Plant Archives Volume 20 No. 2, 2020 pp. 4076-4078 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

RESPONSE OF TWO CULTIVARS OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) TO SPRAYING WITH AMINO ACIDS ON SOME QUANTITATIVE AND QUALITATIVE PARAMETERS

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Abstract

The experiment was carried out in a private field in the Najaf Governorate, Kufa District for the 2019 growing season to study the response of two okra *Abelmoschus esculentus* L. Moench cultivars, Hussainawiya the local and Clemson from Turkeya newly adopted cultivar, to foliar spray with amino acids (AA) at 0, 2 or 4 ml.L^{-1} and to evaluate the effect of AA on plant quantitative and qualitative. The plants were sprayed twice during the growing season, at 45 and 60 days post planting. The experiment was developed as a split-plot with three replicates based on Randomized Complete Blocks Design (R.C.B.D.). Okra cultivars were placed in the main-plots and the AA concentrations were in the sub-plots. Plant quantitative parameters and qualitative characters including number of pod.$plant^{-1}$, pod weight, total yield, and percentage of mineral element N in fruits, percentage of protein and percentage of carbohydrates in fruits were compared among treatments and cultivars according to the least significant difference (L.S.D.) at $P \leq 0.05$. Results showed that the local cultivar Hussainawiya in general was better than cultivar Clemson in all the evaluated quantitative and qualitative parameters. Although the local cultivar resulted in higher values of quantitative and qualitative parameters, Clemson Turkey was more affected by AA treatment concentration than local Hussainawia. All the studied parameters of Clemson okra. AA at 2 and 4 ml.L^{-1} increased yield over the untreated control plants of both cultivars for the local Hussainawia for the Turkish Clemson.

Key Words: Cultivars, Amino Acids, Okra.

Introduction

Okra (*Abelmoschus esculentus* L. Moench) in the Malvaceae family is an important summer vegetable crop in Iraq. Central Africa, Ethiopia, Eritrea, Sudan and Egypt are considered to be okra origins from which okra moved to the Mediterranean aria, Arab and India and lately became more common vegetable in USA, Canada, Australia and many other countries (Matloub *et al.,* 1989). Okra pods are quit nutritional containing phosphorus, calcium, carbohydrates, proteins and vitamin C (Genome and Al-Halabi, 2005). It can be eaten fresh as a salad or cooked either steamed or stewed and can be canned as well. Okra extract (Gel) from stems and roots is used in industry to purify sugarcane juice or in the soap production. Boiling okra flowers is believed to have medicinal effects as analgesics and moisturizers for by suria syndrome (Chakravarty, 1970). In order to meet the need for increasing domestic consumption, it is necessary to investigate effective methods to increase the production of this crop, especially through the introduction of high-yielding varieties. It was found in a study by Al-Jubouri (2006) that there are significant differences between two okra cultivars, Husainawia and an Indian cultivar where the local Husainawia had higher values of all the yield characters traits than the Indian one. Al-Moussaoui (2013) compared two okra cultivars Hussainawia and Btera for their yield characters and showed that Hussainawia plants gave higher averages in number of pods/plant and pod weight than the Btera plants.

Amino acids have an important role in may biological processes, whether they exist in a free from or as a component of proteins, so their importance lies in all stages of plant growth and development as well as making plants more resistant to withstanding some environmental stresses (Hayat *et al.,* 2007).

Therefore, this experiment was conducted to demonstrate the effect of amino acids spraying with the best concentration of two okra cultivars, one of which is local cultivated in Najaf and the other is Clemson from

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Turkey cultivated for the first time in the region and comparing their response to foliar spray with amino acids in terms of plant quantitative and qualitative parameters.

Materials and Methods

The experiment was conducted during the summer growing season of 2019 in a private field in the province of Najaf, Kufa District in. Ten soil samples were randomly taken from the field soil before planting, mixed thoroughly and one representative 250g sample was taken for chemical and physical analysis in the laboratory of soil chemistry at the Faculty of Agriculture/University of Kufa table 1.

Table 1: Physical and chemical characteristics of the experiment greenhouse soil.

pH	E.C. $dS.m^{-1}$	% Organic Matter	Clay	Silt	Sand	Soil texture
			$g.Kg^{-1}$			
7.20	7.5	1.2	230	190	580	Sandy loam

The soil of the field was prepared (tilled, softened and settled) and divided into three 10×50 m lines with 75cm apart from each other. At rate of 200 $Kg.ha^{-1}$ (Al-Obaidi, 1980), fertilizer NPK (5:18:18) was added and buried by banding in a slit along with each planting line. Drip lines were applied on both sides of each planting line. Okra seeds were water soaked for 24h and 3-4 seeds were planted in holes 30 cm apart. Seedlings then were thinned to one plant in each hole. All the crop services and practices were performed as followed in the growing area (Matloub *et al.,* 1989). The experiment was split-plot on Randomized Complete Blocks Design (R.C.B.D.) with three replicates. The main-plot was two okra cultivars (local cultivar Hussainawia and Clemson from Turkey) while the sub-plot was AA at three concentration levels (0, 2 and 4 $ml.L^{-1}$). Plants were sprayed with SA according to each treatment at 40 and 55 day post planting. Each experimental unit was $1.13m^2$ with 9 plants each.

Measurements and statistical analysis

At the end of the experiment (15/8/2019), quantitative characters included number of $pod.plant^{-1}$, pod weight and total yield $tons.ha^{-1}$.

While, qualitative characters in fruits included percentage of mineral element N, percentage of protein and percentage of carbohydrates. Data were statistically analyzed and analysis of variance was performed using the GenStat (12th Edition) statistical computing system. Differences among means were compared based on the Least Significant Test (L.S.D.) at a 0.05 probability level.

Results and Discussion

Results showed that plant yield indicators were affected by plant cultivar and treatment table 2. In case of plant cultivar, the local Hussainawia, regardless of treatment, had always higher values for yield parameters than the Turkey Clemson in all the treatments including the control. Relative to AA treatments, the highest concentration of foliar application resulted in the highest values of all the measured yield parameters for both okra cultivars table 2. The highest values were always recorded in the 4 $ml.L^{-1}$ of AA regardless okra cultivar. Interaction of cultivar and amino acids spray concentration indicate significant effects on yield rate, number of

Table 2: Effect of foliar spray with amino acids AA on quantitative and qualitative parameters of two okra *Abelmoschus esculentus* (L.) Moench cultivars.

quantitative and qualitative parameters	Local cultivar Hussainawia				Clemson from Turkey				L.S.D. ($P \le 0.05$)
	AA concentration levels			Average	AA concentration levels			Average	Cultivars
	Control	2 $ml.L^{-1}$	4 $ml.L^{-1}$		Control	2 $ml.L^{-1}$	4 $ml.L^{-1}$		
No. $pods.plant^{-1}$	51.11	62.49	67.26	60.29	39.43	48.04	51.85	46.44	1.02
Pod weight g	3.75	3.88	4.22	3.89	2.95	3.61	4.00	3.52	0.42
Total yield $tons.ha^{-1}$	1.90	3.79	4.65	3.45	1.05	2.32	2.81	2.06	1.27
percentage of mineral	1.199	1.755	2.094	1.68	0.910	1.132	1.299	1.11	0.205
element N in fruits % percentage of	7.49	10.97	13.09	10.52	5.69	7.08	8.12	6.96	0.72
protein in fruits % percentage of carboh-	8.56	17.21	20.40	15.39	7.00	15.04	17.82	13.29	1.00
ydrates in fruits % Average	12.33	16.68	18.62		9.51	12.87	14.32		
L.S.D. ($P \le 0.05$) AA Concentration	No. $pod.plant^{-1}$= 0.81, Pod weight= 0.20, Total yield= 1.14, Perc. N in fruits= 0.134, Perc. of protein in fruits= 0.65 and Perc. of carbohydrates in fruits= 0.73								
L.S.D. ($P \le 0.05$) Interaction	No. $pod.plant^{-1}$= 1.84, Pod weight= 0.20, Total yield= 1.48, Perc. N in fruits= 0.360, Perc. of protein in fruits=1.00 and Perc. of carbohydrates in fruits= 1.62								

pod.plant^{-1} 67.26, pod weight 4.22 g and total yield 4.65 tons.ha^{-1}, which significantly differed from the control plants of both tested cultivars. Similarly to yield indicators, the results showed that interaction okra cultivar and spraying with AA had also significant effect on qualitative characters. Interaction of Hussainawia and 4 ml.L^{-1} AA resulted in the highest percentage of mineral element N 2.094%, percentage of protein 13.09% and percentage of carbohydrates 20.40% compared AA treatment with Clemson resulted in 0.910%, 5.69% and 7.00%, respectively.

This may be due to genetic differences between the two cultivars (Al-Moussaoui, 2013) beside the higher level of adaptation of the local cultivar to the environmental conditions of the region compared to the Turkish cultivar agreeing with findings of previous study (Al-Jubouri, 2006). This study also showed that plant yield indicators were increased due to AA treatments. This is mostly attributed to amino acids roles in increasing plant content of auxins and cytokines which are responsible of increasing cell division of cells in the root apical meristem (Hayat *et al.,* 2007). Such increase in root growth will be reflected positively on number and weight of leaves and thus carbohydrates synthesis resulting in total yield increase agreeing with findings by Jaafar *et al.,* (2013) in their study on eggplants. It was also found in this study that yield characters and components were increased in both cultivars due to AA treatments. AA compounds were reported to have positive effects and roles in increasing the photosynthesis products and resulting in a surplus in plant content of sugars that available to promote plant floral growth. This will lead to total increase in number of flowers and thus fruits per plant (Hayat *et al.,* 2007). Moreover, abundance in plant content of carbohydrates will defiantly increase their storage in plant pods (fruits) resulting in heavier pod weights (Jabbarzadeh *et al.,* 2009) which in turn will be reflected in total yield increase (Abdullah, 2010).

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