The effect of Spraying Some Nutrients on The vegetative Growth Traits of Three Genotypes of Oats in Saline Soil

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Abstract

A field experiment was carried out during the winter season 2023-2024 in the field of the Field Crops Department - College of Agriculture, Al-Qasim Green University, in Babil / Iraq. To study the response of three genotypes of oats to spraying some nutrients in saline soil. A randomized complete block design (R.C.B.D) was used in a split-plots arrangement with three replications. The main plots included the genotypes Shifa, Algouda, and Oats11, while the secondary plots included four nutrient treatments: spraying distilled water (comparison), spraying boron at a concentration of 1 ml L-1, spraying silicon at a concentration of 1 ml L-1, and spraying both boron at a concentration of 1 ml. L-1 and spray silicone at a concentration of 1 ml L-1 together. The results of the Algouda genotype showed the highest values of the traits , plant height (118.10 cm) and leaf area (26.59 cm2). While the Shifa genotype excelled in the traits of the number of tillers.m-2(458.2 tiller), the total chlorophyll content of the flag leaf (54.19 SPAD), and the lodding index (0.41%). Spraying silicon at a concentration of 1 ml L-1 led to an increase in the traits of plant height (113.62 cm), the number of tillers.m-2(456.4 tiller), the area of the flag leaf (27.19 cm2), and the total chlorophyll content of the flag leaf (55.37 SPAD).Accordingly, the variation between oat genotypes in their response to silicon spraying, which greatly helped in reducing the harmful effects of soil salinity and improving most of the vegetative growth characteristics.

Keywords: Oats genotypes, boron, silicon, nutrients, vegetative growth traits

.1Introduction

Oats (Avnasativa.L) is one of the main grain crops in the world, as it is ranked sixthamong grain crops in terms of productivity and importance accorded 19.42mm tons.[1] Oats is used human food and animal feed due to it contains many vitamins, minerals, and fiber Easily digestible, soluble in water with a special type of protein called avenalin, which differs from the protein found in wheat, furthermore, Oats have many medical benefits in regulating the levels of pressure, sugar, and cholesterol in the blood [2]. However, Oats planting is still limited in Iraq, due to the old field practices used in planting and serving the cropby farmers, exposure of newly introduced genotype plants to the problem of plant loddging, which is one of the main factors determining the planting of this crop due to the loss it causes Loss of grain yield [3].The problem is getting worse, especially in arid and semi-arid areas that suffer from low rainfall rates and increased expansion of lands affected by salinity and its impact on agricultural production [4]. These problems can be reduced either by following breeding

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and plant improvement programs to develop hardy, short-stemmed genotypes, or by using some chemical compounds, which are considered one of the modern trends in scientific research because they give selective and temporary effects in addition to saving the necessary time [5]. The useof foliar application with some important nutrients, such as boron, which is one of the micronutrients necessary to complete the process of fertilization, cell development and division, and contribute to the structural construction of cell walls. Boron deficiency also leads to a decrease in the concentration of the hormone cytokine, which is responsible for delaying leaf senescence [6]. In addition to other non-essential (useful) nutritional elements, such as silicon, which is the second most abundant element in the earth's crust and plays an effective role in strengthening cell walls due to its high ability to be deposited in the walls of vascular tissueand the epidermis. Thus, it enhance the plants ability to resistance environmental stresses and reduces the effect of salinity. As a result of encouraging many important physiological activities within the plant [7]. Therefore, this study aimed to determine the effectiveness of these nutrients in reducing the harmful effects of salinity and reducing the phenomenon of subsidence to improve the growth traits of some genotypes grown in Iraq.

.2Materials and methods

.2.1Experiment requirements

The experiment was conducted during the winter season 2023-2024 in the field of the Field Crops Department - College of Agriculture, Al-Qasim Green University in Babil / Iraq, at a latitude of 32.40 north and a longitude of 44.39 east. to study the effect of spraying some nutrients on the vegetative growth traits of three genotypes of oats in saline soil. Table 1 shows some chemical and physical characteristics of fieldsoil

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

Traits		**Values**
PH		7.5
EC		7.3 $ds.m^{-1}$
OM		1.3 %
Available nitrogen		33.61 $mg.kg^{-1}$
Available phosphorus		8.8 $mg.kg^{-1}$
Available potassium		322 $mg.kg^{-1}$
Soil separators	Sand	283
	Clay	89
	Silt	628
The texture		Mixed silty

Soil service operations were carried out, including plowing, smoothing, and leveling. Then the field was divided into three replicates. Each replicate contained 12 experimental units with an area of 4 m2(2m*2m). Phosphate fertilizer (P2O5 45%) was added at a rate of 80 kg ha-1 [8] mixed

with the soil, and the planting process was carried out on lines with a distance between one line and another of 20 cm at a seed rate of 100 kg ha-1 [9]. Nitrogen fertilizer (urea 46% N) was added at a rate of 120 kg ha-1 In three equal batches, the first after emergence, the second at the beginning of the tillers stage, and the third when 50% of the plants in the experimental unit had flowered [10]. The plants were sprayed during two stages of growth, the first in the tillers stage and the second in the elongation stage. Data were collected and analyzed using the ready-made statistical program GenStat V.20 according to the method. Adopted by [11], the least significant difference test was used at the probability level of 0.05 to compare the arithmetic means.

.2.2Experimental design

A factorial experiment was applied according to a randomized complete block design (R.C.B.D.), in a split-plots arrangement, with three replications. It included a study of the effect of two factors: the first factor: three genotypes of oats, Shifa, Al-Jouda, and Oats11, and the second factor: Spraying four nutrient treatments: spraying distilled water only (comparison), spraying boron at a concentration of 1 ml L-1 (in the form of artificial boron foliage fertilizer - boron 13.20%), spraying silicon at a concentration of 1 ml L-1 (in the form of potassium silicate - silicon oxide 35 %, potassium oxide 12%), and spray both boron at a concentration of 1 ml L-1 and silicon at a concentration of 1 ml L-1 together.

.2.3The studied traits

Vegetative growth traits were measured when plants flowered at 100%, by taking the average of a random sample of ten plants for each experimental unit for the traits:

-Height of the main stem (cm): The measurement process for plants was carried out starting from the surface of the soil to the base of the flower inflorescence of the main stem.

-The number of tillers per square meter, tiller m-2: was taken as an average for each experimental unit by randomly throwing a wooden frame with an area of 1 m2.

-The area of the flag leaf, cm2: was estimated according to the equation adopted by [12] as follows:

Flag leaf area = flag leaf length × maximum width × correction factor (0.75(

-Index of total chlorophyll contentin the flag leaf (SPAD): It was estimated using a Japanese-made Chlorophyll Meter SPAD Model-502, by taking three readings for each flag leaf from the random sample plants.

-paniclelength: The distance between the deltoid node and its end was calculated as an average for ten deltoid nodes.

-lodding of index: This characteristic was determined on the basis of the theoretical scale specified by [13] which includes 1 = upright to 5 = complete lodding, while evidence of lodding was determined according to the following equation: index of lodding = S x I x 0.2 [14], where S: represents the lodding surface area on a scale from 1 = upright to 9 = fully lodded, and I: represents the density of lying on a scale from 1 = upright to 5 = fully lodded.

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.3Results and discussion

.3.1Plant height (cm(

The results of Table 2 showed that there are significant differences between the oat genotypes in trait plant height, as the Alguda genotype achieved the highest mean of 118.1 cm, compared to the Oat11 genotype, which recorded the lowest men of 92.72 cm. The reason for this may be attributed to the difference between varieties in the efficiency of gene expression for longitudinal and transverse growth hormones, which affects the elongation of cells, which is reflected in the height of the plant[15-16].The results also indicated that there are significant differences between the nutrients in plant height, that there was superiority for the silicon spray treatment at a concentration of 1 ml.L-1 achieved the highest mean of 113.92 cm ,compared to the control treatment, which gave the lowest mean of 103.79 cm . Perhaps this increase is due to the rapid delivery of necessary nutrients to the plant through foliar feeding with the nutrient silicon and compensating for its deficiency in the soil to continue the metabolic processes important for cell division and elongation, including stem cells [17].The results of the same table showed that there was a significant interaction between the genotypes and nutrients, as the interaction treatment between the Alguda genotype and spraying silicon at a concentration of 1 ml.L-1excelled in the trait of plant height by recording the highest mean of 126.4 cm compared to the interaction treatment between the Oats11 genotype and the control treatment that recorded the lowest means only 90.47 cm.

Table 2 Effect of nutrients on the Plant height (cm) for oat genotypes in saline soil.

Nutrients / Genotypes	**Control**	**Boron**	**Silicon**	**Boron + Silicon**	**Genotypes averages**
Shifa	111.27	114.76	118.03	115.43	114.87
Alguda	109.63	116.43	126.4	119.93	118.1
Oat11	90.47	91.3	96.43	92.68	92.72
nutrients averages	103.79	107.5	113.62	109.35	
L.S.D $_{0.05}$	**Genotypes =** 4.30		,**Nutrients** = 2.09	,**Interaction** = 4.69	

.3.2Flag leaf area (cm2(

The results of Table 3 indicatethat there are significant differences between the oat genotypes in trait the flag leaf area, as the Alguda genotype achieved the highest mean of 26.59 cm2, compared to the Oat11 genotype, which recorded the lowest men of 23.59 cm2. The reason for this may be due to the difference between the species in their ability to form the compounds and enzymes necessary to complete the process of photosynthesis and stimulate cell division, including flag leaf cells[18-19 .[

that there was superiority for the siliconspray treatment at a concentration of 1 ml.L-1 achieved the highest mean of 27.19 cm2 ,compared to the control treatment, which gave the lowest mean of 22.69 cm2 . The reason for this may be attributed to the role of silicon in alleviating the harmful effects of oxidative stress resulting from free oxygen radicals delaying leaf senescence and promoting vegetative growth [20].While the

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interaction treatment between the Alguda genotype and spraying silicon at a concentration of 1 ml.L-1 excelled in the trait of the flag leaf area by recording the highest mean of 29.81 cm2 compared to the interaction treatment between the Oats11 genotype and the control treatment that recorded the lowest means only 21.05 cm2.

Table 3 Effect of nutrients on the flag leaf area (cm2) for oat genotypes in saline soil.

Nutrients / Genotypes	Control	Boron	Silicon	Boron + Silicon	Genotypes averages
Shifa	22.59	25.37	25.54	25.05	24.64
Alguda	24.42	24.89	29.81	27.25	26.59
Oat11	21.05	23.22	26.2	23.9	23.59
nutrients averages	22.69	24.49	27.19	25.4	
L.S.D $_{0.05}$	**Genotypes=**0.65 ,**Nutrients**=0.78 ,**Interaction**=1.27				

.3.3Chlorophyll content (SPAD(

The results of Table 4 showed that there are significant differences between the oat genotypes in trait the chlorophyll content, as the Shifa genotype achieved the highest mean of 54.19 SPAD, compared to the Oat11 genotype, which recorded the lowest men of 52.34 SPAD. The reason for the difference between varieties in the chlorophyll content of flag leaves may be attributed to variation in genetic makeup and surrounding environmental conditions[21].As for spraying nutrients, it led to a significant increase in the chlorophyll content, that there was superiority for the silicon spray treatment at a concentration of 1 ml.L-1 achieved the highest mean of 55.37 SPAD, compared to the control treatment, which gave the lowest mean of 51.02 SPAD . Because of the effect of the silicon element as a biostimulant similar to the effect of seaweed and biostimulants, which helps to increase the leaf area and produce the highest content of chlorophyll[22].also indicated t that there was a significant interaction between the genotypes and nutrients, as the interaction treatment between the Shifa genotype and spraying silicon at a concentration of 1 ml.L-1 excelled in the trait of the chlorophyll content by recording the highest mean of 56.28 SPAD compared to the interaction treatment between the Oats11 genotype and the control treatment that recorded the lowest means only 50.13 SPAD.

Table 4 Effect of nutrients on the chlorophyll content (SPAD)for oat genotypes in saline soil.

Nutrients / Genotypes	Control	Boron	Silicon	Boron + Silicon	Genotypes averages
Shifa	52.4	53.31	56.28	54.76	54.19
Alguda	50.53	53.58	55.09	54.88	53.52
Oat11	50.13	52.69	54.74	51.79	52.34
nutrients averages	51.02	53.19	55.37	53.81	
L.S.D $_{0.05}$	**Genotypes =** 0.92 ,**Nutrients** = 0.80 ,**Interaction** = 1.38				

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.3.4Number of tillers m-2

The results of Table 5 indicate that there are significant differences between the oat genotypes in trait the Number of tillers m-2, as the Shifa genotype achieved the highest mean of 458.2 tiller m-2, compared to the Oat11 genotype, which recorded the lowest mean of 411.7 tiller m-2. The reason for this may be attributed to the superiority of the Shifa genotype in its ability to adapt to the environment and the extent of benefiting from the processes of water absorption and important elements for growth, in addition to its possession of the characteristic of rapid growth and many branches over the rest of the varieties[23]. that there was superiority for the silicon spray treatment at a concentration of 1 ml.L-1 achieved the highest mean of 456.4 tiller m-2,compared to the control treatment, which gave the lowest mean of 409.4 tiller m-2 . The reason for this may be attributed to the important role of silicon in activating many enzymes and chemical compounds that help in the process of photosynthesis and dry matter production, and this is reflected in an increase in most of the characteristics of vegetative growth, including the number of shoots of the plant [24].The results of the same table showed that there was a significant interaction between the genotypes and nutrients, as the interaction treatment between the Shifa genotype and spraying silicon at a concentration of 1 ml.L-1 excelled in the trait of number of tillers m-2by recording the highest mean of 499 tiller m-2 compared to the interaction treatment between the Oats11 genotype and the control treatment that recorded the lowest means only 394.3 tiller m-2.

Table 5 Effect of nutrients on the Number of tillers m-2 for oat genotypes in saline soil.

Nutrients / Genotypes	**Control**	**Boron**	**Silicon**	**Boron + Silicon**	**Genotypes averages**
Shifa	417.3	440	499	476.6	458.2
Alguda	416.7	426.8	439.7	419.6	425.7
Oat11	394.3	408.2	430.7	413.4	411.7
nutrients averages	409.4	425	456.4	436.5	
L.S.D $_{0.05}$	**Genotypes =** 21.65		,**Nutrients** = 11.42	,**Interaction** = 24.35	

.3.5Panicle length (cm(

The results of Table 6 showed that there are significant differences between the oat genotypes in the panicle length, as the Alguda genotype achieved the highest mean of 26.15 cm, compared to the Oat11 genotype, which recorded the lowest mean of 24.04 cm. This disparity between genotypes may be due to the adaptation of the planted genotypes to environmental conditions in addition to the difference in their genetic factors[25-26]. The results also indicated that there are significant differences between the nutrients in the panicle length, that there was superiority for

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the boron spray treatment at a concentration of 1 ml.L-1 achieved the highest mean of 28.05 cm,compared to the control treatment, which gave the lowest mean of 23.35 cm . The reason for this superiority may be due to the effective role of the element boron in stimulating the development of growing shoots and increasing the growth of meristematic tissues through increased cell division, in addition to its role in the formation of plant hormones such as cytokinins and auxins and regulating the transfer and accumulation of dry matter from the source to the sink, thus improving the growth and development of the reproductive parts of the plant, including panicle length [27-28].while the interaction treatment between the Alguda genotype and spraying silicon at a concentration of 1 ml.L-1 excelled in the trait of the panicle length by recording the highest mean of 26.49 cm, compared to the interaction treatment between the Oats11 genotype and the control treatment that recorded the lowest means only 22.17 cm.

Table 6 Effect of nutrients on the panicle length (cm) for oat genotypes in saline soil.

Nutrients / Genotypes	**Control**	**Boron**	**Silicon**	**Boron + Silicon**	**Genotypes averages**
Shifa	24.07	28.8	26.14	25.06	26.02
Alguda	23.81	29.47	24.84	26.49	26.15
Oat11	22.17	25.89	24.93	23.16	24.04
nutrients averages	23.35	28.05	25.31	24.9	
L.S.D $_{0.05}$	**Genotypes** = 0.30		,**Nutrients** = 0.85	,**Interaction** = 1.30	

.3.6Loddging index (%)

The results of Table 7 indicated that there are significant differences between the oat genotypes in Lodging index, as the Shifa genotype achieved mean of 0.41 %, compared to the Oat11 genotype, which recorded mean of 1.29 % . The reason for this may be attributed to the relationship of the reclining characteristic to other growth characteristics, such as the height of the plant, which distinguishes the Shifa genotype from the rest of the genotypes[29].while that there was superiority for the silicon spray treatment at a concentration of 1 ml.L-1 achieved the highest mean of 0.54 %,compared to the control treatment, which gave mean of 1.12 % . The reason for this may be attributed to the important role of the silicon element in strengthening the structural structure of the stem cell walls due to its high ability to be deposited in the epidermis and the walls of the cells' cellular vessels[30]. as the interaction treatment between the Shifa genotype and spraying silicon at a concentration of 1 ml.L-1 excelled in the trait of lodging index by recording mean of 0.36 % grain panicle-1 compared to the interaction treatment between the Oats11 genotype and the control treatment that recorded means 1.80. %

Table 7 Effect of nutrientson the Lodging index (%) for oat genotypes in saline soil.

Nutrients / Genotypes	Control	Boron	Silicon	Boron + Silicon	Genotypes averages
Shifa	0.4933	0.4167	0.36	0.3967	0.4167
Alguda	1.0633	0.7967	0.51	0.7667	0.7842
Oat11	1.8033	1.3367	0.75	1.2967	1.2967
nutrients averages	1.12	0.85	0.54	0.82	
L.S.D $_{0.05}$	**Genotypes =** 0.14 ,**Nutrients** = 0.04 ,**Interaction** = 0.14				

Conclusion

conclude from this research that there is a difference between the genotypes in their response to the nutrients used in the study as a result of the superiority of the Shifagenotype in most vegetative growth traits. The use of silicon also helped improve plant growth and development under saline soil conditions.

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