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ORIGINAL ARTICLE

EFFECT OF SPRAYING DIFFERENT CONCENTRATIONS OF FOLIAR NUTRIENT (AL-NIBRAS) ON GROWTH AND YIELD OF *VICIA FABA* L.

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Abstract: The research was conducted during the winter season 2017-2018 in the experimental field of the Musayyib Technical Institute to study the effect of the number of sprays and different levels of the foliar nutrient (0.0, 1.0, 1.5, 2.0 and 3.0 $cm^3.L^{-1}$) on the growth and yield of the broad bean plant, using Randomized complete block design with four replicates. The results showed a significant effect of the alnibras foliar nutrient and spraying in all studied traits, the highest average of plant height was 106.1 cm, number of branches 8.65, number of leaves 110.1, leaf area 277.3 dm^2, number of flowers 99.34 and percentage of set 96.1%, which was achieved when interaction using spraying three times and alnibras at the level of 3.0 $cm^3.L^{-1}$. The interaction also had a positive effect on the amount of yield and other studied traits. The highest average was the number of pods/plant, length of pod (cm), pod weight (gm), number of seeds/pod, yield per plant (kg), early yield (kg) and total yield (kg). They reached (51.76, 24.68 cm, 18.98 g, 7.73, 982.4 g, 36,441 kg and 1886,2 kg), respectively. In comparison to the average number of pods/plant, length of pod (cm), pod weight (gm), number of seeds/pod, quantity of yield per plant (gm), early yield (kg) and total yield (kg) amounted to (8.81, 11.65 cm, 6.54 g, 3.01), 57.61 g, 12.65 kg and 110.6 kg), respectively for the control treatment.

Key words: Foliar nutrient, AL-Nibras, Growth, *Vicia faba* L.

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1. Introduction

The Fabaceae family is one of the three largest plant families, which includes 610 genera and more than 81,000 species of trees, shrubs and herbaceous plants. It contains many vegetable plants such as Broad bean, cowpeas, fenugreek, beans and peas, which are flowering plants and the fruit in it is in the form of a pod, containing seeds that are eaten fresh or cooked. They are grown in large areas in all regions of Iraq, where the area planted with legumes in 2011 reached more than 55 thousand dunums throughout Iraq and the total production amounted to 23 thousand tons [Central Statistical Organization (2011), Abd AL-Hseen and Manea (2020)] and Iraq ranks fourth in the world in the production of legumes *Vicia faba* L. Broad beans are grown in Iraq for its green pods, green or dry seeds that are used in many types of cooking. The production of green beans in 2011 was estimated at more than 154.4 thousand tons, and Kirkuk province came first, followed by Baghdad province. The amount of production for each of them was estimated (39.0), (31.3) thousand tons, while the highest average productivity per acre was estimated in Kirkuk province (2841.8) kg/dunum, followed by Baghdad province (2459.6) kg/dunum [Al-Sahaf (1989)]. The area planted with dry broad bean reached 14135 dunums, the total production reached 11325 tons and Iraq occupies the nineteenth place in the world in the cultivation and production of the broad bean crop. Its nutritional importance comes in the fact that it contains nutrients, especially protein, with a high percentage of up to 25%, carbohydrates 57%, fat 1%, water 9% and fiber 4%. The seeds also contain a percentage of vitamins (B2, B1, C, A), amino acids and mineral salts such as iron

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salts. Calcium, iodine, and these salts are needed by the human body in its daily diet [Raziyeh *et al*. (2013)]. Among its health benefits is that it resists stress that affects the body, it is believed that it contains complex chemical compounds that fight cancer diseases that affect the mouth, useful for the heart in terms of increasing the level of good cholesterol in the blood, it works to reduce blood pressure in women in menopause, maintains blood sugar level. It contains substances that strengthen the body's immunity against various diseases. The broad bean husks fight constipation that affects the body. The flowers of the broad bean plants have the property of increasing diuresis. The composition of the nutrients of the foliar fertilizer (Nibras) is a distinct composition because it contains all the nutrients necessary for the plant in a balanced manner and is available for absorption. Also, these elements are in a chelated form and in a manner that achieves the optimum benefit as a result of preventing the occurrence of sedimentation or antagonism between the nutrients, due to its great effect in increasing vegetative growth, improving the quality of fruits, strengthening the root system and increasing production. Nibras fertilizer contains a group of macro and micro nutrients and is rich in organic acids, amino acids and vitamins that revitalize the plant and increase its growth [Basavarajeshwari *et al*. (2008), Manoj *et al*. (2012)]. It also activates many enzymes necessary for the plant and has a role in building proteins in the plant, stimulating plant hormones and building chlorophyll molecules and contributes to regulating the osmotic effort of the plant with other elements by raising it to the plant's ability to absorb potassium and also facilitates the transfer of sugars through cell membranes. It controls the process of converting sugar into starch inside cells [Raziyeh *et al*. (2013), Abd AL-Razaq *et al.* (2018)]. Therefore, this study was conducted to find out the response of bean plants to spraying with the foliar nutrient and its effect on some growth characteristics and the amount of total yield and its effect on some growth characteristics and the amount of total yield under the conditions of the field environment.

2. Materials and Methods

This study was conducted in the experimental field belonging to the Technical Institute, Musayyib during the winter season 2017-2018 to study the effect of the number of spraying times and with different levels of the beacon foliar nutrition produced by the Jordanian Caravans Company which consists of the following nutrients (nitrogen 10%, phosphorous 8%, potassium 6%, chelated iron ppm.200, chelated zinc ppm.200, chelated manganese ppm.150 ppm, chelated magnesium ppm.160 ppm, boron, ppm. 10, chelated copper ppm. 25). The growth and yield of the Barcelona cultivar, produced by the Spanish company Simillasfito, imported by the Ministry of Agriculture. It is one of the Spanish cultivars with abundant production and which has been successfully cultivated in Iraq. The plants are a limited-growing list with large vegetative growth and many branches, and the height of the plant reaches more than 1 m at the end of the season. The plant gives single flowers that are carried on the stems and during the spring the plant gives cluster flowers combined 2-3 or more flowers of purple color impregnated with white, the fruits are a green pod containing seeds. The green pod needs from 30-35 days to become the size of a suitable shape for picking and the individual pods mature successively on the vegetative branches from the bottom of the plant to the top. The plants give an early yield and have a desirable size and shape during the spring, so it is preferable to harvest the pods early and market them like green crops or leave them on the plants until their color changes to black and the seeds inside become ripe. They can be harvested and left in the field for a week to dry the seeds and become desirable in the Iraqi market. After preparing the soil of the field with an area of 1000 m^2 from tillage, smoothing and amending, various soil samples were taken and soil analyzes were conducted (Table 1). Decomposed animal manure was added to the soil at an average of 170 kg per stem of planting lines and NP compound fertilizer (27:27) at an average of 200 $kg.ha^{-1}$, the compost was mixed with the soil by means of the smoothing machine. The soil of the field was divided into 12 stems with a length of 34 m for one stem, the distance between one stem and another 50 cm, and the width of the stem 50 cm, leaving one stem for each side of the field.

One seed/pit was planted on 10/16/2017 in the upper third of the waterer on both sides, the distance between its pit and another is 30 cm. The number of pits in one waterer was 160 plants, 80 plants on each side of the water after leaving a distance between the treatments, and the number of holes in the field was estimated at 1920 plants. The experiment is factorial (2 × 5), where the first factor was the number of spraying times. The

Table 1: Some chemical and physical properties of greenhouse soil.

Soil texture	Volume distribution of soil separations			Organic matter ($g.kg^{-1}$)	Total nitrogen ($g.kg^{-1}$)	$CaCO_3$%	Electrical conductivity $DS.m^{-1}$	pH
Silty clay loam	Sand percentage $g.kg^{-1}$ soil	Silt percentage ($g.kg^{-1}$ soil)	Clay percentage ($g.kg^{-1}$ soil)					
	260	395	345	12	32	25.0	3.5	7.5

first two sprays are 30 days after seedlings and are repeated at the beginning of the emergence of flowers, and the second three sprays are 30 days after seedlings and are repeated at the beginning of the emergence of flowers and when the fruits are formed. As for the second factor, there were five levels of Al-Nebras (0.0, 1.0, 1.5, 2.0 and 3.0) $cm^3.L^{-1}$, as for the control treatment, it was sprayed with water only and in the early morning using a 10 liter capacity afternoon spraying. This experiment was conducted on four stems of each cultivar, and one waterer was divided into ten experimental units, 3 m long per unit and 16 plants per experimental unit. The experiment was conducted according to the randomized complete block design (RCBD) with four replications, and the averages were compared according to the LSD test at a probability level (0.05) [Al-Rawi and Khalaf Allah (1980)]. The date of the first fairy was 3/2/2017 and the reaping continues weekly until the end of April 2018, when the number of pods, their length, weight and the number of seeds in one pod for each experimental unit were calculated. The result of the experimental unit on the number of plants in it, then multiplied by the number of cultivated plants to extract the total yield of the field. The plant height, the number of leaves, the number of vegetative branches and the leaf area of the plant (dm^2) were calculated according to the following methods: The leaf area was measured in each treatment by taking 3 leaves from six selected plants, according to the average area for them and multiplied by the number of leaves of the plant and the area average was calculated by the method of leaf disks for each treatment and then dried by a degree temperature of 75°C for 48 hours until the weight is stable, according to the following equation:

Area of one leaf (cm^2)

$$= \frac{\text{Leaf area of tablets} \times \text{Average dry weight of leaf and tablets}}{\text{Average dry weight of tablets}} \Big/ 18 \text{ number of selected leaves}$$

The number of flowers was calculated cumulatively for each experimental unit and the percentage of the flower set.$plant^{-1}$ was calculated according to the following equation:

Percentage of flower set = (Number of set fruits/ Number of total flowers) × 100

3. Results and Discussion

3.1 Effect of spray and foliar nutrient on vegetative growth, flowering and fruit set

The results in Fig. 1 indicate that the treatment of spraying three times with the foliar nutrient showed a significantly excelled on the treatment of spraying twice in all the studied traits. It gave the highest average plant height (cm), the number of vegetative branches/plant, the number of leaves, the leaf area of the plant (dm^2), the number of flowers and the percentage of set for each plant reached (79.88 cm, 5.568 branches, 73.38 leaves, 180.4 cm^2, 63.71 flowers and 82.26%), respectively.

While the alnibras foliar nutrient had a significant effect on these traits, where the last concentration (3.0 $cm^3.L^{-1}$). The Fig. 2 showed that the last concentration (3.0 $cm^3.L^{-1}$) significantly excelled on all other treatments and in all traits and gave the highest rate of plant height (cm) and the number of vegetative branches/plant. The leaves and leaf area of the plant (dm^2), the number of flowers and the percentage of set for each plant were (92.51 cm, 7.71 branches, 92.21 leaves, 251.8 cm^2, 76.17 flowers and 94.85%), respectively. This increase in vegetative growth and other traits due to spraying with foliar fertilizers may be due to the role of the alnibras foliar nutrient in activating plants and increasing their growth because it is rich in organic acids and amino acids and is very important in the process of photosynthesis and carbohydrates and to the role of organic materials and nutrients found in these foliar fertilizers and their effect on the process of photosynthesis, respiration and protoplasmic construction, as it is involved in the

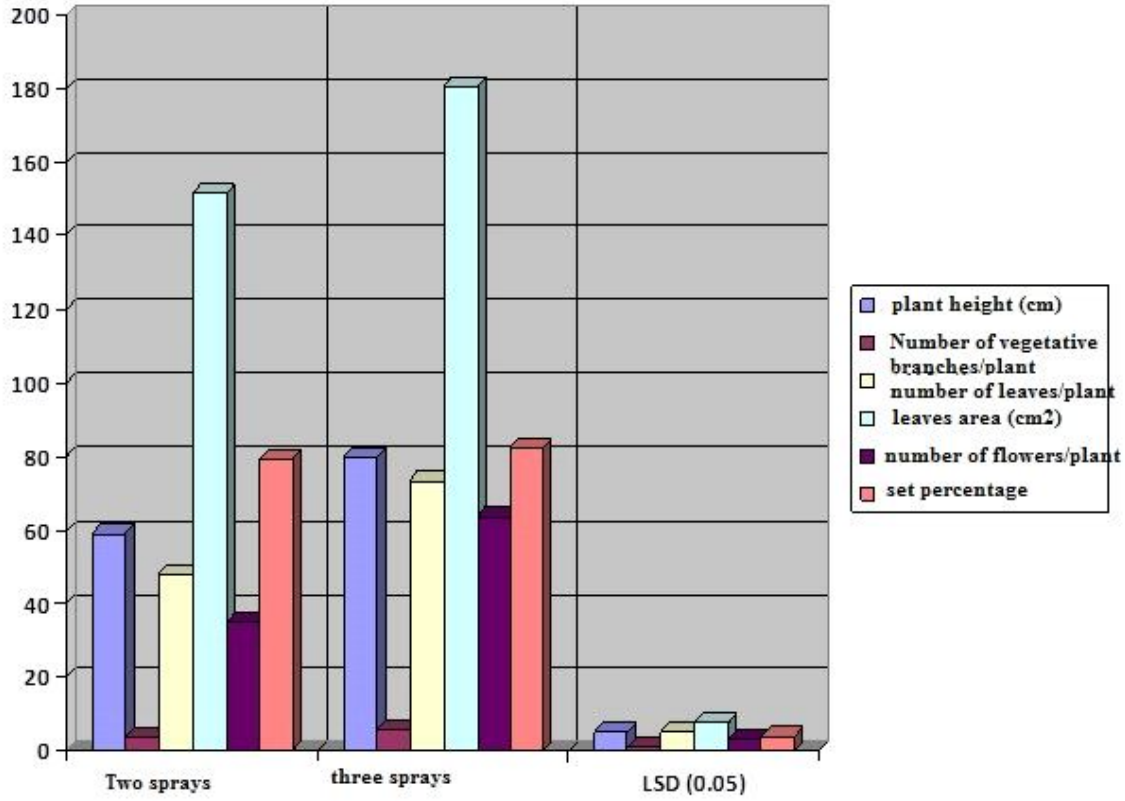
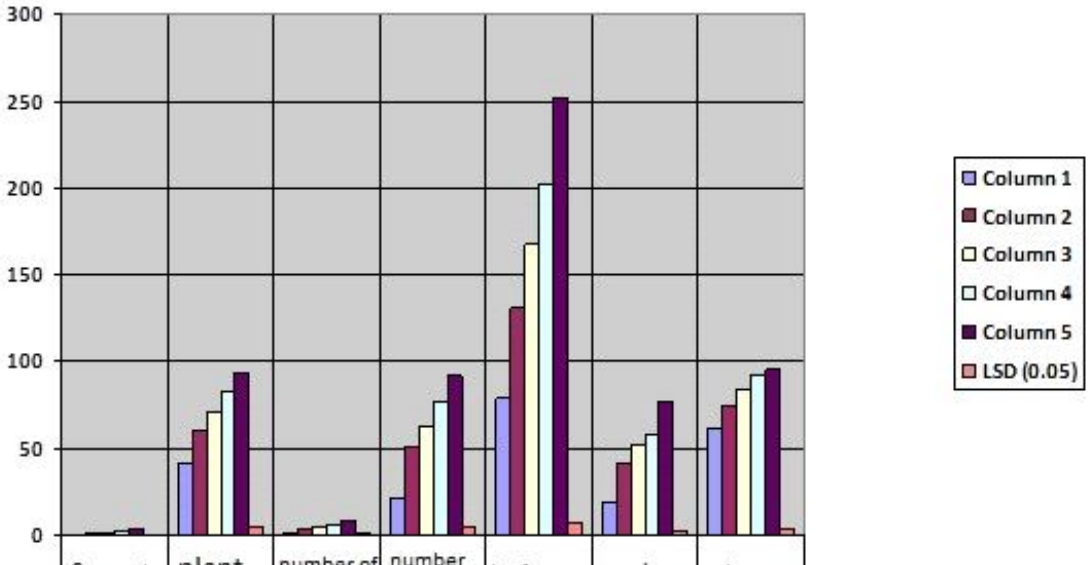


Fig. 1: Effect of the number of spraying times on the vegetative traits of Broad Bean plants



	Concentration (cm/L)	plant height	number of branches	number of leaves	leaf area	number of flowers	set percentag-
Column 1	0	40.91	1.52	21.01	79.07	18.88	60.6
Column 2	1	60.25	3.51	50.93	130.1	41.29	73.7
Column 3	1.5	71.06	4.82	62.76	166.8	51.23	83.7
Column 4	2	82.63	6.15	76.65	202.4	58.16	91.4
Column 5	3	92.51	7.71	92.21	251.8	76.17	94.8
LSD (0.05)		4.73	0.86	4.91	6.86	2.83	3.01

Fig. 2: Effect of different levels of alnibras on the vegetative traits of broad bean plants

synthesis of nucleic acids (RNA and DNA) necessary for cell division. It was confirmed by Al-Thafi *et al*. (2007) that there were significant differences in the average plant height, the number of vegetative branches/plant, the number of leaves/plant, and the leaf area of the plant when spraying with the nutrient solution (Al-Nahrain) several times at a level of 2 mlL^{-1} was confirmed. on Cordoba cultivar pepper plants. It was also confirmed by Al-Thafi *et al*. (2009) that increasing the number of sprays of the nutrient solution two and three times significantly affected the studied traits such as yield and plant height of the two varieties of tomato Super Marymond and Gs12.

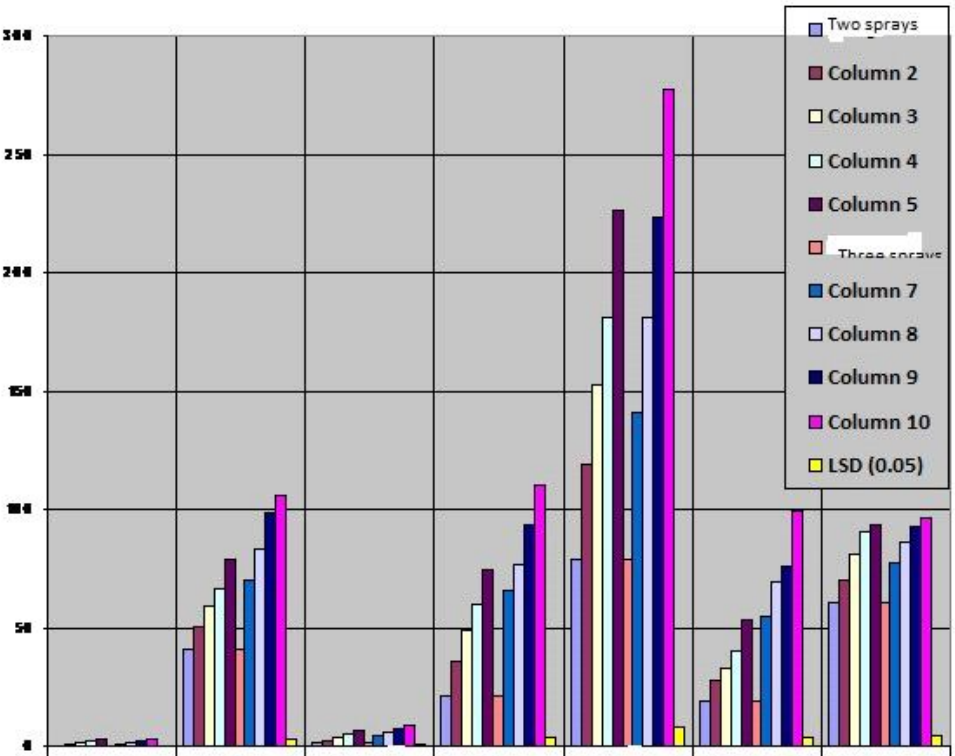
According to the results of Fig. 3, the interaction between the nectarine foliar nutrient and the number of spraying times resulted in the highest averages of plant height (cm), vegetative branch count, leaf count, and leaf area of the plant (dm^2) reaching 101.1 cm, 8.65 branches, 110.1 leaves, 277.3 cm^2, 99.34 flower, and 96.1 percent, respectively. In comparison to the control treatment, which produced the lowest average plant height (cm), the number of vegetative branches, the quantity of leaves, the plant's leaf area (dm^2), the number of flowers, and the percentage of set for each plant were (40.91 cm, 1.52 branches, 21.01 leaves, 79.07 cm^2, 18.88 flowers, respectively.

The reason for this is due to the positive role of nutrients in these traits, and the increase in vegetative growth traits is due to the genetic nature of the cultivated cultivars and to the effect of nutrients in the process of photosynthesis, respiration and protoplasmic structure, where they enter into the synthesis of nucleic acids RNA and DNA necessary for cell division and increase in the length of the internodes. Also, some vitamins enter as enzymatic conjugates that help in the speed of vital reactions, which leads to an increase in the height of plants, the number of branches, the number of leaves/ plant and an increase in the leaf area of the plant [Al-Moaini (1999)].

3.2 Effect of spray and foliar nutrition on the quantitative traits of the broad bean yield

The beneficial effects of foliar nutrients applied to plants grown in greenhouses and open fields, where they cannot be dispensed with even when the soil is fertile and contains significant amounts of decomposing organic fertilisers because the plants require nutrient fertilisers at different stages of growth (Fig. 4).. This is for the purpose of increasing the contract in the flowers and improving the quality of the fruits while increasing the quantity of production and the number of sprays with the bean foliar feeder had a significant effect on the quantitative traits of the broad beans yield. Spraying three times was significantly superior to spraying twice in the number of pods/plant, length of pod (cm), weight of pod (g), number of seeds/pod, yield per plant (gm), early yield and total yield (kg) amounted to (31.24 pods, 18.94 cm, 14.25 g, 5.341 seeds, 499.1 g, 27.41 kg and 997.6 kg), respectively.

This increase in yield and other characteristics may be due to the role of the leaf nutrient in revitalizing plants and increasing their growth, where it is rich in organic acids and amino acids and is very important in the process of photosynthesis and carbohydrates. As it works to move it from the places of its formation in the leaves to the places where it is stored in the fruits, in addition to containing diffusive substances that increase the ability of the plant to benefit from the nutrients in it [Muhammad (1977)]. Fig. 5 also shows that the levels of spraying with the alnibras foliar nutrient had a significant effect on the traits of the yield, as the highest average of pods/plant, pod length (cm) and pod weight (gm), the number of seeds/pod, yield per plant (gm), early yield, and total yield (kg) amounted to (44.81 pods, 22.49 cm, 15.18 g, 6.31 seeds, 706.6 g, 29.19 kg and 1356.7 kg), respectively which was significantly excelled on the control treatment that gave the lowest results, as it reached (8.81 pods, 11.65 cm, 6.54 g, 3.01 seeds, 57.61 g, 12.65 kg and 110.6 kg), respectively. The yield of one plant and the total yield when spraying with manganese at a level of 25 $mg.L^{-1}$ was used with copper at a level of 7.5 $mg.L^{-1}$ on black beauty eggplant plants grown in a greenhouse. It was also found by Hamza (2009) that spraying tomato plants with zinc at a level of 50 $mg.L^{-1}$ had a significant effect in increasing the fruit set, number of fruits, fruit weight and yield per plant. It also confirmed [Al-Khafaji *et al*. (1993)] that spraying tomato plants with magnesium and zinc led to a significant increase in the total yield of tomato plants grown inside greenhouses. The reason for this may be due to the role of foliar nutrients in affecting the quantitative and qualitative traits of the fruits and through the contribution of these nutrients to the vital processes that take place within the plant, which leads to an increase in the movement of nutrients manufactured in the leaves to the active growth areas. Thus, it



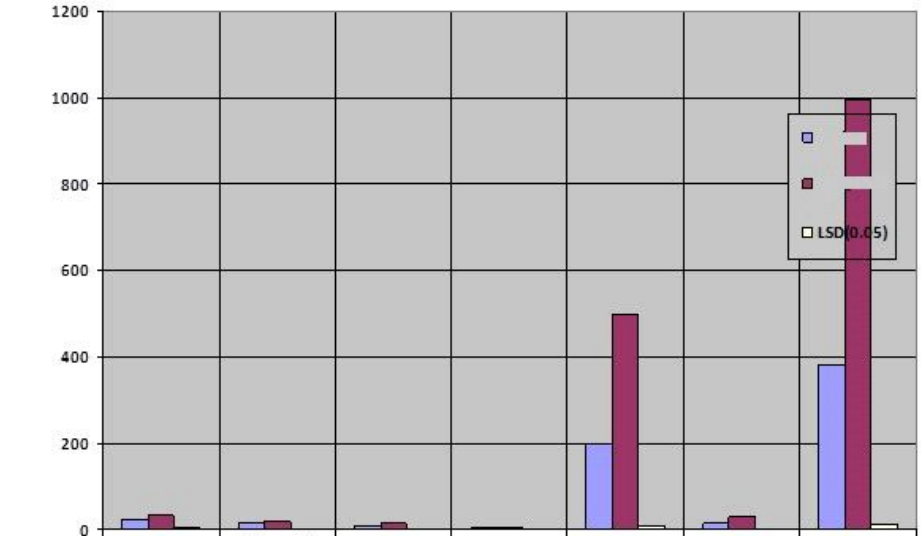
	Concentration (cm/L)	plant height	number of branches	number of leaves	leaf area	number of flowers	set percentage
Two sprays	0	48.91	1.52	21.01	79.07	18.88	68.6
Column 2	1	58.08	2.55	36.11	119.1	27.76	78.2
Column 3	1.5	58.77	3.76	48.65	152.8	33.13	81.3
Column 4	2	66.65	4.98	68.12	181.2	48.11	90.2
Column 5	3	78.91	6.76	74.33	226.3	53.81	93.6
Three sprays	0	48.91	1.52	21.01	79.07	18.88	68.6
Column 7	1	70.43	4.47	65.76	141.2	54.82	77.3
Column 8	1.5	83.35	5.88	76.87	188.9	69.33	86.2
Column 9	2	98.61	7.32	93.18	223.6	76.21	92.6
Column 10	3	106.1	8.65	110.1	277.3	99.34	96.1
LSD (0.05)		2.58	1.02	3.31	7.58	3.41	4.12

Fig. 3: The effect of the interaction between spraying and different levels of the nutritious foliar nutrient on the vegetative traits of broad bean plants

encourages the formation of the largest number of flower buds and increases the set in them, and then leads to an increase in the number of fruits in the plant. And the increase in the processed nutrients inside the plant and its transfer to the fruits increases its weight and thus increases the total yield of the plant.

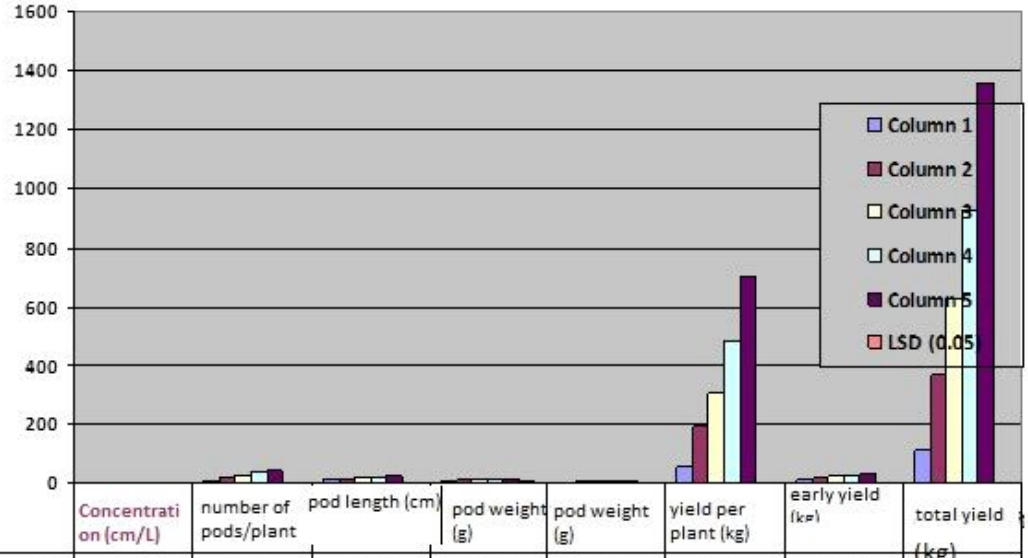
Fig. 6 shows that the interaction between spraying and alnibras concentration gave the highest average number of pods/plant, pod length (cm), pod weight (gm), and number of seeds/pod. The yield of one plant (gm), early yield and total yield (kg) reached (51.76 pods, 24.68 cm, 18.98 g, 7.73 seeds, 982.4 g, 36.44 kg and 1886,2 kg), respectively and that when the interaction between spray and alnibras at a level of 3.0 $cm^3.L^{-1}$, which was significantly excelled on the other interaction treatments and to the control treatment that gave the lowest values amounted to (8.81 horns, 11.65 cm, 6.54 g, 3.01 seeds, 57.61 g, 12.65 kg and 110.6 cm) (kg), respectively. The interaction of cultivar and Micronet 15 at a level of 2.0 $cm^3.L^{-1}$ gave lower values for these traits were 37.87 pods, 20.31 cm, 11.38 g, 4.87 seeds, 430.9 g, 21.89 kg and 827.3 kg.

The apparent decrease in the yield of the plant, which negatively affected the total yield, may be due mainly to the fact that the unselected local cultivars that were not approved by the research centers have deteriorated genetic traits and become unsuitable for cultivation on an economic level. Therefore, it is



	number of pods/plant	pod length (cm)	pod weight (g)	number of seeds/pod	, yield per plant (kg)	early yield (kg)	total yield (kg)
Two sprays	21.92	15.94	8.318	3.952	199.5	15.99	380.7
Three sprays	31.24	18.74	14.25	5.341	499.1	27.41	997.6
LSD(0.05)	2.54	0.86	0.12	0.03	5.56	0.04	10.94

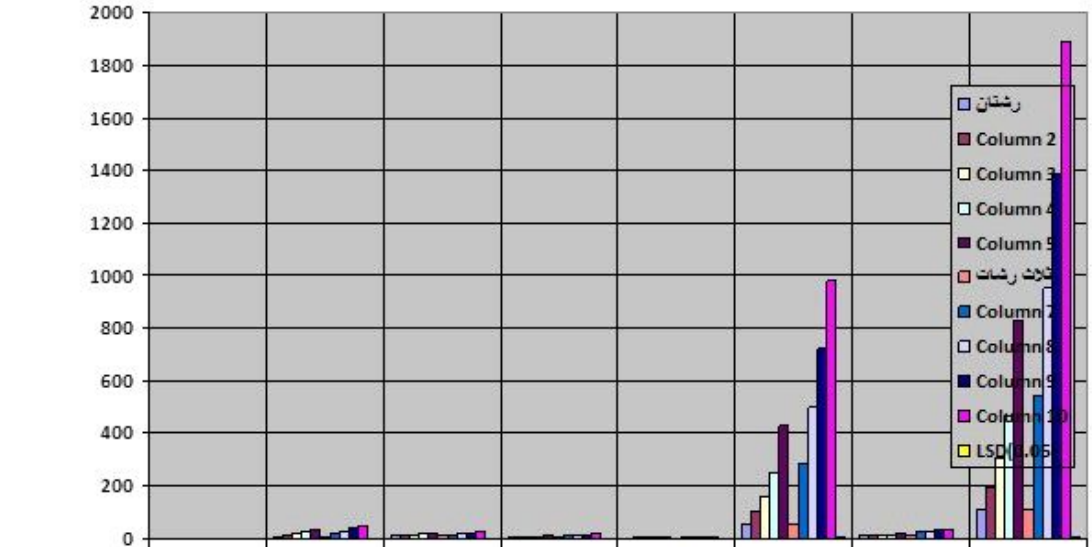
Fig. 4: Effect of spraying on yield traits of bean plants.



	Concentration (cm/L)	number of pods/plant	pod length (cm)	pod weight (g)	pod weight (g)	yield per plant (kg)	early yield (kg)	total yield (kg)
Column 1	0	8.81	11.65	6.54	3.01	57.61	12.65	110.6
Column 2	1	18.43	14.95	9.85	3.89	192.7	18.92	370.1
Column 3	1.5	25.88	17.51	11.82	4.61	303.9	22.71	631.4
Column 4	2	34.99	20.11	13.03	5.41	485.8	25.01	926.9
Column 5	3	44.81	22.48	15.18	6.31	706.6	29.19	1356.7
LSD (0.05)		2.31	0.71	5.02	0.05	0.41	0.03	0.31

Fig. 5: shows the effect of different levels of alnibras on yield traits of broad bean plants

preferable to plant local cultivars known for their good qualities and high productivity in advance and before purchasing them, in order to achieve the main purpose of cultivating them, and then to obtain a significant increase in the quantitative traits of the yield of the cultivated plants. These results are in line with Abed *et al.* (1984), who found that spraying tomato plants Strain-B three times with foliar fertilizers (Irral and Bayfolan, which contain a wide range of micro and macro nutrients and at a concentration of 4%). It led to a significant increase in the amount of the total yield of the plant and other quantitative traits. Al-Thafi *et al* (2010) found



	Concentration (cm/L)	number of pods/plant	length of pod (cm)	pod weight (gm)	number of seeds/pod	yield per plant (kg)	early yield (kg)	total yield (kg)
Two sprays	0	8.81	11.65	6.54	3.01	57.61	12.65	110.61
Column 2	1	14.54	13.92	6.99	3.66	101.6	13.42	195.07
Column 3	1.5	20.66	15.17	7.78	3.89	160.73	14.93	308.59
Column 4	2	27.76	18.66	8.89	4.33	246.7	17.01	462.14
Column 5	3	37.87	20.31	11.38	4.87	430.9	21.89	827.32
Three sprays	0	8.81	11.65	6.54	3.01	57.61	12.65	110.61
Column 7	1	22.32	15.98	12.72	4.12	283.9	24.42	545.08
Column 8	1.5	31.11	19.86	15.87	5.33	497.1	30.47	954.43
Column 9	2	42.22	21.56	17.17	6.51	724.9	32.96	1391.8
Column 10	3	51.76	24.66	18.98	7.73	982.4	36.44	1886.2
LSD(0.05)		2.77	0.97	0.03	0.01	6.98	1.32	9.97

Fig. 6: The effect of the interaction between the number of sprays and different levels of seedlings on yield traits of broad bean plants

a significant increase in the number of fruits, fruit weight, yield per plant, and the total yield of pepper plants grown inside greenhouses when spraying with Alga 600 foliar fertilizer at a level of 0.5 g.L^{-1} with 2.0 g. L^{-1} of fertilizer. It can be concluded from this study and within the conditions of the experiment that there is a clear response of the broad bean plants grown in the open fields to the spraying with the foliar nutrition alnibras and that the best treatment is spraying at a level of 3.0 $cm^3.L^{-1}$. Therefore, it is recommended to adopt a concentration at a level of 3.0 $cm^3.L^{-1}$ with spraying three times for the purpose of obtaining plants with good vegetative growth and giving a high yield, which results in achieving a good economic return that may reduce production costs and raise profit rates for vegetable plants grown in open fields.

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