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Effect of Humic Acid on Some growth Characteristics and Green Yield of Two Hybrids of Broad bean (*Vicia faba* L.)

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Abstract: The experiment was conducted at the agricultural research station of the College of Agriculture- University of Basrah in 2018-2019 season in sandy loam soils in order to study the effect of three concentrations of humic acid (0, 2 and 4 $g.L^{-1}$) on the growth and yields of two hybrids of Broad bean ("Rico and Rama F1"). Split Plot Design by Randomized Complete Block Design (R.C.B.D) with three replications, and the least significant difference test (L.S.D) was used to compare averages at a probability level of 0.05. The most important results obtained are: The hybrid "Rico" is gave a significant increase in the number of branches.$Plant^{-1}$, the percentage of flowering in addition to the average weight of the pod, while the hybrid "Rama F1" gave a significant increase in the number of flowers and pods.$Plant^{-1}$, weigh of pod.$Plant^{-1}$ (259.3 gm) in addition to the total yield (24.34 tons.ha^{-1}). Humic acid concentrations 2 and 4 $g.L^{-1}$ gave a significant increase in number of leaves.$plant^{-1}$, leaf area, soft weight of vegetative, number of flowers.$plant^{-1}$, number of pods.$plant^{-1}$, average weight of pod, yield. $Plant^{-1}$ (259.9 g) in addition the total yield (24.40 tons.ha^{-1}), while control treatment gave a significant increase in the percentage of ripening flowers. The interaction between humic acid and hybrids had significant increase in all characters in the study except the percentage of ripening flowers.

Key words: *Vicia faba* L., Humic acid, Hybrids, Green pods.

Introduction

Plant broad bean (*Vicia faba* L.) a winter annual considers an Important yield of a plant of the legume family (Fabaceae). It's the third most important legume plant after soybeans and peas (Singh *et al*., 2013). Broad bean cultivated for green pods, dry and soft seeds are used in cooking because they are highly nutritious and important because their seeds contain a high protein content of about 25-40% of dry weight (Al-Asawi, & Kharbit, 2011), and a good source of many nutrients such as K, Ca, Mg and Fe (Lizarazo *et al*., 2015; Longobardi *et al*., 2015), as well as every 100g of green seed content 72.1 g water, 17.8 g total carbohydrates, 2.2 g fiber, 0.4 g fat, 1.1 g ash, 37 mg iron, plus vitamins A, B1, B2, and C (Hassan, 2002). In addition, the seeds also contain many biologically active compounds such as polyphenols (Turco *et al*., 2016) and carotenoids (Neme *et al*., 2015).

The statistics referred that the production world of broad bean reached 4.46 million tons, China was superior in world production with 1.61 million tons (FAO STAT, 2017).

Recent studies are geared towards increasing production efficiency through experimenting with the cultivation of good genotypes with high productivity and good quality appropriate to the conditions of agriculture areas. A study was carried out of twenty broad bean varieties by Gurmessa (2018) in Ethiopia, found the four varieties ("Obse, Gachana, Ashange and Dedia") had significant increase in the length of the pod, the number of pods.plant^{-1}, the number of seeds.pod^{-1}, the weight of 100 Seed as well seed yield.

In addition, natural and organic materials can be used as Soil amendments, including humic materials. Humic acid is one of the most economical commercial products and is fast and harmless to humans, animals and plants (Anonymous, 2005). In addition, humic acid improves soil fertility and increases nutrient readiness as well as improving or reducing the negative effect of saline stress (El-Hefny, 2010). There are many studies in the use of humic acid compounds in improving plant growth and yield. Ayman *et al*. (2009) in study as four concentrations of humic acid (0, 1000, 2000 and 3000 mg.L^{-1}) on broad bean plants (Giza 3 cultivar) found that 2000 ml. L^{-1} gave a significant increase in plant height, number of branches, number of leaves, soft weight of vegetative, the number and weight of the pods as well the number of seeds.

This study was conducted with the aim of investigating the effect of humic acid on growth and yield of broad bean hybrids.

Materials & Methods

The experiment was carried out during 2018-2019 in Agriculture Reasarch station, College of Agriculture, University of Basrah in sandy loam soils in order to study the effect of three concentrations of humic acid (0, 2 and 4 g.L^{-1}) on the growth and yields of two hybrids of broad bean ("Rico and Rama F1". Factorial experiment within Randomized Complete Block Design (R.C.B.D.). Split Split-Plot Design with three replications, the hybrids was considered the main factor (Main-Plot) and the addition of humic acid secondary factor (Sub-Plots) to include 18 experimental units, and the least significant difference test (L.S.D) was used to compare averages at a probability level of 0.05 (Al- Rawi & Khalaf Allah, 1980).

The land was divided into three sections for each section of two ridges with 25 m length and 75 cm between ridges. Broad bean seeds were soaked in water for 24 hours and planted on two sides of the ridges at 25 cm between on 18 October 2018. After 35 days of germination addtion humic acid were done and after 15 days later the second and third addition was done.

The following measurements were taken for five plants from each experimental unit: plant height (cm), number of leaves. plant $^{-1}$, leaf area, plant $^{-1}$ (cm ^{2}), is calculated according to the weight method (Watson and Watson ,1953). number of branches. Plant $^{-1}$, soft weight of vegetative (g), number of flowers and pods.Plant^{-1}, percentage of ripening flowers, weigh of pod.Plant^{-1}, yield. Plant^{-1} (g) in addition the total yield (ha^{-1}).

Results & Discussion

Table (1) showed that no significant effect of humic acid in plant heigh and number of branches, while 2 and 4 g.L^{-1} concentrations gave a significant higher in number of leaves and leaf area compared to the distilled water, while 4 gm.L^{-1} concentration exceeded in the fresh weight of the vegetative, and the concentration of 2 gm.L^{-1} had no significant

effect with the other two concentrations. The hybrid "Rico" gave a significant increase in the number of branches.Plant^{-1}, exceeded "Rama F1", while the hybrids had not gave any significant effect on height of the plant, number of leaves, leaf area in addition the soft weight of the total vegetation. The interaction between "Rico" hybrid with a concentration 2 g.L^{-1} humic acid gave a significant in height of plant reached 72.7 cm and the same hybrid with the concentration 4 g.L^{-1} exceeded in number of leaves (242.9 leaves), leaf area (17014 cm^2), number of branches.plant^{-1} (10.20 branches), compared to lowest height (62.5 cm), number of leaves (189.6 leaves) and leaf area (11840 cm^2) resulted in the "Rama F1 " hybrid with 0 g.L^{-1} humic acid, and the lowest number of branches was 9.13 branches produced in "Rama F1 " hybrid with 4 g, The hybrid "Rama F1" with 4 g.L^{-1} gave a significant increase in total weight of the vegetative (467.9 g) compared to 370.4 g produced in the same hybrid interaction with 0 g.L^{-1} humic acid.

Table (1): The effect of humic acid on Some growth Characteristics of two hybrids of broad bean.

Treatment and Concentration		Plant height (cm)	Leaves number	Leaf Area (cm^2)	stem number. Plant^{-1}	Fresh vegetative weight the
Humic acid gm.l^{-1}	0	63.9	172.1	4705	9.43	377.6
	2	70.7	205.7	5817	9.57	405.0
	4	70.3	212.7	5478	9.67	464.6
L.S.D 0.05		N.S	7.88	523.6	N.S	41.18
Hybrids	Rico	69.5	203.3	5761	9.78	412.2
	Rama F1	67.1	190.4	4906	9.33	419.3
L.S.D 0.05		N.S	N.S	351.1	0.38	N.S
Rico	0	65.4	168.6	4497	9.47	384.7
	2	72.7	208.1	6570	9.67	390.5
	4	70.3	233.1	6215	10.20	461.4
Rama F1	0	62.5	175.7	4914	9.40	370.4
	2	68.6	203.3	5064	9.47	419.6
	4	70.3	192.3	4742	9.13	467.9
L.S.D 0.05		7.84	12.45	618.4	0.81	58.01

Table (2) showed that a significant effect of humic acid and hybrids in all the traits of the product under experiment, the 2 and 4 g.L^{-1} concentrations gave a significant increase in number of flowers.Plant^{-1} (67.17 and 71.12 flowers), number of pods.Plant^{-1} (13.79 and 13.51 pods), average weight of the pod (19.02 and 19.24 g), yield per plant (261.8 and 259.9 g) and total yields (24.40 and 24.57 ton.ha^{-1}), respectively, while 0 g.L^{-1} humic acid treatment significantly exceeded in the percentage of ripening flowers (21.71%). As for the hybrids, the hybrid "Rama F1" exceeded "Rico" significantly in the number

of flowers. Plant^{-1} (70.81 flowers), number of pods.Plant^{-1} (14.14 pods), yield per plant (259.3 g) and total yields (24.34 ton.ha^{-1}). "Rico" gave a significant increase in percentage of ripening flowers (20.82%) and average pod weight (18.99 g).

The interaction between both factors was significant in all traits except Percentage of flowering contract, The hybrid "Rama F1" treated at 4 gm.L^{-1} humic acid were significantly higher in number of flowers.Plant $^{-1}$ (75.92 flowers), yield per plant (269.4 g) and total yields (25.29 ton.ha^{-1}), while the hybrid plants "Rama F1" treated with concentration 2 gm^{-1} in the number of pods.Plant^{-1} (14.53 pods) compared to the hybrid plants "Rico" with not treatment with humic acid that gave less values in the number of flowers (57.00), number of pods.plant^{-1} (12.00), yield per plant (221.3 gm) and total yields (20.77 ton.ha^{-1}), while the hybrid plants "Rico" interaction with 2 g.L^{-1} humic acid significantly higher in the average weight of the pod (19.76 g) compared to 17.35 gm produced in hybrid plants "Rama F1" not treated with humic acid, showed that the interaction of humic acid and hybrids had not a significant effect in the percentage of ripening flowers.

This increase may be attributed to the positive effect of the nutrients present in humic acid on plant growth by increasing the permeability of cell membranes, stimulating enzymatic reactions, cell division, cell elongation, increasing production of plant enzymes, and stimulating intracellular vitamins (Pettit, 2003) which helped stimulate absorption of existing nutrients in the soil (Arancon *et al*., 2006). which helped increase vegetative growth which reflected on flowering and yield. These results are consistent with those of Ayman *et al*. (2009) and Shafeek *et al*. (2013).

Table (2): The effect of humic acid on green yield of of two hybrids of broad bean.

Treatment and Concentration		Flowers Number. Plant^{-1}	Pods Number. Plant^{-1}	pod Weight (g)	Yield per plant (g)	Total yields (ton.ha^{-1})
Humic acid gm.l^{-1}	0	60.33	10.08	14.69	148.1	10.43
	2	67.17	10.61	16.02	170.0	11.97
	4	71.12	10.89	16.24	176.9	12.45
L.S.D 0.05		4.88	0.46	0.61	11.49	0.81
Hybrids	Rico	61.61	9.81	15.96	156.6	11.02
	Rama F1	70.81	11.31	15.34	173.5	12.21
L.S.D 0.05		3.29	0.57	0.13	7.90	0.56
Rico	0	57.00	9.20	15.04	138.3	9.74
	2	61.50	10.05	16.76	168.5	11.86
	4	66.33	10.13	16.07	162.8	11.46
Rama F1	0	63.67	11.00	14.35	157.9	11.12
	2	72.83	11.22	15.28	171.5	12.07
	4	75.92	11.63	16.41	190.9	13.44
L.S.D 0.05		5.74	0.59	0.71	13.59	0.96

Conclusions

Broad bean can be grown better in saline soil when added soil with humic acid fertilizers, in which Broad bean plants were shown vigorous vegetative growth (leaf number and leaf area) and yields (Yield plant, Total yields) compared to control.

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