KIRKUK UNIVERSITY JOURNAL FOR AGRICULTURAL SCIENCES

Response two genotype of bean to spraying salicylic acid and boronic acid

Sara Ali Hussein[1] scbm23014@uokirkuk.edu.iq

Mahmoud Shakir Al-jubory[2] aljboorymahmood@uokirkuk.edu.iq

[1,2] Department of Biology, College of Science, University of Kirkuk, kirkuk, Iraq.

- Part of MSc. Dissertation for the first author.
- Date of research received 11/01/2024 and accepted 05/02/2024.

Abstract

The effects of spray nutrition with boron and salicylic acid on two genotypes of bean plants, Local and Spanish genotypes, learned using a Randomize complete block design (RCBD) in growth season 2023-2022. Three boron concentrations (0, 25, 50) mg. L^{1} and salicylic acid concentrations (0, 100, 200) mg. L^{-1} were used, each coefficient contains three replicates. Plant height, glucose content, protein content, and biological yield were all studied. The results explain that 100 mg. L^{-1} of salicylic acid concentrations gives maximum values for plant height and biological yield. The concentration of 200 mg. L^{-1} of salicylic acid gives maximum values in protein and carbohydrate content. The concentration 50 mg. L^{-1} of boon produced the greatest plant height and carbohydrate content, while the concentration 25 mg. L^{-1} of boron yielded the greatest protein content. The biological yield decreased significantly. The local genotype excelled in carbohydrate content, while the Spanish genotype excelled in plant height, protein content, and biological yield. The interaction between types and boron concentration revealed that the Spanish genotype had the maximum plant height and protein content at 25 mg. L^{-1}, However local genotype gives the maximum value of carbohydrate content at 50 mg. L^{-1}, while the biological yield did not achieve any significant increase. The interaction between salicylic acid and genotypes produced the greatest plant height and biological yield for the Spanish genotype, whereas the concentration of 200 mg. L^{-1} of salicylic acid produced the greatest of protein content for the local genotype. The local species had the maximum carbohydrate content at the concentration 100 mg. L^{-1} of salicylic acid. When both salicylic acid and boron concentrations were applied at 100 and 0 mg. L^{-1}, the result explane the interaction between them achieved a significant increase in plant height and biological yield, whereas the interaction of 100 mg. L^{-1} of salicylic and 25 mg. L^{-1} of boron concentrations gives significant increase in protein content. Furthermore, combining concentration 200 mg. L^{-1} salicylic acid with 50 mg. L^{-1} boron an in achieved a significant increase in carbohydrate content. As a result of the three-way interaction between three research components, a concentration 200 mg. L^{-1} 0f salicylic acid with 25 mg. L^{-1} of boron yielded the maximum value for plant height of the Spanish genotype. while, the Spanish species had the maximum protein content at a concentration 100 mg. L^{-1} of salicylic acid with 25 mg. L^{-1} of boron. The concentration is 200 mg. L^{-1} of salicylic acid with 50 mg. $L^{-1}$of boron, on the other hand, provided the greatest value for carbohydrate content of the local genotype.

Key Words: Spraying, Salicylic acid, Levels, Boron, *Vicia faba*.L.

Citation: Hussein, S., & Aljboury, M. (2024). Response two genotype of bean to spraying salicylic acid and boronic acid. *Kirkuk University Journal For Agricultural Sciences*, 15(1), 35-45. doi: 10.58928/ku24.15104

Correspondence Author: Sara Ali Hussein_ scbm23014@uokirkuk.edu.iq

Introduction

Vicia faba L. is a winter crop of the broad bean plant of the legume family Fabaceae. Its seeds have a high protein composition that ranges from 25% to 40% [1] with considerable levels of necessary type of amino acids like lysine, leucine, and arginine. It is considered a cheaper source of protein compared with animal protein, which is more expensive. Broad beans considered an important food for people, particularly those with limited income are considered green protein sources. The seeds are also high in minerals, fiber and vitamins, and comprise roughly 56% carbs [2]. They are high in vitamins A, B12, and C. The importance of broad beans stems from their ability to improve soil characteristics through nitrogen fixation via root nodules developed in association with nitrogen-fixing bacteria, particularly Rhizobium spp. As a result, they're employed in crop rotation to improve soil conditions. Broad beans are also used in the preparation of livestock feed. They may be cultivated in a genotype of soil types, but their drought tolerance is limited, especially during flowering time, when water stress can result in flower drops. This crop tolerates a wide range of soil pH, often between 4.5 and 8.3. The production of root nodules diminishes when pH levels decline, resulting in a reduction in nitrogen fixation efficiency. Boron stimulates biological activities during the flowering stage, which aids in fruit formation. It also helps to construct the cell wall and pollen tube. Boron allows products of photosynthetic to flow from the leaf to other areas of the plant, such as the transmission of active hormones. It also helps in pollination by promoting pollen grain attachment. Its presence improves the plant's drought tolerance by modulating water absorption speed, which helps to regulate cellular water balance through increased cell development. Salicylic acid, also known as orthohydroxybenzoic (OH)COOH, is a naturally occurring phenolic hormone derived from the willow plant. SA [3] is its chemical composition. Salicylic acid is a water-soluble antioxidant chemical that is prevalent in the bark and leaves.

It is generated from the amino acid phenylalanine and regulates a genotype of physiological processes. [4] indicated that using concentration of 300 mg. L^{-1} of salicylic acid led to an increase the nitrogen content in the date plam reached 2.23 % comparative with the control treatment. [5] indicated that using concentration 1 ml. L^{-1} of boron led to an increase in the leaf area of apricot plant reached 24.79 cm^2 compared with the control treatment. [6] indicated that using concentration of 20 mg. L^{-1} of boron led to an increase in the yield characteristics of strawberry plants including a number of flower plant it reached 13.64 flower. $plant^{-1}$ comparative with the control treatment.

Materials and Methods:

The field experiment was carried out throughout the 2023-2022 agricultural season, using a Randomised Complete Block Design (RCBD) with three replicates for each coefficient to study effect of spray feeding using a concentration of boron (0, 25, 50) mg. L^{-1} and concentration of salicylic acid (0,100,200) mg. L^{-1}. Seeds of indigenous and Spanish broad bean genotypes were received from the agricultural agencies in Kirkuk Governorate. The seeds were planted in plastic pots with a capacity of 7 kilogrames, 30 cm in on October 29, 2022, in plastic pots with a capacity 7 kilogrames, diameter 30 cm and 25 cm in height. Five seeds were placed in each pot at first, and after ten days, they were trimmed to three plants. These plants were collected from nurseries and underwent to laboratory testing to assess their physical and chemical properties at the Kirkuk Agriculture Directorate's laboratories. The plants were foliar sprayed with boron concentrations (0, 25, 50) mg. L^{-1} and salicylic acid concentrations (0, 100, 200) mg. L^{-1} thirty days after planting. The plants were drenched with a manual 1 litre size sprayer until totally wet. After 30 days, the second spray was carried out with the same concentrations as the first. The following characteristics were then investigated:

Table (1) show physical and chemical properties of soil.

Property	Measurement Unit	Value
EC	$mmho.cm^{-1}$	0.043
PH		7.75
TDS	mg/Kg	50
Nitrogen	mg/Kg	20.6
Phosphrous	mg/Kg	5.4
Potassium	mg/Kg	90.9
Sodium	mg/Kg	72.12
Calcium	mg/Kg	
Texture		Lomia sand
Clay	%	12
Silt	%	16
Sand	%	72

Studied Traits

1. **Plant Height (cm)**: The height of three plants was measured using a tap measure, starting from the surface of the soil to the top of the plant and then the average was extracted.

2. **Percentage of Protein in the Plant**: The protein percentage was measured by measuring the Nitrogen percentage in the broad bean plants was estimated using the micro-Kjeldahl method following the procedure by [7], and then extracting the protein percentage using the equation as Nitrogen percentage × 6.25.

3. **Estimation of Carbohydrate Content in the Plant**: Soluble carbohydrates in the broad bean plant were estimated using spectrophoto meter at the wavelength 490nm according to the method [8].

4. **Biological Yield (grams per. plant^{-1})**: The biological yield of plant biomass is determined in grams per plant (grame per. plant^{-1}).

The biological yield is calculated through the following equation:

Biological Yield = Total Dry Weight of Vegetative Biomass + Seed Weight

Statistical analysis was performed using the statistical data analysis program SAS version and based on the dengue multiple rang test.

Result & Discussion

Plant height

Table 2 depicts the effect of spraing genotypes with boron and salicylic acid and their interferences in the height plants of broad bean. The results show a significant increase in plant height if the concentration of 100 mg. L^{-1} of salicylic acid gives the highest value in height plant is 60.66 cm compared to the control treatment, which generated a lower height of 54.11 cm. The role of salicylic

acid is improving meristematic activity and increasing cell division and they can be linked to this increase in plant height. Furthermore, can to prolong senescence by modulating gene expression and inhibits the formation of abscisic acid, which is similar to [9] findings.

The table's results also illustrate the effect of boron on plant height increased as boron concentrations increased, with 50 mg. L^{-1} of boron producing the most significant increase, reaching 58.64 cm compared to the control treatment is 53.53 cm. This is due to the role of boron in boosting glucose transport to active areas and the generation of auxin, which stimulates cell elongation, ultimately resulting in increased plant height, as reported by [10].

The average impact of the genotypes also showed a significant difference in plant height. The Spanish genotype exhibited the highest plant height at 58.64 cm, compared to the local genotype, which reached 54.94 cm. This difference between the two genotypes can be attributed to genetic genotypes that affect cell division and elongation.

Table 2 appears that the interferences between types and concentrations of salicylic

acid have substantial effect on plant height. The concentration of 100 mg. L^{-1} of salicylic acid gives the largest plant height for the Spanish genotype, reaching 61.89 cm, whereas the salicylic acid concentration of 200 mg. L^{-1} gives a lower height of 49.70 cm for the local genotype.

Furthermore, there was a large rise in the interferences between boron and genotypes. The concentration of 25 mg. L^{-1} of boron achives the highest plant heights for the Spanish genotype is 60.89 cm, while local genotype had decrease height at 0 mg. L^{-1}. This increase in plant height is due to the role of boron in stimulating the process of photosynthesis and building nucleic acids, which contributes to increasing cell elongation and division, as found by [11].

Furthermore, the results provided in Table 2 also demonstrate the impact of interferences between boron concentrations with salicylic acid concentrations, the interaction indicates significant differences, whereas the concentrations of 100mg.L^{-1} of salicylic acid and 0 mg. L^{-1} of boron yielded the maximum value of plant height, which is 62.72 cm, compared to concentrations 0 mg. L^{-1} of boron and salicylic acid which achieved the minimum value of height plant reaching 45.38 cm.

The interferences between types, boron concentrations, and salicylic acid concentrations demonstrate a significant increase in plant height with increasing concentrations. The Spanish genotype achieved the maximum value of plant height reaching 65.53 cm when spray of 25 mg. L^{-1} boron and 200 mg. L^{-1} salicylic acid, compared to concentration of 0 mg. L^{-1} boron and salicylic acid reaching 42.23 cm.

Table (2) Effect of genotype and spraying salicylic acid and boronic acid and interaction them in plant height (Cm).

Genotypes	Boron concentrations (mg.L^{-1})	Salicylic concentrations (mg.L^{-1})			Average interaction between boron and genotypes
		0	100	200	
Local	0	42.23^{h}	63.10^{ab}	47.23^{gh}	50.86^{c}
	25	60.77^{a-d}	53.20^{c-g}	52.00^{e-g}	55.32^{b}
	50	64.10^{ab}	62.00^{ab}	49.87^{e-h}	58.66^{ab}
Lue Deotono	0	48.53^{e-h}	62.33^{ab}	57.77^{a-e}	56.21^{b}
	25	56.23^{b-f}	60.9^{a-d}	65.53^{a}	60.89^{a}
	50	52.8^{d-g}	62.43^{ab}	61.23^{a-c}	58.82^{ab}
Effect of average salicylic acid concentrations		54.11^{b}	60.66^{a}	55.61^{b}	

Average interaction between salicylic and genotypes

Genotypes	Salicylic concentrations (mg.L^{-1})			Effect of average genotypes
	0	100	200	
Local	55.70^{bc}	59.43^{ab}	49.70^{d}	54.94^{b}
Lue Deotono	52.52^{cd}	61.89^{a}	61.51^{e}	58.64^{a}

Average interaction between salicylic and boron

Boron concentrations (mg.L^{-1})	Salicylic concentrations (mg.L^{-1})			effect of average Boron concentration
	0	100	200	
0	45.38^{d}	62.72^{a}	52.55^{bc}	53.53^{b}
25	58.50^{ab}	57.05^{abc}	58.77^{ab}	58.11^{a}
50	58.45^{ab}	62.22^{a}	55.55^{bc}	58.74^{a}

Protein contains

Table 3 shows the effect of spraing genotypes with boron and salicylic acid treatment and their interferences in the protein content of plants. Results show considerable highest protein content, when spray concentration of 200 mg. L^{-1} of salicylic acid producing greatest protein content at 120.59%, compared to the control treatment is 75.47%. This highest protein content returns to the salicylic acid role by increasing growth rates, which is similar to the findings of [9].

In terms of the influence of boron concentrations, the results in Table 3 show

considerable genotypes, with the concentration of 25 mg. L^{-1} of boron resulting maximum in the protein content is 117.07%, compared to the concentration of 0 mg. L^{-1} of boron, is 79.11%. This rise back to the role of boron in nitrogen fixation and ribonucleic acid synthesis, which is consistent with the findings of [12].

The table results also show the influence of **genotypes**, with the Spanish **genotype** achieving much greater protein content of 105% compared to the local **genotype**, which reached 79.82%. This distinction is owing to the various genetic traits of each type.

It is clear from the results in the table above the interferences of salicylic acid concentrations and **genotypes** had a substantial effect on protein content. The concentration of salicylic acid 200 mg. L^{-1} in local **genotype had** maximum protein content is 122.81%, compared to the lowest value of 53.72% at a dosage 100 mg. L^{-1} of salicylic acid.

A substantial increase in protein content was seen when boron and **genotypes** interacted. The concentration of 25 mg. L^{-1} of boron achieved the highest in protein content for Spanish **genotype** is 126.63%, while local **genotype** had lowest value is 57.85% at concentration 50 mg. L^{-1} of boron.

The result explains interferences between boron and salicylic acid concentrations, it gave a significant increase in the protein content if concentration of 25 mg. L^{-1} of boron and 100 mg. L^{-1} of salicylic acid achieves the maximum protein content is 129.43%, while concentration of 50 mg. L^{-1} of boron and 100mg.L^{-1} of salicylic acid that gaves minimum value is 42.29%. This highest returns to salicylic acid roles in many processes of chemical, physiological and biological, consistent with findings of [13] .
The findings further underscore the importance of the interferences between genotypes, boron concentrations and salicylic acid.Where a significant increase was observed in protein content , if the concentration of 25 mg.L^{-1} of boron and 100 mg.L^{-1} of salicylic acid achieving highest protein content is 152.40% for the Spanish genotype, compared to the concentration of 50 mg.L^{-1} boron and 100 mg.L^{-1} salicylic acid**,** it gave minimum value of protein content reaching 25.52% for local genotype.

Table(3) Effect of genotype and spraying salicylic acid and boronic acid and interaction them in Protein contain %

Genotypes	Boron (mg.L^{-1}) concentrations	Salicylic concentrations(mg.L^{-1})			Average interaction between boron and genotypes
		0	100	200	
Local	0	46.66^{h}	29.17^{i}	146.56^{a}	74.13^{d}
	25	94.79^{e}	106.46^{d}	121.24^{b}	107.50^{b}
	50	47.39^{h}	25.52^{i}	100.63^{d}	57.85^{e}
Lue Deotono	0	56.88^{g}	114.48^{c}	80.94^{f}	84.10^{c}
	25	102.82^{d}	152.40^{a}	124.69^{b}	126.63^{a}
	50	104.27^{d}	59.06^{g}	149.48^{a}	104.27^{b}
Effect of average salicylic acid concentrations		75.47^{c}	81.18^{b}	120.59^{a}	

Average interaction between salicylic acid and genotypes

Genotypes	Salicylic concentrations (mg.L^{-1})			Effect of average genotypes
	0	100	200	
Local	62.95^{e}	53.72^{f}	122.81^{a}	79.82^{b}
Lue Deotono	87.99^{d}	108.65^{c}	118.37^{b}	105.00^{a}

Average interaction between salicylic and boron

Boron concentration (mg.L^{-1})	Salicylic concentrations (mg.L^{-1})			Effect of average boron oncentrations
	0	100	200	
0	51.77^{f}	71.82^{e}	113.75^{c}	79.11^{b}
25	98.81^{d}	129.43^{a}	122.96^{b}	117.07^{a}
50	75.83^{e}	42.29^{g}	125.05^{b}	81.06^{b}

Carbohydratis contains

Table 4 shows the effect of spryaing genotypes with boron and salicylic acid treatment and their interferences in the carbohydrate content in plants. The concentration of 200 mg. L^{-1} of salicylic acid achieved maximum carbohydrate content is 0.89%, whereas the control treatment, reached its value 0.53%. This increase in carbohydrate content return to the role of salicylic acid in the various physiological processes including nutrient absorption, the stimulation of photosynthesis and the inhibition of ethylene synthesis. This is consistent with the findings of [14].

Table 4 shows the underlined significance of boron in carbohydrate content. With increasing boron concentrations, there was a considerable rise in carbohydrate content. The concentration of 50 mg. L^{-1} of boron produced maximum carbohydrate content, reaching 0.99%, whereas concentration 0 mg. L^{-1} of boron produced 0.50%. This rise can be linked to boron role in transferring vital resources from leaves to seeds, as well as its role in increasing glucose metabolism, enhancing photosynthesis, and protein synthesis. These findings are consistent with what [15] reported.

The table also shows the role of genotypes in affecting carbohydrate content. A considerable variation in carbohydrate content was discovered, with the local genotype achieved highest value is 1.27% compared to the Spanish genotype, which had a content of 0.24%. The difference between genotypes is due to the difference in genetic characteristics of each genotypes.

Significant differences were also identified in the interaction of salicylic acid and genotype The local genotype had the highest carbohydrate content at 1.52% at 100 mg. L^{-1}, whereas the Spanish genotype had the lowest at 0.18% at the same concentration. This rise can be related to salicylic acid's stimulation of physiological processes in local genotype, which is similar the findings of [13].

There was a considerable difference in the interaction of boron and genotype. The local genotype had the highest carbohydrate content at 1.73% when the boron concentration was 50 mg. L^{-1}, while Spanish genotype had the lowest level at 0.18% when the concentration was 0 mg. L^{-1}.

The interference between concentrations of boron and salicylic acid achieved maximum in carbohydrate content. The concentrations 50 mg. L^{-1} of boron and 200 mg. L^{-1} of salicylic acid gave a maximum carbohydrate content was 1.18% while concentrations 0 mg. L^{-1} of both acids gave lowest level is 0.30% at 0 mg. L^{-1}.

The table showed the interference between genotypes, boron and salicylic acid effect significance in the carbohydrate content. The concentrations 50 mg. L^{-1} of boron and 200 mg. L^{-1} of salicylic acid had a maximum carbohydrate content at 2.03% for local genotype, while concentrations 25 mg. L^{-1} of boron and 100 mg. L^{-1} of salicylic acid had the lowest carbohydrate content at 0.14% for Spanish genotype

Table(4) Effect of genotype and spraying salicylic acid and boronic acid and interaction them in carbohydratis contains %

Genotypes	Boron concentrations ($mg.L^{-1}$)	Salicylic concentration ($mg.L^{-1}$)			Average interaction between boron and genotypes
		0	100	200	
Local	0	0.46^{c}	1.53^{b}	0.44^{cd}	0.81^{c}
	25	0.35^{c-e}	1.52^{b}	1.98^{a}	1.28^{b}
	50	1.63^{b}	1.52^{b}	2.03^{a}	1.73^{a}
Lue Deotono	0	0.14^{h}	0.19^{gh}	0.22^{f-h}	0.18^{e}
	25	0.32^{d-g}	0.14^{h}	0.34^{d-f}	0.27^{d}
	50	0.26^{e-h}	0.20^{gh}	0.32^{d-g}	0.26^{d}
Effect of average salicylic acid concentrations		0.53^{b}	0.85^{a}	0.89^{a}	

Average interaction between salicylic acid and genotypes

Genotypes	Salicylic acid concentration ($mg.L^{-1}$)			Effect of average genotypes
	0	100	200	
Local	0.82^{b}	1.52^{a}	1.49^{a}	1.27^{a}
Lue Deotono	0.24^{cd}	0.18^{d}	0.29^{c}	0.24^{b}

Average interaction between salicylic and boron

Boron concentrations ($mg.L^{-1}$)	Salicylic acid concentrations ($mg.L^{-1}$)			Effect of average boron concentrations
	0	100	200	
0	0.30^{d}	0.86^{c}	0.33^{d}	0.50^{c}
25	0.33^{d}	0.83^{c}	1.16^{a}	0.77^{b}
50	0.95^{b}	0.86^{c}	1.18^{a}	0.99^{a}

Biological Yield

Table 5 depicts the effect of spryaing genotypes with boron and salicylic acid treatment and their interference in the biological yield plants. The concentration of 100 mg. L^{-1} of salicylic acid gave the maximum biological production, value is 80.51 grams per $plant^{-1}$, whereas the control treatment gave a value of 76.81 grams per $plant^{-1}$. This goes back to the role of salicylic acid in physiological processes such as the division of cells and elongation, as well as in promoting roots to absorb more nutrients. It also increases the activity of antioxidant enzymes, all of this works to increase vegetative growth and as a result a larger biological yield. This observation agrees with the findings of [16].

Furthermore, the results show that the role of boron diminished significantly, with concentration of 0 mg. L^{-1} of boron resulting maximum biological yield, reaching 82.51 grams per $plant^{-1}$, compared to 25 mg. L^{-1} of boron resulting in the lowest biological yield, 70.69 grams per $plant^{-1}$.

The table also shows the role of genotypes in affecting biological yield he Spanish genotype generating much greater biological output, reaching 95.18 grames per $plant^{-1}$, compared to local genotype gave value is 57.09 grames per $plant^{-1}$. This discrepancy is due to genetic differences between the two kinds.

Regarding the interaction between concentrations of salicylic acid with genotypes. The concentration 100 mg. L^{-1} of salicylic acid gives maximum value of biological yield is 97.55 grames per $plant^{-1}$ for Spanish genotype, While the concentration 200 mg. L^{-1} of salicylic acid achieved minimum value of biological yield 49.02 grames per $plant^{-1}$ for local genotype.

As for the interference between genotypes and concentrations of boron, the concentration 0 mg. L^{-1} of boron achieved the maximum biological yield, reaching value 110.70 grams per $plant^{-1}$ for Spanish genotype while the lowest biological yield at concentration 25 mg. L^{-1} of boron is 51.58 grams per $plant^{-1}$ for the local genotype.

Table 5 shows influence of the interference between concentrations of boron and salicylic acid. the concentrations 0 mg. L^{-1} of boron

and 100 mg. L^{-1} of salicylic acid achieved the maximum value of biological yield, reaching value 92.44 grams per $plant^{-1}$, where as the concentrations 25 mg. L^{-1} of boron and 200 mg. L^{-1} of salicylic acid gave lowest biological yield of 64.62 grams per $plant^{-1}$.

The table 5 shows the interference between the genotypes, boron and salicylic acid. The concentrations 0 mg. L^{-1} of boron and 100 mg. L^{-1} of salicylic acid achieved the maximum biological yield, reaching value 122.68 grams per $plant^{-1}$ for the Spanish genotype, while the concentration 25 mg. L^{-1} of boron and 0 mg. L^{-1} of salicylic acid achieved the owest biological yield, 44.44 grams per $plant^{-1}$ for local genotype.

Table (5) Effect of genotype and spraying salicylic acid and boronic acid and interaction them in biological yield(gram.$plant^{-1}$).

Genotypes	Boron concentrations (mg.L^{-1})	Salicylic acid concentrations(mg.L^{-1})			Average interaction between boron and genotypes
		0	100	200	
Local	0	47.90^{fg}	62.20^{e}	52.96^{f}	54.36^{e}
	25	44.44^{g}	63.29^{e}	47.01^{fg}	51.58^{e}
	50	84.05^{d}	64.90^{e}	47.09^{fg}	65.35^{d}
Lue Deotono	0	103.24^{b}	122.68^{a}	106.09^{b}	110.70^{a}
	25	96.45^{c}	90.70^{c}	82.23^{d}	89.79^{b}
	50	84.76^{d}	79.27^{d}	91.24^{c}	85.09^{c}
Effect average of salicylic acid concentration		76.81^{b}	80.51^{a}	71.10^{c}	

Average interaction between salicylic and genotypes

Genotypes	Salicylic acid concentrations (mg.L^{-1})			Effect of average genotypes
	0	100	200	
Local	58.80^{d}	63.46^{c}	49.02^{e}	57.09^{b}
Lue Deotono	94.82^{ab}	97.55^{a}	93.19^{b}	95.18^{a}

Average interaction between salicylic acid and boron

Boron concentration (mg.L^{-1})	Salicylic acid concentrations (mg.L^{-1})			Effect of average boron oncentrations
	0	100	200	
0	75.57^{cd}	92.44^{a}	79.53^{c}	82.51^{a}
25	70.44^{e}	76.99^{c}	64.62^{f}	70.69^{c}
50	84.41^{b}	72.08^{de}	69.17^{e}	75.22^{b}

References

[1] Natalia Gutierrez., C. M, Avail., M.T, Moreno., and A.M, Torres (2008). Development of SCAR markers linked to zt-2, 0ne of the genes controlling absence of tannins in faba bean, Aust J of Agric. Res.,59 pp62-68.

[2] Mahmoud A. Najm. (2010). Economic analysis of the response of broad beans to level of n and p firtilizers.J. Agric.Sci., 41(5) PP 125-132.

[3] Hayat, S.and Ahmed, A. (2007). Salicylic acid a plant Hormone. Springer, Dordrecht, Netherlands:401 P.

[4] Abdulaziz, N.A. & Khalaf, J.M. (2023, November). Study of Effect of Foliar Spraying with Salicylic Acid and Organic Nutrient (Disper chlorophyll) on some Vegetative and Chemical Characteristics of Three Date Palm Cultivars (Phoenix dactylifera L.). In IOP Conference Series: Earth and Environmental Science (Vol.1158, No.4, p 042045). IOP Publishing.

[5] Lateef, M. A.A., Fadil, N.N., & Mohammed, B.K. (2021, November). Effect of Spraying with Cal-Boron and Potassium Humate and Maturity Stage on Fruit Quantity, Quality Characteristics of Apricot Pruns Armeniaca L.CV. "Royal". In IOP Conference Series: Earth and Environmental Science (Vol.910, No.1, p012038). IOP Publishing.

[6] Hussein, S.A.& Al-Doori, M.F. (2021). The Effect of Spraying with Calcium, Boron and Benzyl Adenine on The Quantity and Quality of Yield for Strawberry Plants (Fragaria Ananassa Duch) CV. Rubygem. In IOP Conference Series: Earth and Environmental Science (Vol. 910, No.1, p012066)). IOP Publishing.

[7] Walsh, L. M., & Beaton, J.D.eds. (1973). Soil testing and plant analysis. Soil Sci.Soc. of Amer., Madison, USA.

[8] Herbert, D., Phillips, P.J., & Strange, R.E. (1971). Methods in microbiology. Acad.Press, Lond.

[9] Al-Jubory, A. A. A. W and Jerry, A. N (2020). Effect of Antioxidant (Tocopherol-α and Acetylsalicylic acid) and addition method on the growth and component of the green yiled for *broad bean* plant cultivatied in the south of Iraq,

Euphrates Journal of Agriculture Science -12(2) :324-334.

[10] Fadil, A. H. .and Jader, J.J. (2020). The Effect of Foliar Spraying with Boron and Chelating Iron on Growth and yield of Broad Bean *(Vicia faba L.*). Plant Archives Vol.20, Supplement 1, pp 425-430.

[11] Alk.M.K.(2015). Effect of spray by nutrient solution (Murashige& Skoog) and boron in growth, yield and type of beans (*Vicia faba L*.). Diyala Journal of Agriculture Science 7(1):132-121.

[12] Jasim, A .H and Obaid, A. S. (2014). Effect of Foliar Fertilizers Spray, Boron and Their Interaction on Broad Bean (*Vicia faba L.*) Yield. Scientific Paper. Serries B, Horticulture. Vol. LVIII.

[13] EL-Afifi, S. T; E.E. Metwaly; M.B. Shokr and Madeha S.M. lsmail (2017). Effect of some safe compound on growth and productivity of Peas (*Pisum sativum*). J. Plant Production, Mansoura Univ., Vol.8 (1): 77-82.

[14] Mohammed, A. S, Mostafa H. M. Mohamed, Samar S. Halawa and Said A. Saleh (2023). Partial Exchang of Mineral N Fertilizer for Common Bean Plants by Organic N Fertilizer in the Presence of Salicylic Acid as Foliar Application. Gesunde pflanzen http:/doi .org/10.1007/s10343-023-00834-3.

[15] Saad, A. M (2015). Growth Behavior and Productivity of Faba Bean (*Faba vulgaris, L.)* as Affected by Various Promoting Foliar Applications. Middel East Journal of Applied Sciences. Volume :05. Issue:03. ISSN2077-4613.

[16] Talib ,Muhammed M.A. Abdulrazzaq and Muhammed Salem(2017).Effect of spray salicylic acid and Mechanical hoeing reduced the effect of biotic and abiotic anomalies on yield characteristics and components of *yellow corn*.Al-furat Journal of Agricultural Sciences-9(4):967-953.

.

استجابه صنفين وراثيين من الفول للرش بحامض السالسليك وحامض البورونيك

ساره علي حسين[1]
scbm23014@uokirkuk.edu.iq

محمود شاكر الجبوري[2]
aljboorymahmood@uokirkuk.edu.iq

[2،1] قسم علوم الحياة، كلية العلوم، جامعة كركوك، كركوك، العراق.

- البحث مستل من رسالة ماجستير للباحث الاول.
- تاريخ استلام البحث 11 /01 /2024 وتاريخ قبوله 05 /02/ 2024.

الملخص

نفذت هذه الدراسة في موسم النمو2022-2023 وفق تصميم القطاعات العشوائيه الكامله Randomize (R.C.B.D) Complete Block Design اذ استخدمت ثلاثه تراكيز من حامض البوريك وحامض السالسليك (50,25,0) ملغم.لتر$^{-1}$ (200,100,0) ملغم.لتر$^{-1}$ على التوالي بواقع ثلاث مكررات لكل معامله لدراسه تاثير التغذيه الورقيه لحامض البوريك وحامض السالسليك والتداخل بينهما على صنفي من نبات الباقلاء هما المحلي والاسباني حيث درست عدد من الصفات منها ارتفاع النبات والمحتوى البروتيني والمحتوى الكاربوهيدراتي والحاصل البايلوجي. اذ حقق التركيز 100 ملغم.لتر$^{-1}$ من حامض السالسليك اعلى قيمه للارتفاع النبات بينما اظهر االتركيز 50 ملغم.لتر$^{-1}$ من البورون اعلى قيمه في ارتفاع النبات .اما تاثير الاصناف فقد تفوق الصنف الاسباني في ارتفاع النبات على الصنف المحلي . اما التداخل الثنائي بين حامض السالسليك والاصناف فقد حقق التركيز 100 ملغم.لتر$^{-1}$ اعلى قيمه في ارتفاع النبات للصنف الاسباني ، بينمااوضحت نتائج التداخل الثنائي بين الاصناف والبورون فقد حقق التركيز 25 ملغم.لتر$^{-1}$ للصنف الاسباني اعلى قيمه في ارتفاع النبات. كما لوحظ ان التداخل بين تراكيز حامض السالسليك والبورون حقق زياده معنويه فقد اعطى التركيز 0 ملغم.لتر$^{-1}$ و100ملغم.لتر$^{-1}$ من حامض السالسليك والبورون على التوالي اعلى قيمه في ارتفاع النبات ، اما التداخل الثلاثي بين عوامل الدراسه الثلاث فقد اعطى التركيز25 ملغم.لتر$^{-1}$ و200 ملغم.لتر$^{-1}$ اعلى قيمه لارتفاع النبات للصنف الاسباني . وفسرت النتائج ان التركيز 200 ملغم.لتر$^{-1}$ من حامض السالسليك اعطى اعلى قيمه للمحتوى البروتيني ،اما تاثير البورون فقد اظهر التركيز 25 ملغم.لتر$^{-1}$ من البورون اعلى قيمه في المحتوى البروتيني.بينما تفوق الصنف الاسباني في االمحتوى البروتيني على الصنف المحلي. بينما التداخل الثنائي بين حامض السالسليك والاصناف قد حقق زياده معنويه اعطى التركيز 200 ملغم.لتر$^{-1}$ من حامض السالسليك اعلى قيمه للمحتوى البروتيني للصنف المحلي ،بينمااوضحت نتائج التداخل الثنائي بين الاصناف والبورون فقد حقق التركيز 25 ملغم.لتر$^{-1}$ من البورون للصنف الاسباني اعلى قيمه فالمحتوى البروتيني .كما لوحظ ان التداخل بين تراكيز البورون وحامض السالسليك فقد حقق التركيز25 ملغم.لتر$^{-1}$ و 100 ملغم.لتر$^{-1}$ من البورون وحامض السالسليك على التوالي زياده معنويه المحتوى البروتيني، اما التداخل الثلاثي بين عوامل الدراسه الثلاث فقد اعطى االتركيز 25 ملغم.لتر$^{-1}$ من البورون و100 ملغم.لتر$^{-1}$ من حامض السالسليك اعلى قيمه للمحتوى البروتيني للصنف الاسباني. وحقق التركيز 200 ملغم.لتر$^{-1}$ من حامض السالسليك اعلى قيمه للمحتوى الكاربوهيدراتي .واوضحت النتائج ان التركيز 50 ملغم.لتر$^{-1}$ من البورون اعطى اعلى قيمه في المحتوى الكاربوهيدراتي ،وقد تفوق الصنف المحلي على الصنف الاسباني في محتوى الكاربوهيدراتي .اما التداخل الثنائي بين حامض السالسليك والاصناف فقد حقق التركيز 100 ملغم.لتر$^{-1}$ من حامض السالسليك اعلى قيمه للمحتوى الكاربوهيدراتي للصنف المحلي. بينمااوضحت نتائج التداخل الثنائي بين الاصناف والبورون

زياده معنويه فقد حقق التركيز 50 ملغم.لتر$^{-1}$ من البورون اعلى قيمه في المحتوى الكاربوهيدراتي للصنف المحلي. كما لوحظ ان التداخل بين تراكيز البورون وحامض السالسليك ادى الى زياده معنويه للمحتوى الكاربوهيدراتي فقد حقق االتركيز 50 ملغم.لتر$^{-1}$ و 200ملغم.لتر$^{-1}$ من حامض البورون وحامض السالسليك على التوالي اعلى قيمه للمحتوى الكاربوهيدراتي. اما التداخل الثلاثي بين عوامل الدراسه الثلاث فقد اعطى التركيز 50 ملغم.لتر$^{-1}$ من البورون و200 ملغم.لتر$^{-1}$ من حامض السالسليك اعلى قيمه للمحتوى الكاربوهيدراتي للصنف المحلي. فسرت النتائج ان التركيز 100 ملغم.لتر$^{-1}$ من حامض السالسليك االعطى على قيمه لحاصل البايلوجي، بينما لم يلاحظ أي تاثير للبورون في الحاصل البايلوجي .اما تاثير الاصناف فقد تفوق الصنف الاسباني في االحاصل البايلوجي على الصنف المحلي. اما التداخل الثنائي بين حامض السالسليك والاصناف فقد حقق التركيز 100 ملغم.لتر$^{-1}$ من حامض السالسليك اعلى قيمه في الحاصل البايلوجي للصنف الاسباني ،بينمااوضحت نتائج التداخل الثنائي بين الاصناف والبورون ان هذا التداخل لم يحقق أي زياده معنويه في الحاصل البايلوجي.كما لوحظ ان التداخل بين تراكيز البورون وحامض السالسليك فقد حقق التركيز 0 ملغم.لتر$^{-1}$ و100ملغم.لتر$^{-1}$ من البورون وحامض السالسليك على التوالي زياده معنويه في الحاصل البايلوجي بينما اظهر التداخل الثلاثي بين عوامل الدراسه الثلاث فقد اعطى التركيز التركيز 0 ملغم.لتر$^{-1}$ و100ملغم.لتر$^{-1}$ من البورون وحامض السالسليك للصنف الاسباني على التوالي زياده معنويه في الحاصل البايلوجي.

الكلمات المفتاحية: الرش، البورون، حامض السالسليك، مستويات، نبات الباقلاء .