



PROMOTION OF THE GROWTH AND YIELD OF OKRA (GREEN VELVET CULTIVAR) BY USING DIFFERENT LEVELS OF HUMI MAX(ORGANIC LIQUID FERTILIZER)

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Abstract

The current study was conducted to examine the stimulus of Humi Max (an organic liquid fertilizer) to the productivity and growth of okra plants (Green velvet cultivar). A field experiment was carried out in a local farm in Karbala in 2018-2019 season to achieve the aim above. The experiment was included two main factors and designed using RCBD with three replicates, the first factor was concentrations of humi max (0, 4, 8 and 12 ml.L⁻¹) and the second was the number sprayings (once, two times and three times). Results showed that the spraying of organic fertilizer was improved vegetative growth (plant height, dry weight of total vegetative) and the productivity (fruit number in each plant, fruit weight, and yield in each plant and total productivity) and the effect on studied traits was enhanced when both concentration and sprayings number increased. Results also showed that the interaction between studied factors was significant when spraying okra plants three times by 12 ml.L⁻¹ of humi max which gave higher values of examined traits (1.65 m.plant⁻¹, 61.43gm.plant⁻¹, 82.94 fruit.plant⁻¹, 4.85 gm, 402.25 gm.plant⁻¹ and 25.81 ton.h⁻¹) respectively.

Key words: *Hibiscus esculentus*, Humi Max, vegetative traits, organic fertilizer.

Introduction

Okra (*Hibiscus esculentus* L.) is an important vegetable plant that belongs to Malvaceae and it is planted in summer season in Iraq. It is originally grown in Central Africa, Ethiopia, Eritrea, Sudan and Egypt then from there spreads to Mediterranean region, Arabia-Peninsula and India (Matlop *et al.*, 1989). Okra fruits contain some important nutrients such as phosphorous, calcium, carbohydrates, protein and vitamin C (Al-Mohamady and Almishal, 1987). It is also used as a raw material in some industries and in canning, the sticky gel is extracted from roots and stems which used to filter sugar cane juice or in the manufacture of soaps and its flowers are used for medicinal purposes after boiling them (Chakravarty, 1976). The use of humic fertilizers is become very common to avoid the negative effects from using synthetic fertilizers that work to cause major problems such as pollution of groundwater with residues of these fertilizers as well as increasing the content of vegetables products from nitrates which cause negative effects on human and animal health (Al-Redhaiman, 2004). Humic

fertilizers contain some organic acids that have vital effect on availability of plant micronutrients which affect plant growth significantly. Faust, (1998) mentioned that humic fertilizers facilitate the movement of mineral elements and split cells of plant which result in increasing productivity. Another study by Yildirim, (2007) found that the best plant height, dry weight of total vegetative and fruit weight occurred in tomato plants when it treated with 20ml.L⁻¹ humic acid by spraying on leaves compare to control treatment (water only). While after one month of spraying pepper with 20ml.L⁻¹ humic acid gave the highest fruit weight and yield (Yasar, *et al.*, 2009). The nutritional and medicinal importance of okra has made it necessary to find modern agricultural methods to increase vegetative growth and productivity qualitatively.

Materials and Methods

A field experiment was carried out in a local farm in Karbala in 2018-2019 season. Ten random samples were taken from 0-30cm depth of field soil surface then mixed together after that, the chemical and physical characteristics of these samples and well water. Humi Max (Leili Agrochemistry Co., Ltd. China) was used

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which contains 12% humic acid, 6% Fulvic acid and micronutrients (Fe, Zn, Mn and Cu). Local seeds of okra (Green velvet cultivar) were tested for the percentage of germination and recorded 92% germinated seeds. Field was prepared by tilling and levelling the soil then the area was divided into three lines, 56m length and 50cm width for each line then 5:18:18 of NPK fertilizer 200kg.d⁻¹ was added (AlObadi, 1980). Fertilizer was added to plants on rows, the distance between these rows was 75 cm then drip irrigation pipes were put in both sides of raw. An incision was made in the top of the row then three seeds were planted in each incision, after the emergence of seedlings, plants were thinned to one plant and the distance between each plant was 30cm. Concentrations of liquid organic fertilizer were prepared by taken 4ml then volume completed to 1L by distal water to get 4ml.L⁻¹ then 1ml.L⁻¹ of washing liquid was added as a diffuse substance (Al-Sahaf, 1989). Vegetative growth was sprayed three times during the season, the first spray was done after 21 days of swing seeds then other sprayings were applied after two weeks. The experiment was included two main factors and designed using RCBD with three replicates, the first factor was concentrations of humi max (0, 4, 8 and 12 ml.L⁻¹) and the second was the number sprayings (once, two times and three times). Each experimental unit was 3m length and 0.75m in width with 20 plants. Differences between means were compared using Duncan's Multiple Range Test at 0.05 (AL-Rawi and Khalf, 2000).

5 plants were taken randomly from each experimental unit then the following traits were studied:

- 1- Plant height (m.plant⁻¹) was measured from soil surface until the top of plant.
- 2- Dry weight of total vegetative (gm.plant⁻¹) estimated after drying in electric oven at 70°C for 48h then samples were weighted in sensitive scale.
- 3- Fruit number (fruit.plant⁻¹)
- 4- The weight of each fruit (gm).
- 5- The yield of each plant (gm.plant⁻¹).
- 6- Total yield (ton.h⁻¹).

Results and Discussion

Total vegetative traits

Results of Table 1 and 2 showed that there were significant effect of spraying liquid organic fertilizer on plant height and dry weight of total vegetative. 12ml.L⁻¹ treatment gave the highest value of plant height and dry weight which recorded 1.52m.plant⁻¹ and 55.89gm.plant⁻¹ respectively compare to lowest value 1.32m.plant⁻¹ and

Table 1: The effect of spraying organic fertilizer and the number of sprayings and their interaction on the average of plant height (m.plant⁻¹).

Sprayings number	Concentration of liquid organic fertilizer (ml.L ⁻¹)				Mean of sprayings number
	0	4	8	12	
One Spray	1.21g	1.26c	1.35d	1.44a	1.31b
Two sprayings	1.21g	1.31b	1.42cd	1.52c	1.37c
Tree sprayings	1.21g	1.38e	1.49a	1.60b	1.42a
Fertilizer mean	1.21d	1.32c	1.42b	1.52a	

*Means that have similar letters refer to no significant difference in Duncan test.

Table 2: The effect of spraying organic fertilizer and the number of sprayings and their interaction on the average of dry weight of total vegetative of okra plants(gm. plant⁻¹).

Sprayings number	Concentration of liquid organic fertilizer (ml.L ⁻¹)				Mean of sprayings number
	0	4	8	12	
One Spray	31.53h	38.17f	43.29de	50.46abc	40.81b
Two sprayings	32.73h	43.58fe	47.60cd	55.78ab	44.92c
Tree sprayings	33.12h	47.81e	51.35bc	61.43a	48.42a
Fertilizer mean	32.40d	43.18c	47.41b	55.89a	

*Means that have similar letters refer to no significant difference in Duncan test.

32.40gm.plant⁻¹ in control treatment. Results also showed significant effect when increasing sprayings number in both plant height and dry weight of total vegetative when three times spraying treatment gave higher plant height and dry weight and recorded 1.42m.plant⁻¹ and 48.42gm.plant⁻¹ in comparison with 1.31 and 40.81 in control treatment (one spraying only). The reason of this increasing may because that humic fertilizers are rich of nitrogen and phosphorous which synthesize nucleic acids DNA and RNA, proteins and enzymatic companions that contribute to increase cell division and activate biological processes of plant which led to increasing vegetative growth (Shaheen *et al.*, 2007). The interaction between treatments of spraying organic fertilizer and the number of sprayings had significant effect on plant height and dry weight when the spraying with 12ml.L⁻¹ treatment three times gave the highest values 1.6m.plant⁻¹ and 61.43gm.plant⁻¹ compare to 1.21 and 31.35 in control (one spraying with water only).

Yield and its contents

Table 3 showed that there was significant effect on fruit numbers between plants treated with different concentration of liquid organic fertilizer when 12ml.L⁻¹ treatment exceeded other treatments and gave 76.37 fruit.plant⁻¹ compare to 47.46 fruit.plant⁻¹ in control. There

Table 3: The effect of spraying organic fertilizer and the number of sprayings and their interaction on fruits number (fruit.plant⁻¹).

Sprayings number	Concentration of liquid organic fertilizer (ml.L ⁻¹)				Mean of sprayings number
	0	4	8	12	
One Spray	46.76b	57.55c	62.63h	96.81j	59.18b
Two sprayings	47.29b	63.47d	66.49f	76.37a	63.40c
Tree sprayings	48.53b	67.23bc	71.75e	82.94i	67.56a
Fertilizer mean	47.46d	62.57c	66.95b	76.37a	

*Means that have similar letters refer to no significant difference in Duncan test.

were also significant differences between the numbers of sprayings when spraying plants three times with the organic fertilizer gave 67.56 fruit.plant⁻¹ compare with 59.18 fruit.plant⁻¹ in control. This may occurred due to the contribution of nutrients in the organic fertilizer to increase the activity of enzymes in plants which led to increase fruits number. The interaction between spraying organic fertilizer and the number of sprayings had significant effect on fruits number when spraying plants with 12ml.L⁻¹ treatment three times gave 82.94 fruit.plant⁻¹ compare to 46.76fruit.plant⁻¹ in control.

Results of table 4 showed that there was significant effect of spraying organic fertilizer on the average of fruit weight. 12ml.L⁻¹ treatment gave the highest value of fruit weight 4.60gm compare to 2.43gm in the control treatment. The numbers of spraying also had significant effect when three times treatment gave 3.43gm in comparison with 3.26gm in control. This may be because the role of micronutrients in humic acid (Fe, Zn, Cu and Mn) to increase photosynthesis in the vegetative parts which led to increase carbohydrates in fruits (Al-Sahaf, 1989). These results are in agreement with Padem *et al.*, (1999) who found that spraying eggplant and pepper with 12ml.L⁻¹ three times gave best fruit weight 4.85gm compare to 2.31gm in interaction control (spraying water only).

Table 4: The effect of spraying organic fertilizer and the number of sprayings and their interaction on the average of fruits weight (gm).

Sprayings number	Concentration of liquid organic fertilizer (ml.L ⁻¹)				Mean of sprayings number
	0	4	8	12	
One Spray	2.31f	2.81d	3.59e	4.33j	3.26b
Two sprayings	2.44f	3.05b	3.79h	4.62k	3.47c
Tree sprayings	2.56f	3.34c	4.12a	4.85i	3.71a
Fertilizer mean	2.43d	3.06c	3.83b	4.60a	

*Means that have similar letters refer to no significant difference in Duncan test.

Results of table 5 and 6 showed significant effect of spraying humi max on the yield of each plant and total yield and the highest average of them occurred when spraying 12ml.L⁻¹ which gave 352.44gm.plant⁻¹ and 22.77ton.h⁻¹ compare to 115.72gm.plant⁻¹ and 11.08ton.h⁻¹ in control treatment. Sprayings number also had significant effect on the above traits when three times spraying treatment gave 261.54gm.plant⁻¹ and 18.61ton.h⁻¹ respectively in comparison with 199.20 and 14.35 in control. The increasing of concentrations of the organic acid and the number of sprayings was increased the productivity which is in consistent with (Yildirim, 2007; Yasar *et al.*, 2009) results on tomato and pepper. The interaction between spraying organic fertilizer and the number of sprayings had significant effect on the yield of each plant and total yield when spraying plants with 12ml.L⁻¹ treatment three times gave 402.25gm.plant⁻¹ and 25.81ton.h⁻¹ compare to 108.01 and 10.43 in control.

Table 5: The effect of spraying organic fertilizer and the number of sprayings and their interaction on the yield of each plant (gm.plant⁻¹).

Sprayings number	Concentration of liquid organic fertilizer (ml.L ⁻¹)				Mean of sprayings number
	0	4	8	12	
One Spray	108.01k	161.71e	224.84b	302.27j	199.20b
Two sprayings	115.38f	193.58d	251.99c	352.82i	228.44c
Tree sprayings	123.77g	224.54h	295.61a	402.25l	261.54a
Fertilizer mean	115.72d	193.27c	257.48b	352.44a	

*Means that have similar letters refer to no significant difference in Duncan test.

Table 6: The effect of spraying organic fertilizer and the number of sprayings and their interaction on total yield (ton.plant⁻¹).

Sprayings number	Concentration of liquid organic fertilizer (ml.L ⁻¹)				Mean of sprayings number
	0	4	8	12	
One Spray	10.43k	12.67e	15.18b	19.15j	14.35b
Two sprayings	11.12f	14.40d	17.56c	23.37i	16.61c
Tree sprayings	11.71g	16.23h	20.69a	25.81l	18.61a
Fertilizer mean	11.08d	14.43c	17.81b	22.77a	

*Means that have similar letters refer to no significant difference in Duncan test.

From the current study, it can be concluded that spraying Humi Max on vegetative of okra plants at 12ml.L⁻¹ concentration was improved the growth traits and total productivity.

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