The Effect of Boron Spraying on Some Productive and Specificcharacter of two Ecotypes of Anise (Municipal and Shami) (Pimpinella anisum L.)

Hala Mohammad[1*], Ali Somaa[1*]

[1] College of Agriculture, Tishreen University, Syria

[*]Corresponding authors: halamohammad445@gmail.com, alisomaa88@gmail.com

Abstract: The lack of studies on the anise plant contributed to increasing the importance of the research, as the research was carried out in the Salhab region, Hama Governorate, Syria, for the agricultural season 2022-2023. The aim was to study the effect of boron spraying on some characteristics of two ecotypes of anise, which are the municipal anise and the Shami anise. Four concentrations of boron (0-25-50-75) mg/L had been studied according to the" split plot design for one time only" design. Thus, boron was sprayed twice at the beginning of flowering and at the beginning of the fruiting stage. In addition, averages were recorded, and significant differences were calculated. The results showed that the municipal ecotype was superior to the Shami ecotype in productivity per hectare, as model ecotype affected productivity.
The results of the interaction of the studied ecotypes with the studied concentrations of boron showed that there were significant differences between the studied treatments and control, while the interaction of the municipal ecotype of anise with boron 25 mg / L achieved a significant superiority over the rest of the treatments and control in terms of fruit weight / plant, and achieved the highest value of (18.62). g compared to control, which achieved the lowest value (7.46) g for the municipal ecotype.

On the other hand, the results of the interaction between the studied ecotypes and concentrations of boron (0,25,50,75) mg/l for the weight of 1000 fruits showed that there were significant differences between treatments and control. The interaction of the municipal aniseed ecotype with boron at a concentration of 75 mg / L achieved a significant superiority over the rest of the treatments and control. The interaction of the Shami ecotype with boron at a concentration of 75 mg / L achieved a significant superiority over the studied treatments and control in terms of the number of fruits /inflorescences.
The interaction of the municipal ecotype with boron of a concentration of 25 mg/L achieved the highest percentage of essential oil, which was (5.60%), while the lowest value was in the Shami ecotype and at the same concentration of boron, which was (2.40%). It was observed that there were no significant differences between the studied boron concentrations and the average concentrations in each of the rows, the weight of 1000 fruits, and the percentage of essential oil.
In addition, there were no significant differences in the ecotype of the studied cultivars and each of the characteristics of the number of fruits in one flower, the weight of 1000 fruits, and the weight of the fruits/plant.

Keywords: Apiaceae, Pimpinella anisum L, Anise, Boron, weight of 1000 fruits, essential oil, productivity yield, micronutrients, Ecotype.

تأثير الرش بالبورون في بعض الصفات الإنتاجية والنوعية لطرازين من اليانسون (البلدي والشامي) (*Pimpinella anisum L.*)

الملخص: ساهمت قله الدراسات عن نبات اليانسون في زيادة اهميه البحث حيث تم تنفيذ البحث في منطقة سلحب، محافظه حماه للموسم الزراعي 2022 –2023.وذلك بهدف دراسة تأثير الرش بالبورون في بعض الصفات لطرازين من اليانسون، وهما طراز اليانسون البلدي وطراز اليانسون الشامي، حيث تمت دراسة أربع تراكيز للبورون (0–25–50–75) ملغ/ل وفق تصميم القطع المنشقة لمره واحدة فقط. وتم الرش بالبورون مرتين في بداية الإزهار وفي بداية العقد، وتم تسجيل المتوسطات، وحساب الفروق المعنوية وقد بينت النتائج تفوق الطراز البلدي على الطراز الشامي في انتاجيه الهكتار الواحد. حيث أثر نوع الطراز في الإنتاجية. وأظهرت نتائج تفاعل الطرز المدروسة مع التراكيز المدروسة للبورون وجود فروق معنوية بين المعاملات المدروسة والشاهد، حيث حقق تفاعل الطراز البلدي لليانسون مع البورون 25ملغ/ل تفوقا معنويا على باقي المعاملات والشاهد في صفه وزن الثمار/نبات، وحققت اعلى قيمه التي بلغت (18.62)غ مقارنه بالشاهد التي حققت أدنى قيمه (7.46)غ للطراز البلدي.

من جهة أخرى، بينت نتائج التفاعل بين الطرز والتراكيز المدروسة من البورون (0،25،50،75) ملغ/ل بالنسبة لصفه وزن 1000ثمرة وجود فروق معنوية بين المعاملات والشاهد. وقد حقق تفاعل الطراز البلدي لليانسون مع البورون تركيز 75ملغ/ل تفوقا معنويا على باقي المعاملات والشاهد. وحقق تفاعل الطراز الشامي مع البورون تركيز 75ملغ/ل تفوقا معنويا على المعاملات المدروسة والشاهد في صفه عدد الثمار في النورة الزهرية الواحدة.

حقق تفاعل الطراز البلدي مع البورون تركيز25ملغ/ل أعلى نسبة مئوية من الزيت العطري وبلغت (5.60%) بينما كانت أدنى قيمه عند الطراز الشامي وعند نفس تركيز البورون وهي (2.40%). وتم ملاحظة غياب الفروق المعنوية بين تراكيز البورون المدروسة ومتوسط التراكيز في كل من صفه وزن ال1000ثمرة، والنسبة المئوية للزيت العطري.

بالإضافة الى ذلك لم يكن هنالك فروق معنويه في نوع الطرز المدروسة وكل من صفة عدد الثمار في النورة الزهرية الواحدة، ووزن ال1000ثمرة، و وزن الثمار/النبات.

الكلمات المفتاحية: الفصيلة الخيمية، يانسون، بورون، وزن ال1000 ثمرة، الزيت العطري، صفات انتاجيه، مغذيات دقيقه، طراز بيئي.

1. Introduction

Herbal medicine is one of the oldest forms of health care that has been used for decades in developing and developed countries and the use of plants as medicines dates back to 60,000 years ago, according to reports from ancient Babylon. In Egypt and China, written material on herbal medicines dates back nearly 5,000 years, and in Asia Minor and Greece it dates back 2,500 years[1].

Anise (Pimpinella anisum L.) is considered one of the important medicinal and aromatic plants, and its native habitat is the Mediterranean basin. It is an annual herbaceous plant, belonging to the family Apiaceae. It has common names in different countries such as: Anis vert (France), anise seed (Japan), anise and star anise (USA), anisella (Italy), petit anise (North Africa), and anise (England)[2]. It reaches an average height of 30-50 cm, and the entire plant is covered with soft bristles. Root thin and fusiform, stem rounded, grooved and branched upwards, with umbrella-shaped clusters of small white flowers, anise cross-pollinated. The fruit is oval, pear-shaped, somewhat compressed on the side. Fruits 3–5 mm long, 1.5–2.5 mm wide, smooth (grey, green to grey, brown) [3].

Basically, the part used in the anise plant is the fruits, which are an important natural raw material that is used in several fields medically, nutritionally, and pharmaceutically, and the fruits of Pimpinella anisum contain about 2 to 6% of essential oil. In addition, anise contains antimicrobial and antifungal activities. For fungicides and insecticides[4]. Nutritionally and medicinally: Anise fruits are used as flavorings, and they have digestive and carminative benefits, and relieve gastrointestinal spasms. The consumption of anise in lactating mothers increases milk and relieves their children from digestive problems. Anise is used as a flavoring and aromatic agent for fish products, ice cream and sweets. Anise fruits are used as an analgesic in cases of migraines and also as an anticonvulsant, antiseptic, and diuretic. It can increase milk production, menstruation and urine. And secretion of sweat as well as makes the complexion good. It is also effective in polishing teeth. In some traditional texts, anise is mentioned for melancholy and nightmares as well as in the treatment of epilepsy and seizures. Anise contains 1.5–6.0% volatile oil consisting mainly of anethole, but also up to 8–11% lipids rich in fatty acids, such as palmitic and oleic acids, in addition to approximately 4% carbohydrates and 18% protein[5].

In addition, the ethanolic extract has toxic activity on human prostate cancer cells. Thus, anise can be one of the foods attributed to the prevention and treatment of cancer.

It can also be a natural source of new anti-cancer compounds with anti-proliferative properties [6].

Boron is considered one of the elements necessary for plant growth, and it promotes the formation of adenosine triphosphate ATP, and accelerates the movement of sugars to the active areas during growth throughout the stages of plant reproduction, and that the deficiency in boron causes: slow plant growth, decrease in production and deterioration of crop quality, and it was found that adding boron To some industrial crops (sesame - sunflower - safflower - rapeseed - soybeans - cotton - flax) lead to stimulating plants and accelerating the growth of these crops, and increasing their production by affecting many physiological functions that determine growth and crop yield[7].

The biological yield of plants of the family; (Apiaceae), the percentage of oil and its components of the active substance are affected by the environmental pattern, and the prevailing environmental conditions in the region during the agricultural season, in addition to agricultural treatments, such as irrigation, fertilization, density, and planting distances, so that specific characteristics and productivity are negatively or positively affected by these factors[8]. It is an essential nutrient for optimal growth, development, yield, and quality of crops. Boron deficiency in general can lead to various physiological disorders in agricultural crops[9]. Previous research has proven that this element is essential for plants, and boron plays a major role in plant metabolic activities[10].

And the application of foliar feeding has multiple benefits, but the most prominent of them include: rapid response to plant growth, and it can be beneficial and more effective than soil use of nutrients, especially when there is not enough moisture in the soil, while it can be combined with other agrochemicals such as pesticides, and stands out The importance of foliar fertilization in improving plant growth and crop quality, which can complement soil fertilization, and is a cost-effective way to improve yield, yield characteristics, and crop quality standards because usually only small amounts are needed, and nutrients penetrate the stomata or leaf epidermis, then enter the cells[11].

In a study[12] conducted in Baghdad on aniseed (Pimpinella anisum L.), foliar spraying of boron at concentrations (0_0.75 _1.50) kg/ha led to (an increase in the height and branching of the anise plant, and the number of fruits/inflorescences). (one flowerpot), and the boron treatment (1.50) kg / h gave the highest oil content compared to the control, and (Anethole) compound had the highest concentration when using: (organic fertilizer 5 tons / ha) with (foliar boron 1.50 kg / ha) compared to other treatments.

The explained[13] in their study in Iraq on the fennel plant (Foeniculum vulgare Mill) that: spraying with boron at the elongation stage with a concentration (0_40_80) mg / L achieved a significant increase in plant height, fresh and dry weight of the shoot, and the number of seeds In one flower inflorescence, and the total seed yield. It was found: a significant interaction between nitrogen and boron, where the concentration of boron (40) mg / L with (92) kg / h of nitrogen fertilizer gave the highest values for the studied traits.

in their Bengal study[14] on coriander plants observed: spraying with boron (0.05%). With zinc (0.01%), it led to: an increase in the number of primary and secondary branches of plants, and the length of carrots/plant.
Zhaoma et al [15] concluded in their research on celery plants that: when spraying with a foliar fertilizer containing boron, zinc and copper (Cu-ZnB) at concentrations: (1-1.5-2) g/l, the best concentration is (1 g/l), as it led The use of the mixture (Cu-ZnB1) to: increase the content of vitamin C, enhance the quality of plant nutrition and yield, and reduce the disease index.

The results of Mohamed and others [16]in a study conducted in Egypt on the basil plant (Ocimum basilicum L.) showed that co-treatments of (1)g/l of amino acids and boron (100ppm) led to a high significant increase in plant height, number of branches, and fresh and dry weights.

The results of a study[17] conducted by researchers on the coriander plant in Brazil showed that when foliar spraying boron at concentrations (0, 1, 1.5, 2,3) kg / ha in the form of boric acid (17%), the concentration of 3 kg / ha achieved the highest increase Significant in the shoots of the plant, while there was no significant difference in the weight of the root shoots compared with the control.

The results of researchers[18] in Egypt, in a study on coriander plant (Coriandor sativumL), of the effect of different types of fertilizers and boron and their interactions on growth, yield and essential oils, indicated that foliar spraying with boron (10) mg/L led to an increase in the number of fruits, yield, and percentage of essential oil, and the interaction between the organic matter and the foliar application of boron led to a significant increase in growth characteristics (plant height, number of branches and fruit/plant weight), and in (fruit weight/acre, oil percentage, oil content).
The results of a research study[19] conducted in Iraq on hibiscus sabdariffa L. showed that foliar spraying with (boron) in the form of boric acid at a concentration of (2) g/l and (zinc) in the form of zinc sulfate at a concentration of (1) g/l, and (Gibberellin acid) at a concentration of (200) mg/L increased the plant height up to (146 cm), the number of branches up to (25 branches/plant), and the number of leaves up to (567 leaves/plant).

A study[20] by researchers in Turkey showed that foliar spraying of flax plant (Linum usitatissimum L) with boron at a concentration of (0.3)% in the form of borax, and with zinc sulfate at a concentration of (0.5%) led to: an increase in plant height up to (55.14 cm), and the plant stand up to (216.201) cm, an increase in dry matter (3.66 g/plant), the number of capsules per plant (38.68), the number of seeds/plant (8.57), and the weight of 1000 seeds (7.64 g) and thus an increase in production.

2. Research importance and objectives:

The importance of this research stems from the scarcity of studies on local medicinal and aromatic plants treated with boron, especially aromatic plants, including anise. In addition to the fact that the anise plant is of medical, nutritional and pharmaceutical importance and has a variety of uses in addition to being an important economic crop. The research also aims to study the effect of spraying with different concentrations on the growth and development of the anise plant, and to determine the optimal rate of boron, which gives the best productivity and the highest quality of the crop.

3. Matrials and methods:

3.1 The Site:

The experiment was carried out in an agricultural land in Al-Ghab Plain, Salhab district, Hama governorate. Which rises 185 meters above sea level, during the agricultural season 2022-2023. A sample of field soil was taken from a depth of (0-30 cm) and some mechanical and chemical analyzes of the soil were performed at(Jub-Ramla) research station.

Table: (1) Shows chemical analysis of some soil components

		PMM		
Soil depth	OM%	N	P	K
0-30	2.3%	8.2	4.8	264

3.2 Ecotype used:

The use of the fruits of each of the local anise plant and the Shami anise plant, where the fruits of the Syrian local ecotypes were used. And we obtained the local anise fruits from an agricultural pharmacy in the Salhab region, and these seeds had not been stored for more than one year, while the Shami anise fruits were obtained from Damascus from an agricultural pharmacy, and it had not been stored for more than one year.

3.3 Land preparation for cultivation:

We carried out a plowing of the soil, and then we turned the soil manually, removing stones and weeds, and we applied the experiment according to the" split plot design for one time only" design.
(12) repeaters, the length of each repeater is (2m) and the width is (2m) and between each two repeaters (1m) for ease of carrying out agricultural operations and taking readings, where planting was done on lines with a distance of (35cm) between one line and the other and between each two seeds (25cm) at a rate of (3 seeds) In each hole, at a depth of (2 cm) from the soil surface.
Planting took place on 11/12/2022, and after 30 days, germination occurred.

3.4 Crop management:

All crop management work was carried out after planting, and boron was sprayed twice at the beginning of flowering and at the beginning of the fruiting stage.

3.5 Treatments:

The effect of four concentrations of boron has been studied:
1-Control (0) mg/L.
2- Boron concentration (25) mg / L.
3-Boron concentration (50) mg / L.
4-Boron concentration (75) mg / L.

3.6 Environmental conditions:

Table No. (2) shows the average temperatures, precipitation rate, and natural weather phenomena, according to the monitoring station in the search area.

Months	Average precipitation Rain/ml	Minimum temp. (°C)	Maximum temp. (°C)	natural weather phenomena
12/2021	4.43	3.71	10.87	fog
1/2022	3.9	2.1	7.9	Frost and fog
2/2022	2.35	2.35	12.12	Frost and fog
3/2022	4.75	3.42	10.37	frost
4/2022	0.0	5.8	22.0	frost
5/2022	0.5	11.1	26.8	No thing
6/2022	25.7	17.1	32.4	No thing

3.7 Parameters studied:

1-Fruit/plant weight: Ten plants were randomly selected from the center of each of them,
the experimental and collect the fruits of these plants, after which the averages are calculated.
2-The weight of 1000 fruits(g): 100 fruits were counted and weighed, then we multiplied this result by 10.
3- number of fruits in one flower: Ten plants were randomly selected from the center of each of them the experimental and We collected the fruits of each plant, then number of fruits in one flower of each plant, and counted them for each plant.
4-hectare productivity(kg/h): We calculated the weight of the fruits per plant, and determined the productivity per square meter and then per hectare.
5- Extraction and quantification of oil %: The oil was extracted using the water distillation method by Clevenger was used after extracting the oil from each environmental ecotype,
Then the quantity (ml) was measured, after which the percentage of all samples was calculated.

3. 8Experimental statistical analysis:

The obtained results were tabulated in Excel, and then the results were analysed using GenStat 12 statistical analysis software, and a complete randomized design was used to calculate the least significant difference value%.

4. Result And Discussion:

• The effect of spraying with boron on the fruit weight/plant of the two ecotypes of aniseed Municipal and Shami:

Table (3) shows the effect of spraying with boron concentrations on the characteristic of fruit/plant weight for two ecotypes of anise (Municipal and Shami), thus the averages showed (11.27, 13.76, 11.70, 14.80) grams for the studied boron concentrations (0,25,50,75) mg/l. There are significant differences between the treatments and the control, and the averages of the studied ecotypes (13.20, 12.56) g/plant showed the absence of significant differences for the studied cultivars, as the ecotype of cultivar did not affect the weight of the fruit/plant.

The results of the interaction between the ecotypes and the studied concentrations of boron (0,25,50,75) mg/l showed that there were significant differences between the studied treatments and the control. And the interaction of the municipal ecotype with a concentration of boron 25 mg / L achieved a significant superiority over the rest of the treatments and the control, and achieved the highest value (18.62) compared to the control that achieved the lowest value (7.46) for the municipal ecotype. This may be attributed to the role of boron in increasing the amount of carbohydrate synthesis, and storage inside the fruits, and thus The weight of the fruits increased on the plant, and this agreed with the results of the study of (Tania et al., 2018) in their research in Bengal on the coriander plant, where it was found that: spraying with boron (0.05%) with zinc (0.1%) led to an increase in its grade (fruit weight/ the plant).

	The studied boron concentrations (mg/L)				
Ecotypes	Control	25.00	50.00	75.00	Average ecotyps
Municipal	7.46 ^{h}	18.62 ^{a}	11.93 ^{e}	14.81 ^{c}	13.20 ^{a}
Shami	15.09 ^{b}	8.90 ^{g}	11.46 ^{f}	14.79 ^{d}	12.56 ^{a}
concentration averages	11.27 ^{d}	13.76 ^{b}	11.70 ^{c}	14.80^{a}	
L.S.d5%	**V**=1.231	**B**=0.624	**B×V**=1.022		
CV%		3.9			

Table3.the effect of boron spraying on the weight of the fruit/plant(g)

• The effect of spraying with boron on the weight of 1000 fruits of the two ecotypes of anise municipal and Shami:

The studied boron concentrations (mg/L)					
Ecotypes	Control	25.00	50.00	75.00	Average ecotyps
Municipal	3.73 [a]	3.33 [b]	3.63 [a]	3.80 [a]	3.62 [a]
Shami	3.60 [a]	3.67 [a]	3.67 [a]	3.57 [a]	3.63 [a]
concentration averages	3.67 [a]	3.50 [a]	3.65 [a]	3.68 [a]	
L.S.d5%	V=0.22	B=0.31	B×V= 0.44		
CV%		6.9			

Table 4. The effect of spraying boron on the weight of 1000 fruits (g)

Table (4) shows the effect of spraying with boron concentrations on two ecotypes of anise (municipal and Shami) in its row, the weight of 1000 fruits. The averages showed (3.67, 3.50, 3.65, 3.68) grams, for boron concentrations (0,25,50,75) mg/ For the absence of significant differences between the treatments and the control, and for the studied ecotypes, the averages (3.62, 3.63) grams also showed the absence of significant differences between them, as the ecotype of ecotype did not affect the weight of 1000 fruits. The results of the interaction of the ecotypes with boron concentrations (0,25,50,75) mg/l showed significant differences, as the interaction of the boron concentration (75) mg/l with the municipal anise variety achieved a significant superiority over the rest of the treatments and the control, and achieved the highest value (3.80 grams). Compared to the concentration (25) mg / L, which achieved the lowest value (3.33) grams for the municipal ecotype. This may be due to environmental conditions, where frost occurred in the germination stage, and also frost occurred in the flowering stage, as shown in Table No. (2), and as a result of the falling of a number of flowers, which led to a decrease in the number of fruits on the plant, and this is contrary to Jassem and Al-Jarallah. (2012) in their study in Iraq on the plant (Foeniculum vulgare), where there was no significant effect of spraying boron on the weight of 1000 fruits, but it tended to increase when compared to the control treatment.

• The effect of spraying with boron on the number the number of fruits/inflorescences of the two ecotypes of anise municipal and Shami:

Table (5) shows the effect of spraying with boron concentrations on the number of fruits/inflorescences of two ecotypes of anise (municipal and Shami), where the averages (121.80, 160.90, 158.10, 188.70) for boron concentrations (0,25,50,75) mg/l showed significant differences Between the treatments and the control, where the concentration of 75 mg/L was superior to the other concentrations studied and to the control, and achieved the highest value (188.70) of fruit/inflorescence. While there were no significant differences between the two concentrations (25.50), and the control gave the lowest value (121.80) fruit / inflorescence, and for the studied

samples, the averages (154.30, 160.50) also showed the absence of significant differences between them, as the ecotype of variety did not affect the number of fruits inflorescences. The results of the interaction of the ecotypes with the studied boron concentrations (0,25,50,75) mg/l indicated that there were significant differences between the studied treatments and the control. Where the interaction of the boron concentration (75) mg / L with the Shami ecotype of anise achieved a significant superiority over the rest of the treatments and the control, and achieved the highest value (193.70) compared to the control that achieved the lowest value (115.70) for the municipal ecotype. This result is explained by the role of boron in increasing the amount of carbohydrate synthesis and storage inside the fruits, and thus the number of fruits increased. Also, boron works on the germination of pollen grains and the growth of the pollen tube, and the improvement of fertilization and contraction because it is a chemical directive for the growth of the pollen tube through the reproductive tissues towards the ovary, which in turn increases of the final production of plants, and this is consistent with the results of the study (Jasim and Al-Jarallah, 2012) in their study on the fennel plant in Iraq, where spraying with boron at a concentration of (80-40-0) mg / L significantly increased the number of fruits in the plant, and agreed with the study of (Mhedi et al., 2017) on anise plant, where it was found that foliar spraying with boron at concentrations of (1.50) kg / gave the highest number of fruits / inflorescences, and therefore the highest production compared to the control.

Table5. The effect of boron spraying on the number of fruits/inflorescences.

Ecotypes	Control	25.00	50.00	75.00	Average ecotyps
Municipal	115.70	174.40	168.10	183.70	160.50[a]
Shami	127.80	147.50	148.10	193.70	154.30[a]
concentration averages	121.80 [c]	160.90 [b]	158.10 [b]	188.70	
L.S.d5%	V=19.53	B=16.82	B×V=22.53		
CV%		8.50			

• The effect of boron spraying on the hectare productivity of the two ecotypes of anise municipal and Shami:

Table (6) shows the effect of spraying with boron concentrations on the hectare productivity of two anise ecotypes. Where the averages (28183, 3439, 29238, 36992) kg / ha, for boron concentrations (0,25,50,75) mg / L showed that there were significant differences between the treatments and the control.

Where the concentration of boron 75 mg / L exceeded the other studied concentrations and the control, and achieved the highest value (36992) kg / ha. The control gave the lowest value (28183) kg / ha. As for the ecotypes, the averages (31392, 33010) showed significant differences between them, as the municipal ecotype was superior to the Shami ecotype, and the productivity of the municipal ecotype was (33010) kg / ha, while the Shami ecotype was (31392) kg / ha.

The results of the interaction of the ecotypes with boron concentrations (0,25,50,75) mg/l showed that there were no significant differences between the studied treatments and the control.

This may be attributed to the important role of boron inside the plant, as it works to increase the synthesis and storage of carbohydrates inside the seeds, and thus greatly increase the number of fruits and weight. Boron also enhances the growth of the pollen tube and improves fertilization and nodes that increase the final production, and this is consistent with the results of a study (Tania et al., 2018) in their research in Bengal on the coriander plant, where it was found that: spraying with boron (0.05%) with zinc (0.1%) led to an increase in the yield characteristics of coriander (fruit/plant weight, fruit/inflorescence weight, and hectare productivity).

Table6. Effect of boron spraying on hectare productivity (kg).

Ecotypes	Control	25.00	50.00	75.00	Average ecotyps
Municipal	18650	46542 [a]	29833	37017	33010 [a]
Shami	37717 [a]	22242	28642	36967	31392 [b]
concentration averages	28183 [d]	34392 [b]	29238 [c]	36992	
L.S.d5%	V=1160.3	B=1641.0	B×V=2320.7		
CV%		4.1			

• The effect of boron spraying on the percentage of essential oil of the two ecotypes of anise municipal and Shami:

Table (7) shows the effect of spraying with boron concentrations on the percentage of essential oil%, for two ecotypes of anise (municipal and Shami), as the averages showed (3.20, 4.00, 3.20, 3.80), for boron concentrations (0,25,50,75) mg/ The absence of significant differences between the transactions and the control. As for the studied ecotypes, the averages (3.75, 3.35) also showed the absence of significant differences between them, as the ecotype of ecotype did not affect the percentage of essential oil. The results of the interaction of the ecotypes with boron concentrations (0,25,50,75) mg/l indicated that there were significant differences between the studied treatments and the control. Where the concentration (25) mg / L of the anise variety achieved a significant superiority over the rest of the treatments and the control, and gave the highest value (5.60%), followed by the concentration (75) mg / L of the anise variety of the Shami, as it was significantly superior to the control, and this is explained by the indirect effect of boron By transferring the products of photosynthesis to anise fruits and storing them, which increases the content of volatile oils in anise fruits, and this is consistent with the results of a study (Mheidi et al., 2017) in a study of them on anise plants, where the oil content in the fruits increased when treated (B2).) where the oil content was (3.264%), while in the treatment (B0) the oil content was (3.007%) However, the reaction (M2B2) showed a high percentage of fruit oil amounted to (3.706%), while (M0B0) showed a low oil content of the fruits It reached (2.636%).

Table7. Effect of spraying with boron on the percentage of essential oil%.

Ecotypes	Control	25.00	50.00	75.00	Average ecotyps
Municipal	2.60 e	5.60 a	3.20 d	3.60 c	3.75 a
Shami	3.80 b	2.40	3.20 d	4.00 a	3.35 a
concentration averages	3.20 a	4.00 a	3.20 a	3.80 a	3.75 a
L.S.d5%	V= 0.856	B= 1.210	B×V=1.712		
CV%		19.8			

5. Conclusion

The municipal ecotype was superior to the Shami ecotype in terms of hectare productivity, and the ecotype of ecotype affected this characteristic. While there was no effect of the studied ecotype on each of the following characteristics (number of fruits/inflorescences, weight of 1000 fruits, weight of fruits/plant, percentage of essential oil). In addition, it was observed that there were no significant differences between all the studied concentrations and the control in each of the row, the weight of 1000 fruits, and the percentage of essential oil.

On the other hand, the interaction of the municipal ecotype with a concentration of boron 25 mg / L achieved a significant superiority over all studied treatments and the control in the row of fruits / plant weight, while the interaction of the municipal ecotype with a concentration of 75 mg / L achieved a significant superiority over all studied treatments and the control in the row of 1000 fruits.

The Shami ecotype and the concentration of boron 75 mg/L achieved a significant superiority over all studied treatments, the number of fruits/inflorescences being thecontrol. As for the percentage of essential oil, it was superior to the municipal ecotype with a concentration of 25 mg / L on all studied treatments and the control.

6. References

[1] S. Wachtel-Galor and I. F. Benzie, "Herbal medicine :An Introduction to Its History, Usage, Regulation, Current Trends, and Research Needs.," Lester Packer, Ph. D., Boca Raton (FL): CRC Press/Taylor . Francis, p. 1, 2011.

[2] W. Sun, M. H. Shahrajabian, and Q. Cheng, "Anise (Pimpinella anisum L.), a dominant spice and traditional medicinal herb for both food and medicinal purposes," Cogent Biology, vol. 5, no. 1, p. 1673688, 2019.

[3] M. Özgüven, " Aniseed," in Handbook of Herbs and Spices (Second Edition), K. V. Peter, Ed.: Woodhead Publishing, pp. 138-150. University of Cukurova.Turkey.2012.

[4] K. G. El-Rokiek, M. E. Ibrahim, S. A. S. El-Din, and S. A. El-Sawi, "Using anise (Pimpinella anisum L.) essential oils as natural herbicide," J. Mater. Environ. Sci, vol. 11, pp. 1689-98, 2020.

[5] A. Shojaii and M. Fard, "Review of pharmacological properties and chemical constituents of Pimpinella anisum. ," International Scholarly Research NetworkISRN Pharmaceutic, vol. 2012, p. 8, 2012.

[6] S. Kadan, M. Rayan, and A. Rayan, "Anticancer activity of anise (Pimpinella anisum L.) seed extract," The Open Nutraceuticals Journal, vol. 6, no. 1, 2013.

[7] W. K. Al-Juheishy, "EFFECT OF BORON ON SOME INDUSTRIAL CROPS: A REVIEW," Mesopotamia Journal of Agriculture, vol. 48, no. 4, pp. 134-145, 2020.

[8] N. Tort and B. Honermeier, "Investigations on the ratio of methylchavicol and trans-anethol components in essential oil of anis (Pimpinella anisum L.) from different regions of Turkey," Asian Journal of Chemistry, vol. 17, no. 4, pp. 2365-2370, 2005.

[9] Y. Mohamed, I. Mohamed, M. Elsadek, M. Ali, and Y. Ghatas, "Improving growth, productivity, and chemical composition of Trachyspermum ammi L. by using organic and chemical fertilization in the presence of boron," Industrial Crops Products,vol. 169, pp. 1-10, 2021.

[10] R. Abdel Aliem, H. Khaled, B. Soliman, M. Mourad, and H. Dighiesh, "Boron, the forgotten element," Frontiers in Scientific Research, vol. 2023, no. 6, pp. 20-28, 2023.

[11] M. H. Shahrajabian, W. Sun, and Q. Cheng, "Foliar application of nutrients on medicinal and aromatic plants, the sustainable approaches for higher and better production," Beni-Suef University Journal of BasicApplied Sciencesvol. 11, no. 1, pp. 1-10, 2022.

[12] U. H. Mheidi, I. M. Ali, and A. H. Abdulkafoor, "The effect of organic manure, foliar spraying with boron on growth, yield, quality and quantity of active ingredients of anise palnt (Pimpinella Anisum)," Pak. J. Biotechnol, vol. 14, no. 4, pp. 729-734, 2017.

[13] A. Jassim and K. aljarallah, "Effect of boron spray and nitrogen fertilization on growth and yield of fennel (foeniculum vulgare Mill.)," journal of kerbala university, vol. 2012, no. The second scientific conference of the Faculty of Agriculture, pp. 666-672, 2012.

[14] Tania.C, Das.R, Basanta.T, Chatterjee.R, and Chattopadhyay.K, "Assessment for growth and yield of coriander (Coriandrum sativum linn.) with micronutrients.," International Journal of Current Microbiology and Applied Sciences, vol. 7, no. 12, pp. 336-339, 2018.

[15] J.-Z. Ma et al., "Copper-based-zinc-boron foliar fertilizer improved yield, quality, physiological characteristics, and microelement concentration of celery (Apium graveolens L.)," vol. 31, no. 1, pp. 261-271, 2019.

[16] Y. Mohamed, R. Zewail, and Y. Ghatas, "The role of boron and some growth substances on growth, oil productivity and chemical characterization of volatile oils in basil (Ocimum basilicum L.) cv. Genovese," Journal of Horticultural Science Ornamental Plants, vol. 8, no. 2, pp. 108-118, 2016.

[17] J. R. de Mello Duarte, S. de Aguiar Basílio, I. C. Silva, E. G. S. Moreira, and A. Pelá, "Foliar spraying of doses of boric acid in coriander (Coriandrum sativum L.)," Revista de Agricultura Neotropical, vol. 7, no. 1, pp. 66-69, 2020.

[18]S.Mohamed,and R.Khater, Adaptation of Coriander Plants by Different Types of Fertilizers with Foliar Spraying of Boron to Improve Growth and Productivity," Middle East Journal of Agriculture,vol.10,no.4,pp. 1116-1129,2021.

[19] A. K. M. Al-Karaawi, "Effect of gibberellin GA3, boron and zinc foliar application on the growth and production of Hibiscus Sabdariffa L," in Journal of Physics: Conference Series, vol. 1294, no. 9, pp. 1-9,2019.

[20] M. P. Alam and M. Kumari, "Effect of zinc and boron on growth, yield and economics of linseed (Linum usitatissimum L.) under medium land of Jharkhand," The Pharma Innovation Journal, vol. 10, no. 4, pp. 462-466, 2021.