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Effect of organic fertilization with Bactofeed and spraying with boron on the growth and yield of two hybrid okra plants

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Abstract

The experiment was carried out in a field of Agriculture College / University of Karbala during the agricultural season 2024 where it was in 12/4/ 2024 and finished in 10/8/2024 to study the effect of fertilizer combination included eight treatments (0, boron 1 g. L^{-1}, 20 organic fertilizer L-ha^{-1}, 25 organic fertilizer L-ha^{-1}, 30 organic fertilizer L-ha^{-1}, 20 organic fertilizer L-ha^{-1} with boron 1 g. L^{-1}, 25 organic fertilizer L-ha^{-1} with boron 1 g. L^{-1} ,30 organic fertilizer L-ha^{-1} with boron 1 g. L^{-1}) on growth and yield of two okra hybrids, the hybrid of okra were Sultana F1 and Gennext . The experiment was laid out in factorial within randomized complete block design (RCBD) with three replications. The means were compared by using LSD test at probability of 0.05. The results showed that the Gennext hybrid superiority upon Sultana F1 in growth and yield parameters (plant height, number of branches, number of leaves, leaf area, number of pods, average pod weight and total yield). fertilizer combination treatment T7 (30 liters ha^{-1} organic fertilizer + 1 g L^{-1} boron) showed significantly affected in all parameters compared with control. The interaction effect of two hybrids with fertilizer combination ,it clearly indicated that there was significant interaction effect in all parameters under observation (plant height, number of branches, number of leaves, leaf area, number of pods, average pod weight, and total yield), where superior interaction between Gennext with T7 (30 liters ha^{-1} organic fertilizer +1 g L^{-1} boron)which was recorded (139.33cm,11 branches.$plant^{-1}$, 110 leaves.$plant^{-1}$ and 198.80 cm2.$plant^{-1}$, 91.70 pods $plant^{-1}$, 6.91 g. pod^{-1} and 21.95 tons. ha^{-1}) respectively.

Keywords: Bactofeed, boron, growth, yield, Gennext, Sultana F1and okra

Introduction

Okra (*Abelmoschus esculentus* L. Moench) belongs to Malvaceae family. It thought to be native to Africa and is an important crop in tropical and sub-tropical around the world. Okra is a summer vegetable crop. Okra has high nutritional value. Every 100 grams of fresh fruits contains 81.6 grams of water, 36.00 calories, 2.10 grams of

protein, 0.20 grams of fat, 8.20 grams of carbohydrates, 1.70 grams of fiber, 84.00 mg of calcium, 90.00 mg of phosphorus, 1.20 mg of iron, 185.00 micrograms of carotene, 47.00 mg of ascorbic acid, 0.08 mg of riboflavin, 0.04 mg of thiamine and 0.60 mg of niacin [1, 2].Okra has various applications across several industries, including food, pharmaceutical and paper .[3]To improve the growth and yield of the produce , it is necessary to pay attention on the optimum balanced use of nutrients through fertilizer application. Okra requires organic and inorganic nutrient for it's economic yields. fertilizers play a key role in the production of both growth and yield. organic fertilizers have the capability of supplying arrange of nutrients and improving the physical and biological properties of the soil. organic fertilizers are very important for plant, health human and great of clean environment [4,5]. [6]indicated that the effect of experimental treatments containing organic fertilizer led to significantly effected on growth of Okra ,such as plant high and leaves number compared with control [7]. indicated that the effect of experimental treatments containing organic fertilizer led to significantly effected in (number of pods, pod weight, and total yield of Okra , compared with control.[8] indicated that the effect of experimental treatments containing organic manure to significantly effected in growth, quality and seed yield of Okra .plant require mineral elements for normal growth and development such as boron.

Boron plays an important role regulating plant hormones level, increase flowering production, pollen tube elongation, germination and seed and fruit development.[9, 10] indicated that the effect of experimental treatments containing boron led to significantly effected in yield of Okra, such as pod weight and total yield compared with control. [11] indicated that the effect of experimental treatments containing boron led to significantly effected in growth, quality and seed yield of Okra[12] indicated that the effect of experimental treatments containing boron led to significantly effected in growth, yield and quality of Okra
Hybrids plants are very important ,it has several advantages including increase yield, improve diseases resistant ,greater adaptability to different environmental condition [13].

Due to the low production of okra by using the prevailing varieties and the excessive use of chemical fertilizers, the experiment aimed to find out the most suitable treatment of organic fertilizer and Boron for growth and yield of okra with two hybrids.

Materials and Methods

The experiment was conducted in the field of the Department of Horticulture and Landscape Engineering at the College of Agriculture, University of Karbala during the 2024 season to study the effect of organic fertilization with Bactofeed and spraying with boron as boric acid on growth and yield of two okra hybrids. The experiment was laid out in factorial within randomized complete block design (RCBD) with three replications with 16 treatments which were an interaction between tow hybrids of okra Gennext and Sultana F1 with eight treatments of combination between bactofeed with boron , {0, 1 g. L^{-1} boron, 20, 25 and 30 L. ha^{-1} organic fertilizer, 20, 25, 30 L. ha^{-1}

organic fertilizer + 1 g. L^{-1} boron}, symbolized as (T0, T1, T2, T3, T4, T5, T6, T7), respectively

Aggregate soil samples were drowned from experiment field at 30 cm before planting,The result of analysis is presented in table 1.

Table (1): Chemical and physical properties of the field soil and irrigation water

soil analysis		
Characteristics	Unit	Valuable
Reaction Rate	----------	7.39
Electrical Conductivity (EC)	Desi Siemens. M-1	50.8
Available Nitrogen	mg. kg^{-1}	14
Available Phosphorus	mg. kg^{-1}	4.9
Available Potassium	mg. kg^{-1}	63.9
Organic Matter	%	4.1
% Soil Separators	%	Clay 1.8 Grain 47 Sand 51.2
Soil Texture	----------	sandy mixture
Water Analysis		
Reaction Rate (Ph)	----------	6.45
Conductivity (EC)	Desi Simmons. M-1	5.39

Ten plants from each net plot were randomly selected and there were labeled. the plants were used for recording all parameters in respect of growth and yield (plant height, number of branches, number of leaves, leaf area, number of pods, average pod weight and total yield).

Results and Discussion

The growth characterizations

The data present in Table (2) clearly showed that the hybrids and fertilizer combinations played significant role in affecting of growth where Gennext hybrid were superior 0ver sultana F1 in (plant height, number of branches, number of leaves, and leaf area)Which were recorded(129 cm, 7.67 branches.$plant^{-1}$, 90.54 leaves.$plant^{-1}$, and 187.95 cm^2.$plant^{-1}$),respectively superior over Sultana which was recorded(85.21cm,4.92branches.$plant^{-1}$,63.75leaves.$plant^{-1}$,and155.71cm^2.$plant^{-1}$), respectively .

Results showed that the fertilizer combination significantly affected on growth where T7 superior over other treatments where gave highest (plant height, number of branches, number of leaves and leaf area) which was recorded (118.83 cm, 8.33 branches. plant^{-1}, 92.5 leaves. plant^{-1} and 184.78 cm^2.plant^{-1}), respectively.
The minimum results recorded in control which was recorded (99.83 cm, 5.17 branches. plant^{-1},67. 33leaves.plant^{-1}and 153.14 cm^2.plant^{-1}), respectively.

Interaction between fertilizer combination and hybrids played significant role in affecting on growth (plant height, number of branches, number of leaves and leaf area) ,where superior interaction between T7 with Gennext on other interactions which was recorded (139.33cm, 11 branches.plant^{-1}, 110 leaves.plant^{-1} and 198.80 cm^2.plant^{-1})respectively.The minimum(plant height,number of branches, number of leaves and leaf area) was noticed with interaction between control and sultana which was recorded (77.33 cm, 3.33 branches.plant^{-1}, 54.67 leaves.plant^{-1} and 125.44 cm^2.plant^{-1}), respectively A similar finding was also reported by [9,14,15,16,17].

Table (2): Effect of fertilizer combination on growth of two Okra hybrids

Leaf area (cm^2.plant^{-1})	**Number of leaves (leaf.plant^{-1})**	**Number of branches (branch.plant^{-1})**	**Plant height (cm)**	**Treatments**	
				Fertilization combination	hybrid
155.71	63.75	4.92	85.21		H1
187.95	90.54	7.67	129		H2
3.424	3.889	0.92	3.366	L.S.D %	
153.14	67.33	5.17	99.83	T0	
158.74	68	5.67	101.67	T1	
167.49	70.33	5.83	104.33	T2	
174.41	72.67	6.17	105.67	T3	
176.80	77.17	6.33	108	T4	
180.97	81.67	6.33	108.50	T5	
182.31	87.50	6.50	110	T6	
184.78	92.50	8.33	118.83	T7	
6.848	7.779	1.84	6.732	L.S.D %	
125.44	54.67	3.33	77.33	T0	
136.95	55	4.33	80	T1	
148.62	56.67	4.67	82	T2	
160.27	59.67	5	82.33	T3	H1
164.14	66.33	5.33	86.67	T4	
169.45	69.67	5.33	86.67	T5	
170.04	73	7	88.33	T6	

170.75	75	8	98.33	T7	
172.54	80	7	122.33	T0	
180.83	81	7	123.33	T1	
186.37	84	7	126.67	T2	
188.55	85.67	7.33	129	T3	H2
189.47	88	7.33	129.33	T4	
192.49	93.67	7.33	130.33	T5	
194.58	102	7.33	131.67	T6	
198.80	110	11	139.33	T7	
9.685	11.001	2.602	9.52	L.S.D %	

The Yield

The data present in (Table 3) clearly showed that the hybrids and fertilizer combinations played significant role in affecting on yield where Gennext hybrid were superior 0ver sultana F1 in (number of pods. plant^{-1}, pod weight.gm; pod^{-1}, and total yield. Ton ha^{-1}) which was recorded (71.40 pods. plant^{-1}, 5.72 gm.pod^{-1} and 14.33 tons ha^{-1}), respectively. superior over Sultana which was recorded (53 pods. plant^{-1}, 4.99 gm.pod^{-1}, and 9.19 tons. ha^{-1}), respectively

Results showed that the fertilizer combination significantly affected on yield parameter , where T7 superior over other treatments where gave highest (number of pods, pod weight and total yield) which was recorded (75.70 pods.plant^{-1}, 6.08 g pod^{-1} and 16.42 tons.ha^{-1}) compare with control, where gave lowest results which was recorded (54.2 pods.plant^{-1}, 4.88 g. pod^{-1} and 9.25 tons.ha^{-1}), respectively .

Interaction between fertilizer combination and hybrids played significant role in affecting on yield (number of pods, pod weight and total yield), where superior interaction between T7 with Gennext on other interactions which was recorded (91.70 pods plant^{-1}, 6.91 g. pod^{-1} and 21.95 tons. ha^{-1}), respectively. The minimum (number of pods, pod weight and total yield) was noticed with interaction between control and sultana which was recorded (47 pods plant^{-1}, 4.50 g. pod^{-1} and 7.32 tons. ha^{-1}), respectively A similar finding was also reported by [4,9,14,15,16,18,19].

Table (3): Effect of fertilizer combination on yield of two Okra hybrids

Total yield (tons.ha^{-1})	**Average pod weight (g)**	**Number of pods (pod.plant^{-1})**	**Transactions**	
			Fertilization combination	Hybrid
9.19	4.99	53		H1
14.33	5.72	71.40		H2
1.393	0.316	5.990	L.S.D %	
9.25	4.88	54.20	T0	
9.75	4.95	55	T1	

10.75	5.20	58.20	T2	
10.95	5.23	59	T3	
11.94	5.38	61.70	T4	
12.74	5.49	64.81	T5	
13.93	5.62	68.80	T6	
16.42	6.08	75.70	T7	
2.787	0.633	11.970	L.S.D %	
7.32	4.50	47	T0	H1
7.76	4.56	47.70	T1	
9.15	5.05	50.70	T2	
9.35	5.06	52	T3	
9.55	5.07	53.70	T4	
10.15	5.20	55	T5	
10.75	5.23	58	T6	
11.15	5.25	59.70	T7	
11.54	5.27	61.30	T0	H2
11.94	7.34	62.32	T1	
12.54	5.35	65.70	T2	
12.54	5.41	66	T3	
14.13	5.70	69.70	T4	
15.33	5.79	74.71	T5	
17.12	6.01	79.73	T6	
21.95	6.91	91.70	T7	
3.983	0.896	16.930	L.S.D %	

The superiority of hybrid H2 over hybrid H1 in growth and yield indicators may be due to genetic factors as well as the plants' ability to adapt to environmental condition, leading improved growth and yield indicators which are controlled by the interaction between environmental and genetic factors. Hybrids crops tend to be more uniform in size and maturity which can be beneficial for commercial growers, grater vigor , resulting in faster growth, large size, stronger plants and reduce plant stress that is lead to improve growth and yield indicators. [21]

The integrated of organic fertilizer such as Bactofeed combination with Boron was found significant in improving the overall plant growth and yield. Organic fertilizer play significant role in growth and crop production and soil health by improving physical, chemical, biological function in the soil and promote microbial activity. Vital roles of organic matter especially of organic carbon which improves soil fertility, nutrients availability ,reduce nutrient losses and soil health [5 , 20] .additionally bactofeed contains Nitrogen and Potassium. Nitrogen is an essential macronutrient that's play an important for protein production ,it plays a pivotal role in many critical function (such as photosynthesis) in the plant and is a major component of amino acid ,formation of protoplast ,the site of cell division and plant growth .Nitrogen is necessary for

enzymatic reactions in plants .It is necessary component of several vitamins and Nitrogen is part of the nucleic acid(DNA and RNA) that's lead to improve growth and yield parameter.

Potassium is an essential macronutrient that plays functions mainly on regulation and maintenance of electrochemical equilibrium in cells and other compartment and regulation of enzyme activities .it also involved in carbohydrate metabolism, regulation of activities of various essential elements, adjustment of stomata functions and water relations. Potassium is very important for regulation of water and nutrient movement, promote growth, flowering and fruiting that's lead to improve growth and yield indicators.

In addition bactofeed contains bacterial solution can make nutrient nitrogen and phosphorus more accessible to plant, nitrogen fixation that's lead to root growth that's leading to a more extensive and efficient root system, some bacteria can help plants better tolerate drought conditions by improving water uptake and reducing water loss and can help plant withstand extreme temperature which plays a role in improvement of nutrient absorption and enhance the plant ability to produce the hormones such as IAA and GA3 , also produce organic acids that dissolve phosphorous [16].

Boron is an essential micronutrient that plays a vital role in various plant function its plays an important role regulating plants hormones level , sugar transport, increase flower production, pollen tube elongation, germination and seed ,fruit development[9] and also formation of cell walls, providing structural support and rigidity to plant cells, carbohydrate metabolism and enzyme activity [22] which in turn might have involved in cell division, photosynthesis, metabolism of carbohydrate, regulating proper translocation and stimulated enzyme activity that's leading to increase the rate of growth and yield character .application of organic fertilizer with boron which might have accelerate the vigorous growth and increase flower ,set flower ,fruit per plant and total yield of two hybrid of okra.

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