Effect of Treatment with Humic Acid on Some Growth Characteristics and Protein Content in Different Varieties Vicia faba L. Plant

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KEYWORDS

Aba bean, Humic Acid

ABSTRACT

An experiment was carried out using plastic pots in the 2023-2024 season to evaluate the method of treatment with humic acid in the growth characteristics and protein percentage of different varieties of faba bean plants. The study included two factors, the method of adding humic acid (without acid, spraying acid on the plant, adding acid to the soil). The second factor included four varieties of beans (local Iraqi, Netherland, Spanish, and French). The results showed: superiority of the treatment of adding Humic acid to the soil in terms of plant height, total chlorophyll percentage, number of leaves, and protein percentage by 13.25% and 7.59 mg g-1 wet weight. 6.78% and 8.75%, respectively Compared to the control treatment, the local variety was superior in the characteristics of plant height and number of leaves by 31.72 and 7.26% compared to the French variety, which was superior in the characteristics of number of leaves and protein percentage by 12.27 and 24.0%, respectively. The interaction also outperformed adding acid to the local variety in plant height. By 53.13%, the French variety with added acid exceeded the characteristics of number of leaves and protein percentage by 26.40 and 30.50%, respectively.

1. Introduction

The faba plant, Vicia faba L., belongs to the family Fabaceae, which is one of the important plant families because it includes large numbers of important economic crops: chickpeas, beans, lentils, and peas. This family includes about 600 genera and 1,300 species and is divided according to the size of its seeds into two groups. Vicia faba var major, which are characterized This group has large, flat grains that are mainly used in human nutrition. The second group, Vicia faba var minor, which is fodder beans, is characterized by small, spherical seeds that are used as animal feed. This The crop is of increasing importance as it is used as food for humans as well as fodder for animals and is characterized by its high protein content of 21.39% and carbohydrates of up to 58.41%, in addition to its dry seeds containing calcium, vitamin C and vitamin A (Al-Younis, 1993 and El-Dabaa et al., 2019).

There are many factors that contribute significantly to increasing plant productivity, including the good variety adapted to the region, which contributes significantly to increasing crop productivity. Varieties of beans vary in their productivity, and this is natural due to the genetic nature. Therefore, introducing new varieties with high productivity affects increased production, improves quality, and reduces costs. Choosing varieties appropriate to the conditions of the region helps increase production and improves quality (Al-Abbar, 2021 and Muhammad, 2021).

Recently, the importance of using organic fertilizers for the nutrients that plants need has emerged because they contain some organic acids such as humic and fulvic acids, amino acids and other substances, which are characterized by their cheap price, ease of use, low pollution of the environment and agricultural products, and their contribution to improving many physical, chemical and biological properties. to the soil, which reflects positively on its growth and plant production (Muktamar et al., 2017; Ren et al., 2017).

2. Methodology

This study was conducted during the 2023-2024 agricultural season in one of the nurseries in Al-Shirqat District - Salah al-Din Governorate, using plastic pots for the period from 11/1/2023 to 4/20/2024. The soil was taken from the Tigris River basin and sieved using a sieve with a diameter of (2) mm after it was air-dried. Then I placed the soil inside plastic pots with a height of (40) cm and a diameter of (30) cm, amounting to 15 kg. Pot^{-1} soil. Then it was watered with water and left for a full day to get rid of the voids.

The experiment was designed according to a completely randomized design (C.R.D), with three replications with two factors. The first factor: Liquid humic acid was used in three ways (without acid, adding acid to the soil, spraying plants) and (using four Variety of beans, namely Iraqi, Netheland, French FAVA DA ORTO and Spanish LUS DE OTONO, 3 ml.L of water^{-1} of acid was used, whether directly added to the soil or foliar spraying 40 days after planting and the second one a month after the first spraying, so the number of factors reached 12. Treatment with three replicates, so that the number of experimental units was 36, distributed randomly. Humic acid was indicated by the symbol H, where H0 was not added, H1 was adding the acid to the soil, H2 was spraying the acid on the plant, and the varieties were indicated by the symbol V, where V1 is the local variety, V2 is the Netherland variety, V3 is the Spanish variety, and V4 is the French variety.

***Studied traits:**

***Vegetative traits:**

Plant height (cm): It was measured from the base of the plant to the end of its top in the mature stage. For three replicates, the average was taken.

***Number of branches plant^{-1}**: It included calculating the number of branches emerging on the main stem of each plant in each replicate and taking their average.

***Total chlorophyll in leaves(mg gm^{-1}dry weight**): The amount of chlorophyll in leaves and stems of the bean plant was estimated according to the method (Palta, 1990). The following equations were used to calculate the amount of total chlorophyll,

Chlorophyll a=(12.7×A663)-(2.69×A645)×V/(1000×w)

Chlorophyll b=(22.9×A645)-(4.68×A663)×V/(1000×w)

Total chlorophyll =20.2(A645)+ 8.02(A663)xV/(1000×w)

***Number of leaves per plant $^{-1}$**: The number of leaves per plant in each replicate was calculated and the average was taken.

***Protein percentage in seeds (%):**

The percentage of nitrogen in the seeds was estimated using a device (Microkhejldal), and then the percentage of protein was calculated as follows:

Protein percentage = Nitrogen percentage × 6.25 (Rastovski and Vanesetal 1987)

3. Result and Discussion

It is clear from the results of Table (1) that the treatment methods with humic acid had a significant effect on the height of the bean plant. Adding the acid directly to the soil led to obtaining the highest height of 42.75 cm, with a height rate of 13.25% compared to the control treatment, which had a plant height of 37.75. poison, which did not differ significantly from the humic acid spray treatment.

The results in the same table show that the plants of the local variety were superior in terms of plant height, giving 45.22 cm and a height ratio of 31.72% compared to the plants of the French variety, which gave the lowest plant height of 34.33 cm.

The interaction between humic acid treatment methods and varieties showed a significant effect on the plant height. The interaction between adding acid to the soil and the local variety gave the highest height of 49.00 cm, with a height rate of 53.13% compared to the plant of the French variety not treated with acid, which reached a plant height of 32 cm.

Table 1. Effect Treatment Method with Humic Acid and Vrieties on Plant Hight(cm).

V	Local	Netherland	Espanish	Franch	H..Mean

H					
0	42.00cd	38.00gh	39.00fg	32.00j	37.75b
Adding	49.00a	42.00cd	43.00bc	37.00h	42.75a
Spray	44.67b	41.00de	40.00ef	34.00i	39.92ab
		V. Mean	45.22a	40.33b	40.66b	34.33c

It is clear from the results of Table (2) that the methods of treatment with humic acid did not show a significant effect on the number of shoots, while the varieties showed a positive significant effect, in which the French variety was distinguished by giving the highest number of shoots per plant, amounting to 4.43 shoots per plant, with an increase rate of 7.26% compared to Plants of the local variety, which gave 4.13 shoots plant^{-1}, which did not differ significantly from the Dutch and Spanish varieties, and the interaction between the acid treatment methods and the varieties did not show any significant effect in influencing the character of the number of branches.

Table 2. Effect Treatment Method with Humic Acid and Vrieties on Branches .Plant^{-1}.

V	Local	Netherland	Espanish	Franch	**H**..Mean
H					
0	4.00a	4.23a	4.20a	4.40a	4.21a
Adding	4.07a	4.13a	4.23a	4.43a	4.23a
Spray	4.33a	4.16b	4.26b	4.43a	4.30a
			4.43a	4.26b	4.16b	4.13b	**V**. Mean

The numbers in Table 3 show that the methods of adding acid to plants showed a significant effect on the percentage of total chlorophyll, as the highest percentage reached 12.32 mg g-1 wet weight, with an increase rate of 7.59% compared to the plants sprayed with acid, which gave the lowest percentage of 11.45 mg. gm-1 wet weight, which did not differ significantly from the control treatment.

The varieties showed a significant difference in their total chlorophyll content, as the French variety had the highest percentage, reaching 12.27 mg gm plant^{-1} wet weight, compared to the Iraqi, Netherland, and Spanish varieties, which gave 11.52, 11.73, and 11.76 mg gm^{-1} dry wet weight, respectively, which did not differ in terms of between them morally.

From the table, we note that the interaction between acid treatment methods and varieties had a significant effect on the percentage of total chlorophyll in the leaves, amounting to 12.87 mg gm^{-1} dry wet weight when adding acid to the French variety, with an increase rate of 15.95% compared to plants of the local variety not treated with acid, which gave the lowest percentage. It reached 11.10 mg gm^{-1} dry wet weight.

V	Local	Netherland	Espanish	Franch	**H**..Mean
H					
0	11.10g	11.47ef	11.27c	11.74d	11.45b
Adding	12.00c	12.16bc	12.27b	12.87a	12.32a
Spray	11.46ef	11.57e	11.37f	12.23b	11.71b
			12.27a	11.76b	11.73b	11.52b	**V**. Mean

It is noted from the results presented in table (4) that the different treatment methods with humic acid had a significant effect on the number of leaves on plant-1, as the treatment of adding the acid to the

potting soil excelled in giving it the highest number of leaves, amounting to 87.75 leaves, with an increase rate of 6.78% compared to the control treatment, which gave 82.18 leaves, which did not differ significantly from the acid spray treatment.

From the same table, we notice the difference between the varieties in terms of the number of leaves plant^{-1}. The French variety excelled, giving the highest value of 92.65 leaves, with an increase rate of 16.66% compared to the local variety, whose number of leaves reached 79.37 leaves.

The interaction between humic acid and the cultivars showed a significant effect on the number of leaves, plant^{-1}, in which the interaction between the French cultivar with humic acid added to the pots in which it was grown gave the highest number of leaves, amounting to 97.33 leaves, with an increase rate of 26.40% compared to the local variety not treated with acid, which gave the lowest number of the leaves it was 7.02 leaf plant^{-1}.

Table 4. Effect Treatment Method with Humic Acid and Vrieties on Number of leaves .plant^{-1}

V	Local	Netherland	Espanish	Franch	**H**..Mean
H					
0	77.02i	81.70fg	81.67fg	88.33c	82.18b
Adding	81.00g	86.00d	86.68d	97.33a	87.75a
Spray	80.00h	83.00e	82.33ef	92.00b	84.33ab
		V. Mean	79.34c	83.57b	83.56b	92.56a

Table (5) shows that treatment methods with humic acid have a significant effect on the percentage of protein in the seeds, as the highest percentage reached 23.75% when adding the acid to the soil, with an increase of 8.75% compared to the control treatment, in which the percentage of protein in its plants reached 21.84%, while it did not Significantly different from the acid spray treatment.

The varieties differed in their protein content. The highest percentage was in the foreign varieties, with the highest percentage in the French variety reaching 24.0%, and it did not differ significantly from the Spanish and French varieties, in which the percentage of protein reached 22.83 and 23.67%, respectively.

The interaction between the method of adding acid and the varieties was significant, in that the interaction was superior to the addition of acid for the French variety, with the highest percentage of protein reaching 24.99%, with an increase rate of 30.50% compared to the local variety, whose percentage of protein in its plants reached 15.15%.

Table 5. Effect Treatment Method with Humic Acid and Vrieties on Percentage of Protein%.

V	Local	Netherland	Espanish	Franch	H..Mean
H					
0	19.15h	22.41e	22.40e	23.40c	21.84b
Adding	21.22f	24.41c	24.29c	24.99a	23.75a
Spray	19.78g	22.78d	22.79d	23.62b	22.25a
		V. Mean	20.05b	23.20ab	23.16ab	24.00

Discussion: The difference between varieties in the height of their plants is due to internal genetic reasons

As for the increased plant height as a result of adding humic acid, the reason is due to the ease of

absorption of the acid through the roots and the difficulty of absorbing it through foliar spraying because the molecular weight of the acid is high. The effect of humic acid comes in increasing the vital activity of the plant and raising the rate of absorption of nutrients which leads to an increase in the plant growth rate, or the reason may be due to the fact that humic acid has a hormonal effect, as it affects the cell protoplasm and the cell wall, which leads to rapid cell division and growth and thus increases the height of the plant.

The increase in the total chlorophyll content of plants is also due to the fact that humic acid is included as a complementary source of polyphenols in the early stages of plant growth, which acts as a respiratory chemical mediator. This in turn leads to an increase in the biological activity of the plant, as the effectiveness of the enzymatic system increases, and the division and development of cells and the development of the system increase. Root, and dry matter production increases with the activation of chemical processes in the plant, such as photosynthesis and chlorophyll collection ,and he superiority achieved in growth characteristics, including the number of branches and the accompanying positive moral effect resulting from the use of humic acid, is due to a similarity between the effect of auxin and the stimulating humic acid in encouraging vegetative growth and the accompanying absorption of nutrients, and humic acid has important effects in the absorption of nutrients by the plant (Bohme and Thilua, 1997).

The high percentage of protein in plants may be attributed to the addition of humic acid in the table to the role of the acid in supplying nutrients, improving soil texture, facilitating water absorption and ion exchange, and improving plant growth, which was reflected in the plant's quantitative and qualitative yield (Muter et al., 2015), and the difference between varieties in Its protein content depends on internal genetic factors linked to the variety itself.

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