



# EFFECT OF SOIL APPLICATION SEAWEED ALGA-600 AND FOLIAR FERTILIZER BLACK FORCE ON GROWTH, YIELD, AND QUALITY OF BROAD BEAN

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## Abstract

The study was carried out in vegetable farm, Horticulture and Landscape Design Department, College of Agriculture and Forestry, Mosul University, during the growing season 2017/2018 to study the effect of seaweed extract Alga-600 as soil application, 2kg/ha., and spraying twice with different concentrations, Zero, 2, 3 ml/l. of organic fertilizer black force on vegetative growth and yield of broad bean plant.

Results revealed that Alga-600 and Black force have a positive effect on the most studied characters. Results indicated that Black force gave the best results and more effective than Alga-600, plant sprayed with 2ml/l. gave a high significant yield 3.31 ton/ha. Of green seeds. The interaction treatments were differed significantly in the studied parameters.

**Key words:** Alga-600, black force, Broad bean, Seaweed, Legumes.

## Introduction

Broad bean *Vicia faba* L. belong to Fabaceae family, it's cultivate as green / or dry seeds yield (Hasan, 2011), green pods and green seeds consumed (Morton, 1976). Broad bean makes the human body healthy, that is due to broad bean is nutritionally important vegetable crops which containing 20-30% protein (Anon, 2005). Broad bean in turn plays an important role in the improving soil fertility, through nitrogen fixation in a soil (Kandil, 2007), in addition to the biological effects, resulted from the activation of Rhizobia bacteria (Chafi and Bensultan, 2009). In recent years, world going to organic agriculture by using the organic fertilizers, which is consider as natural sources. Researchers were found that soil application of organic fertilizer is better than foliar applications, that may be due to the less environment pollution. Seaweed extracts are consider as one of the natural organic fertilizers, Alga-600 is a seaweed extract, which have many uses and advantages in horticulture, especially vegetable crops e.g. potato, garlic, cowpea, broad bean and pea. El-shamary (2011) found that cowpea plants treated with Alga-600 gave a significant increase in vegetative growth and yield. In broad bean plants treated with Alga-600, resulted an excess in the number of pods per plant, it gave the highest yield (Ayed, 2011). Pea plant

applied with Alga-600 at 0.5 ml/l. caused a significant increase in the number of days to flowering, also resulted a significant increase in pods/plant, pod weight, pods yield /plant and total yield and so in protein and nutrient content (El-Nagar *et al.*, 2013). Tarek and Hasan (2014) found that spraying garlic plants with seaweed Alga-600 caused excess in the number of leaves/plant. Researcher found that the organic fertilizers have a positive effect on plant growth and development. Plants have a quick response to organic fertilizers application, may be that due to easy to absorb from treated plants. The organic fertilizers also consider a good source of nutrients, in turn plays a role in plant nutrition, finally the treated plants will be strong and healthy. This research aimed to study the effect of Alga-600 as soil application and black force as foliar application on vegetative growth, yield and quality of broad bean crop.

## Materials and Methods

This study was conducted at the vegetable field hort. and landscape design / College of agriculture and forestry / University of Mosul during the growing season 2017/2018. Broad bean seeds of Spanish *cv.* Luz De Otono was planted on 26/11/2017, using beds 2.5m. length, 1.5m. width, 30cm. the distance between each other. Plants were applied with 2 kg/ha. of the seaweed Alga-600 as

**Table 1:** Effect of soil application of seaweed and foliar application organic fertilizer on plant height (cm) of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	44.33 d	60.00 a	56.00 abc	53.44 a
	twice	49.66 bcd	58.35 ab	53.66 abcd	53.88 a
---	Once	48.50 cd	55.00 abc	50.33 bcd	51.27 a
	twice	51.33 abcd	55.00 abc	51.33 abcd	52.55 a
		Number of spraying X levels			Mean effect of number of spraying
	Once	46.41 c	57.50 a	53.16 ab	52.36 a
	twice	50.50 bc	56.66 ab	52.50 abc	53.22 a
		Seaweed X Levels			Mean effect of seaweed
	+	47.00 c	59.83 a	54.83 ab	53.66 a
	---	49.91 bc	55.00 ab	50.83 bc	51.91 a
	Mean effect of levels	48.45 c	53.08 a	52.83 b	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

**Table 2:** Effect of soil application of seaweed and foliar application organic fertilizer on number of branches /plant of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	3.50 c	4.66 abc	4.00 c	4.05 ab
	twice	3.75 c	5.33 ab	4.33 bc	4.43 a
---	Once	4.33 bc	5.5 a	3.50 c	4.44 a
	twice	3.5 c	3.5 c	3.66 b	3.55 b
		Number of spraying X levels			Mean effect of number of spraying
	Once	3.92 b	5.08 a	3.75 b	4.25 a
	twice	3.63 b	4.42 ab	4.00 b	4.01 a
		Seaweed X Levels			Mean effect of seaweed
	+	3.63 c	5.00 a	4.17 bc	4.26 a
	---	3.92 bc	4.50 ab	3.58 c	4.00 a
	Mean effect of levels	3.77 b	4.75 a	3.88 b	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

**Table 3:** Effect of soil application of seaweed and foliar application organic fertilizer on leaf area (cm<sup>2</sup> /plant) of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	2311.0 d	6809.0 bc	5661.0 c	4927.2 c
	twice	5950.0 c	11212.0 a	6314.0 bc	7825.5 a
---	Once	6358.0 bc	5440.0 b	4980.0 c	6592.6 ab
	twice	5627.0 c	5461.0 c	5072.0 c	5386.5 bc
		Number of spraying X levels			Mean effect of number of spraying
	Once	4334.5 b	7624.7 a	5322.5 b	5759.9 a
	twice	5788.5 b	8336.0 a	5693.1 b	6605.0 a
		Seaweed X Levels			Mean effect of seaweed
	+	4130.8 d	9010.4 a	5987.6 bc	6376.2 a
	---	5992.2 bc	6950.3 b	5026.1 cd	5989.5 a
	Mean effect of levels	5061.5 b	7980.3 a	5506.8 b	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

**Table 4:** Effect of soil application of seaweed and foliar application organic fertilizer on number of pods /plant of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	4.00 bcd	4.33 abc	4.83 ab	4.39 a
	twice	4.00 bcd	5.00 a	4.25 abcd	4.42 a
---	Once	3.750 cd	5.00 a	3.75 cd	4.17 ab
	twice	4.00 bcd	4.00 bcd	3.33 d	3.78 b
		Number of spraying X levels			Mean effect of number of spraying
	Once	3.88 c	4.67 a	4.29 abc	4.28 a
	twice	4.00 c	4.50 ab	3.79 c	4.10 a
		Seaweed X Levels			Mean effect of seaweed
	+	4.00 bc	4.67 a	4.54 ab	4.40 a
	---	3.88 c	4.50 ab	3.54 c	3.97 b
	Mean effect of levels	3.93 b	4.58 a	4.04 b	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

**Table 5:** Effect of soil application of seaweed and foliar application organic fertilizer on seed weight (gm/pod) of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	7.8 d	12.86 ab	12.80 ab	11.15 b
	twice	11.60 abc	13.60 a	12.00 ab	12.40 a
---	Once	9.87 c	12.4 ab	12.20 ab	11.48 ab
	twice	11.20 bc	12.43 ab	11.50 abc	11.71 ab
		Number of spraying X levels			Mean effect of number of spraying
	Once	8.833 c	12.63 ab	12.50 ab	11.32 a
	twice	11.40 b	13.01 a	11.75 ab	12.05 a
		Seaweed X Levels			Mean effect of seaweed
	+	9.70 c	13.23 a	12.40 a	11.77 a
	---	10.53 bc	12.41 a	11.85 ab	0000
	Mean effect of levels	10.11 b	12.82 a	12.12 a	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

**Table 6:** Effect of soil application of seaweed and foliar application organic fertilizer on seed weight /plant (gm/plant) of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	31.20 f	55.35 bcd	60.53 abc	49.02 b
	twice	46.40 de	68.00 a	51.00 cd	55.13 a
---	Once	36.80 ef	62.00 ab	45.80 de	48.20 b
	twice	44.80 de	49.73 d	38.33 ef	44.28 b
		Number of spraying X levels			Mean effect of number of spraying
	Once	34.00 c	58.67 a	53.16 a	48.61 a
	twice	45.00 b	58.68 a	44.66 b	49.71 a
		Seaweed X Levels			Mean effect of seaweed
	+	38.80 b	61.67 a	55.76 a	52.08 a
	---	40.80 b	55.86 a	44.06 b	46.24 b
	Mean effect of levels	39.80 b	58.77 a	35.11 b	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

**Table 7:** Effect of soil application of seaweed and foliar application organic fertilizer on green pod yield /plant (gm/plant) of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	90.00 d	180.33 a	180.63 a	150.33 a
	twice	101.00 d	179.33 a	177.67 ab	152.66 a
---	Once	116.33 d	142.00 abc	108.83 abc	135.72 a
	twice	116.00 cd	140.00 bc	153.83 abc	136.77 a
		Number of spraying X levels			Mean effect of number of spraying
	Once	107.17 b	161.12 a	134.75 a	143.02 a
	twice	108.78 b	159.70 a	165.75 a	144.72 a
		Seaweed X Levels			Mean effect of seaweed
	+	95.50 c	179.83 a	179.00 a	151.50 a
	---	110.42 c	141.00 b	151.33 b	136.25 b
	Mean effect of levels	105.93 b	160.00 a	115.25 a	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

**Table 8:** Effect of soil application of seaweed and foliar application organic fertilizer on green pod yield (ton/ha. ) of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	1.644 f	2.952 bcd	3.228 abc	2.614 b
	twice	2.474 de	3.626 a	2.720 cd	2.940 a
---	Once	1.962 ef	3.306 ab	2.442 de	2.570 b
	twice	2.389 de	2.652 d	2.044 ef	2.362 b
		Number of spraying X levels			Mean effect of number of spraying
	Once	1.813 c	3.129 a	2.835 a	2.592 a
	twice	2.432 b	3.139 a	2.382 b	2.651 a
		Seaweed X Levels			Mean effect of seaweed
	+	2.069 b	3.289 a	2.974 b	2.777 a
	---	2.176 b	2.979 a	2.243 b	2.466 b
	Mean effect of levels	2.122 c	3.134 a	2.608 b	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05 .

**Table 9:** Effect of soil application of seaweed and foliar application organic fertilizer on biological yield (gm / plant) of broad bean plant\*.

Sea weed	Number of spraying	Organic fertilizer (ml/l.)			Seaweed X organic fertilizer
		0	2	3	
+	Once	148.67 f	333.33 a	307.83 abc	263.28 ab
	twice	173.00 ef	326.17 ab	262.00 cd	253.72 b
---	Once	265.00 cd	331.17 a	270.83 bc	289.00 a
	twice	207.17 de	265.00 cd	253.00 cd	241.72 b
		Number of spraying X levels			Mean effect of number of spraying
	Once	206.83 c	332.25 a	289.33 b	276.14 a
	twice	190.08 c	295.58 ab	257.50 b	247.72 b
		Seaweed X Levels			Mean effect of seaweed
	+	160.83 d	329.75 a	284.92 b	258.50 a
	---	236.08 c	298.08 ab	261.92 bc	265.36 a
	Mean effect of levels	198.46 c	313.92 a	273.42 b	

\*Means with the same letters had no significant differences according to Duncan's multiple range test at probability 0.05.

soil application at 2-true leaf stage, then plants were sprayed twice with different levels zero, 2, 3 ml/l. of the organic fertilizer black force first at 4-5 true leaf stage the second after two weeks from the first. The experiment was layedout in a randomized complete blocks design with three replicates. Data analyzed statically according to (SAS, 2017) programme.

## Results and Discussion

Table 1 showed that plant height was differed significantly by black force application, 2ml/l. gave the best value 57.08cm. It was clears that there were a significant differences in the double interaction between Alga-600 X black force, also between the number of application X levels of black force. The highest value 60.00cm. resulted in the interaction treatment. Alga-600 X once application X 2ml/l. black force. As shown in table 2 the application of black force caused a significant excess in the number of branches per plant, 2ml/l. treatment gave the best result 4.750. It was cleared that there were a significant differences, the highest value 5.500 branches/plant resulted in zero Alga-600 X once spraying X 2ml/l. black force. In table 3 it was cleared that black force caused a significant differences in leaf area, 2ml/l. was superior than other treatments it gave 7980.2 cm<sup>2</sup> ./plant. The highest value was 11212.0 cm<sup>2</sup> / plant resulted from Alga-600 X twice spraying X 2ml/l. black force. Table 4 indicated that soil application of Alga-600 was increased significantly pods/plant, reached 4.402 pods/plant. It was cleared that black force treated plants differed significantly, 2ml/l. resulted 4.583 pods/plant. All the interaction treatments were differed significantly in this traits.

The seed weight was differed significantly in all interaction treatment, Alga-600 X twice spraying X 2ml/l. of black resulted the highest value 13.60 gm/pod. As shown in table 6, soil application of Alga-600 caused a significant increase in seed weight, it gave 52.08 gm./plant. compared with 46.24 gm./plant in control. Black force treated plants gave a significant differences, 2ml/l. was superior than treatments 58.77 compared with 39.80 gm. plant in the control. It is clear that there were a significant differences between all interaction treatments, Alga-600 X Twice spraying X 2ml/l. of black force was superior than other treatments. Table 7 was indicated that soil application of Alga-600 resulted a high significant in green pods yield, 151.50 gm. Plant, compared with the lowest value, 136.25 gm. Plant in control. As showed from results, it was clear that the interaction treatment differed significantly in this traits, the highest value 180.67 gm. Plant resulted in Alga-600 application X once spraying

X 3ml/l. of black force. Results in table 8 showed that plants treated with Alga-600 caused a significant increase in green seeds yield, 2.777 ton/ha. compared with 2.466 ton/ha. in control. Plants spraying with black force gave a significant increase, 2ml/l. gave the highest value 3.134 ton/ha. compared with 2.122 ton/ha. in control. In table 9 it was clear that there were a significant differences between the number of spraying with black force in the biological yield, also, the same table indicated that plants spraying with 2ml/l. gave a highly significant increase in the biological yield 313.92 gm./plant compared with other treatments. There were a significant differences between all interaction treatments, the highest value 333.33 gm. Plant in Alga-600 X once spraying X 2ml/l. of black force. Regarding to the seaweed extract Alga-600, It's contain alginic acid, organic matter and some nutrient elements N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, CaO and MgO, these components in turn plays on important role in plant nutrition, which reflex on plant growth and development. According to the above mentioned, plant immunity system will be strong, so the plant will become healthy and more resistant to diseases and insects, that reflects on a good plant growth, in addition to a positive effects on flowering and fruit set, so plant yielded more with a good quality. Regarding to the organic fertilizer, black force it's contains the macronutrients, N and K<sub>2</sub>O which are necessary for plant growth and development.

Generally the organic matter affects on soil characteristics, through the role in improve the relationship between the soil and water in plant, also water use efficiency (Shaaban and Okacha, 2007), as well as to that organic fertilizer make the nutrients release be slowly by the activation of microorganisms which release the elements from organic matter and translate these elements to available phase to plant, finally the plant grows well and more.

The conclusion derived from this study that importance of organic fertilizers as one aspects of organic farming which improve plant growth and yield in order to produce healthy food, that will be protect human health and maintain the environment safety. Therefore we recommended to use 2kg/ha, of the seaweed Alga-600 as soil application and spraying twice with the organic fertilizer black force at 2ml/l. under the conditions of this study in this important crop.

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