Influnce of foliar spray with concentrations of Calboron on the growth and productivity of two Faba bean varieties (Vicia faba L(.

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Abstract

An experiment was conducted in the Research station of field crops sciences department/College of Agriculture/University of Diyala for the fall season 2024-2023 with the aim of studying the effect of adding caliboron on the growth and yield of Faba bean.The experiment included two factors and was applied according to a randomized complete block design (R.C.B.D) with three replicates in a split-plot arrangement. The first factor was three concentrations of Calboron (0, 500 and 700) ml/L-1, were symbolized by (T1, T2, T3), which were sprayed before the flowering stage, were assigned as main panels. The second factor was two varieties of broad beans (Spanish and local Iraqi), which are symbolized by (G1 and G2), were assigned as the secondary panels. The results showed that the Spanish variety G1 didn't significantly superior to the local variety in most of the studied traits. It was presented the highest average in the number of branches, number of pods, pod length, and weight of 100 seeds, as it gave 6.78 branches. plant-1, 7.33 pods. plant-1, 19 cm, 114 g, respectively. Spraying with Calboron at a concentration of 700 ml / L-1 was superior in most of the studied traits. It was offered the highest average values for plant height, number of branches, pod length, number of pods, and weight of 100 seeds, which were 72.8 cm, 7.00 branches. plant-1, 18.67 cm, 8.67 pods. plant-1, 115 g, respectively. The research results showed a significant interaction in the number of pods and the weight of 100 seeds. The interaction between the spray treatment T2 and G2 were presented the highest rates, while the spray treatment T1 and G1 were offered the lowest values.

Keywords: Calbron, Faba bean varieties, Addition concentrations.

Introduction:

Faba bean (Vicia faba L.) are an important food source, as their seeds contain a high percentage of protein, estimated at 25-40%, and carbohydrates, which may reach 56%, in addition, It minerals, fibers, oils, and vitamins contains [1]. They are one of the crops that improve soil properties by fixing atmospheric nitrogen in to soil as a result of their containing root nodules, and consequently It is considered to be important in the agricultural rotation system with the aim of improving soil properties [2]. The production rate of this crop in Iraq is still low, as the total area planted with it is 20,811 dunums with a productivity estimated at 41 thousand of green faba bean [3]. Compared to global production, which amounted to about 2,327 hectares with a

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productivity of 4.1 million tons [4]. This decrease in yield is due to the fall of newly formed flowers. It is one of the problems facing the cultivation of broad beans in Iraq, which accounts for)60-80%) of the total flowers, and this percentage is high. lossing hair is due to a deficiency of some important nutrients such as (Mn, Fe, Cl, Mo, B, Zn, CU).

It was found that adding these elements by spraying foliar feeding. It is considered one of the important methods for treating the deficiency of elements in the plant to compensate or reduce the loss of these nutrients [5]. Boron is one of the important elements in the process of protein formation through its importance in fixing atmospheric nitrogen biologically and its effect on the process of RNA formation. Boron also plays an important role in transporting carbohydrates from the source to the outlet, protecting auxin IAA and its transfer and increasing cell division and expansion. It gives a greater opportunity for growth and branch formation that is reflected in vegetative growth in general [6 and 7]. The element boron plays a role in plant growth and development by facilitating the movement and transfer of photosynthesis products from the leaves to the active areas of the plant and encourages the growth of the pollen tube, causing increased fertilization and maintaining the water balance in the cell [8]. Baron deficiency occurs when calcium increases due to the antagonistic relationship between them or when the groundwater level rises and ventilation is poor [6 and 9]. Due to the importance of the element boron and its effective role in increasing production through its effect on the fertilization and flowering process. Calcium plays a role in supporting and strengthening the various parts of the plant, preventing damage to cell walls, and regulating the ratios of major and minor nutritional elements [10.[

The aim of this research was to demonstrate the importance of foliar spraying with different concentrations of calborone on the growth and productivity of faba bean crop.

Materials & Methods :

The study was conducted at the Research Station of the Department of Field Crop Sciences, College of Agriculture, University of Diyala, for the fall season 2023-2024. The experimental land was prepared using a rototiller and the soil was leveled using a disc plough. Leveling operations were carried out and the field was divided according to the randomized complete block design (RCBD) with three replicates according to the split-plot arrangement system, as the varieties occupied the secondary plots (Spanish and local Iraqi) and were symbolized by (G1 and G2) And the concentrations of calcium (30% calcium and 1% boron) were placed in the main plates, which are (0, 500 and 700) ml/L-1, which are symbolized by (T1, T2, T3). That were added using a backpack sprayer. The seeds were planted on 10/31/2023 using the grove method, the distance between one grove and another is 50 cm and between holes is 20 cm. The area of the experimental unit was 10 m2 (5 m x 2 m).), the plants were thinned and one plant was left in the hole two weeks after germination. In addition to the manual weeding was practicing and , removing the accompanying weeds, and watering according

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to the plant's need. Table (1) shows the physical and chemical properties of the experimental soil.

Table 1. shows the physical and chemical properties of the experimental soil

Characteristics	**Unit**	**Value**
Sand	$g.kg^{-1}$	811
Slime	$g.kg^{-1}$	129
Clay	$g.kg^{-1}$	61
Cation exchange capacity	$cmol.kg^{-1}$	15.40
Electrical conduction EC	$(ds.m^{-1)}$	4.3
Soil PH	-	7.4
Organic matter	%	46
Gypsum	$g.kg^{-1}$	0.142
Nitrogen	$mlg.kg^{-1}$	27.5
Phosphors	$mlg.kg^{-1}$	30.2
Potassium	$mlg.kg^{-1}$	130.2
Soil texture		Sandy mixture

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Characteristics studied in the experiment :

-1Plant height (cm(

Measured by ametrik tape from the crown area to the growing tip in the top, with five plants for each treatment, then extract the average plant height.

-2Number of branches (branch.plant-1(

The number of branches was calculated for five plants in each experimental unit and then the average was extracted.

-3Length of pod (cm(

The pod length of five plants in each experimental unit was measured and the average was extracted.

-4Number of seeds in pod (1 seed.pod-1(

It was calculated this trait by taking 5 plants, counting the seeds, and extracting their average.

-5Number of pods per plant (pod.plant-1(

It was calculated the number of pods for five plants and for each experimental unit and was extracted extract its average.

-6Weight of 100 seeds (g(

The seed weight of five plants for each experimental unit was measured and the average was extracted.

The data of the studied traits were analyzed according to the design used (RCBD) with the split-plot system using the GenStat statistical analysis program, and the averages were tested according to the L.S.D test (least significant difference) below the probability level of 0.05.

Results and Discussion:

Plant height (cm.(

Plant height is one of the important indicators of vegetative growth, which results in cell division and elongation when the plant grows naturally without external influence or stress. The results in table 2 showed that there was no significant effect of either calboron concentrations, varieties, or the interaction between them on the trait of plant height. Non-significant effects between trait averages may be attributed to the fact that some varieties did

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not have a negative effect on competition for nutrients and light, and this is due to the large size of the plant and its rapid growth [11.[

Table 2. Effect of Calboron spraying on plant height (cm) for two faba beans varieties

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Calboron	**Varieties**		**Means**
	G1	**G2**	
T1	56.3	72.7	64.5
T2	57.3	75.3	66.3
T3	67.3	78.3	72.8
	60.3	**75.4**	
Interaction NS	**Varieties NS**	**Calboron NS**	**L.S.D** 0.05

Number of branches (branch.plant-1. (

Branching is of great importance in crop production and is considered a major component of the yield components of field crops such as wheat, especially faba bean, as the varieties of faba bean are affected by the genetic nature in determining the plant's ability to grow and branch and present the highest possible number of effective vegetative branches [12]. The results of table 3 showed that the Spanish variety G1 was superior in presenting the highest average number of branches, which reached 6.78 branches.plant-1, while the local variety G2 recorded the lowest average for the trait, which reached 6.44 branches.plant-1, but these differences were not significant. Faba bean varieties differ among themselves in characteristics, and this is due to the difference in genetic makeup in terms of their ability to grow and cell division [11.[

The results in table 3 showed that spraying Calboron at a concentration of 700 ml.L-1 recorded the highest average number of branches, reaching 7 branches.plant-1, while the concentration of 500 ml.L-1 recorded the lowest average for the studied trait, reaching 6.33 branches.plant-1, but these differences did not reach the level of significance.

The results showed that the interaction between the two faba bean varieties and Calboron spraying the interference between the concentrations of Calboron and varieties had no significant effect on this characteristic table 3 did not reach the level of significance.

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Table 3. Effect of Calboron spraying on the number of branches (branch.plant-1) of two faba beans varieties

Calboron	**Varieties**		**Means**
	G1	**G2**	
T1	7.23	5.67	6.50
T2	5.67	7.00	6.33
T3	7.33	6.67	7.00
	6.78	**6.44**	
Interaction **NS**	**Varieties** **NS**	**Calboron** **NS**	**L.S.D** 0.05

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Length of pod (cm. (

The results of table 4 showed that the Spanish variety G1 was superior, presenting the highest average pod length of 19 cm, which did not differ significantly from the local variety G2, which recorded the lowest average for the trait of 18.11 cm.

The results of table 4 showed that the treatment of spraying Calboron at a concentration of 700 ml.liter-1 offered the highest average for the trait, reaching 18.67 cm, which did not differ significantly from the remaining treatments, while the treatment of 500 ml.liter-1 and the treatment of not spraying recorded the lowest average for pod length, reaching 18.50 cm. The reason for the lack of effect of foliar spraying with Calboron may be due to the possibility that the plant obtains its sufficiency of these elements through the roots from the soil, and for this reason we note from the data that the amount of increase in the studied trait was very small and did not reach the level of significance.

As for the interaction treatments between the two faba bean varieties and Calboron spraying, did not reach the level of significance.

Table 4. Effect of Calboron spraying on pod length (cm) of two faba beans varieties

Calboron	**Varieties**		**Means**
	G1	**G2**	
T1	19.33	17.67	18.50
T2	18.67	18.33	18.50
T3	19.00	18.33	18.67
	19.00	**18.11**	
Interaction **NS**	**Varieties** **NS**	**Calboron** **NS**	**L.S.D** 0.05

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Number of seeds in pods (seed.pod-1. (

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The number of seeds per pod is one of the most important components of the yield in faba beans and represents the number of fertilized eggs that succeeded in producing seeds. It is also one of the most desirable traits in selection due to its importance in increasing the seed yield in the plant. The results in table 5 indicated that there are differences between the two broad bean varieties, but they did not reach the level of significance, as the G2 variety presented the highest average for the trait, reaching 5.67 seeds.pod-1, while the G1 variety offered the lowest average for the studied trait, reaching 5.22 seeds.pod-1.

The results in table 5 showed that the Calboron spraying treatment (500 ml. L-1) presented the highest average number of seeds per pod, reaching 5.67 seeds. Pond, which did not differ significantly from the concentration (700 ml. L-1) and the non-spraying treatment, which recorded 5.50, 5.17 seeds. Pond-1, respectively. This is due to the important role of nutrients in the pollination process and thus increasing the fertility rate in the pods, which leads to an increase in the number of seeds in the pod [8]. This result is consistent with [13.[

The results of the statistical analysis of table 5 showed no significant differences between the two-way interaction between the two faba bean varieties and Calboron spraying. It was found that the two-way combination (G2 and the spraying treatment at a concentration of 500 ml. L-1) offered the highest average for the number of seeds per pod, reaching (6) seeds. pod-1, while the two-way combination (G1 and the non-spraying treatment) recorded the lowest average for the studied trait, reaching (5 seeds. pod-1.(

Table 5. Effect of spraying Calboron on the number of seeds per pod (seed.pod-1) of two faba beans varieties

Calboron	**Varieties**		**Means**
	G1	**G2**	
T1	5.00	5.33	5.17
T2	5.33	6.00	5.67
T3	5.33	5.67	5.50
	5.22	**5.67**	
Interaction **NS**	**Varieties** **NS**	**Calboron** **NS**	**L.S.D** 0.05

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Number of plant pods (pod.plant-1(

The increase in the number of pods in the plant, which is one of the most important factors in increasing the economic yield by increasing the concentrations of the nutrient solution (calcium). May be due to the fact that the pectin in the cell walls acts as a drain for the absorbed nutrients that are later prepared for the flowers and seeds. It was found that in the case of a deficiency of nutrients, the flowers may be damaged or the seeds may be aborted [6]. The varieties did not differ in the number of pods in the plant, as table 6

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indicated that there are no significant differences in this characteristic.

Spraying plants with Calcium Boron (Calcium and Boron) had a positive and significant effect on the number of pods per plant, as the number of pods per plant reached 8.67 pods. plant-1 at a concentration of 700 ml.L-1, while the concentration of 500 ml/L and the non-spraying treatment presented the lowest average for the studied trait, reaching 5.83 pods. plant-1. The reason for the increase in the number of pods in the plant is attributed to the contribution of the nutrient solution (calcium and boron) in increasing flower set by achieving the highest percentage of pollen germination and increasing the length of the pollen tube [5]. In addition to the superiority of the concentration of 700 ml/liter by offering the highest average pod length, which was positively reflected on the number of pods in the plant. These results are consistent with [14.[

As for the interaction treatments, the results in table 6 showed that the interaction treatment (G1 variety and 700 ml.L-1) presented the highest rate of pods per plant, reaching 10.67 pods per plant, while the treatment (first variety and control treatment) recorded the lowest rate for the studied trait, reaching 5.33 pods per plant. The reason for the difference in the response of the varieties to Calboron may be due to the genetic difference between the genetic compositions. As many studies confirm the existence of differences between the varieties in most of the vegetative and yield traits, the most important of which is the number of pods per plant [5.[

Table 6. Effect of spraying Calboron on the number of pods (pod.plant-1
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Calboron	**Varieties**		**Means**
	G1	**G2**	
T1	5.33	6.33	5.83
T2	6.00	5.67	5.83
T3	10.6	6.67	8.67
	7.33	**6.22**	
Interaction 5.54	**Varieties** **NS**	**Calboron** 1.78	**L.S.D** 0.05

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Weight of 100 seeds (g(

This trait is affected by the genetic nature of the variety and environmental conditions, so this trait is important in distinguishing between faba bean culture .This trait depends on the variety's ability to accumulate synthetic substances at the source (leaves) and transfer them to the downstream (seeds). Table 7 showed that there are no significant differences in the weight of 100 seeds, as the G1 culture offered the highest average of 114.1 grams, with the variety presenting the lowest average of 86.4 grams. This result is consistent with [15], due to the differences

between varieties in seed size, and that the seed weight of any plant is a function of the rate of photosynthesis and the transfer of its results.

As for the effect of foliar spraying with carbon, the results of table 7 showed that the spraying treatment at a concentration of 700 ml.L-1 had a significant effect on the weight of 100 seeds and presented the highest average of 115.7 g compared to the concentration of 500 ml/L-1 which offered 85 g, while the non-spraying treatment recorded 100g as an average for the weight of 100 seeds. The reason for the increase is due to the role of boron in increasing the transfer of carbohydrates and thus the maximum accumulation of starch in the seed occurs [6.[

The binary interactions showed significant differences between them. Table 7 showed that the interaction treatment (variety G1 and G2 700 ml.L-1 presented the highest average of 145.5 g compared to the combination (variety G1 and G2 and concentration 500 ml.L-1) in offering the lowest average for the studied trait of 85.0 .

Table 7. Effect of Calboron spraying on weight of 100 seeds (g (

Calboron	**Varieties**		**Means**
	G1	**G2**	
T1	112.2	87.7	100.0
T2	85.0	85.0	85.0
T3	145.5	86.3	115.7
	114.1	**86.4**	
Interaction 48.70	**Varieties** **NS**	**Calboron** 16.99	**L.S.D** 0.05

Conclusion

The results obtained in this study showed that the response of the two cultivated varieties differed while the Spanish variety was significantly superior to the local variety in the characteristics of the number of pods and the weight of 100 seeds. As for the concentrations of Calboron spraying, the spraying treatment with a concentration of 700 ml.L-1 had a significant effect on the characteristic in the weight of 100 seeds and presented the highest average. This is due to the increase in the percentage of flower set, which led to an increase in the number of pods. Calboron is excellent in improving fruit set and reducing the fall of fruits and flowers. It prevents and treats physiological diseases resulting from calcium deficiency.

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