 .

Rahman, K. (2012). Performance of different okra (Abelmoschus esculentus L.) cultivars under the agro-climatic conditions of Dera Ismail Khan. *Pakistan Journal of Science*, *64*(4).316

Ramadan, M., & El Mesairy, M. (2015). Effect of Humic acid and Chitosan on growth and yield of Okra (Abelmoschus esculentus L.) under saline conditions. *Egyptian Journal of Desert Research*, *65*(1), 47-60.

Sadiq, Sadiq Qasim, Suad Mohammed Khalaf and Ubair Dawood Salman. (2017). Response of two protected okra cultivars to different covers and their effect on growth and yield. Iraqi Journal of Agricultural Sciences. 48 (5): 1184-1189.

SAHU, P., & BISWAL, M.(2017). Effect of Pinching Treatments on Growth Flowering and Yield of Okra cv. Pusa A4. Trends in Biosciences 10(17), Print : ISSN 0974-8431, 3089-3092, 2017.

Shrikant, W. P. (2010). *Effects of apical pinching and fruit picking on seed yield and quality of okra (Abelmoschus esculentus (L.) Moench)* (Doctoral dissertation, jau, junagdh).

Zidan, Al-Takriti, and Abdulrahman Ayed. (2018). Evaluation of some okra cultivars (Abelmoschus esculentus L. Moench) grown at different times under unheated greenhouse conditions. Tikrit Journal of Agricultural Sciences, Vol. 18, No. 2, pp. 68 -76 .