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The vital response of the corn *Zea mays* L. to Foliar Application with Arginine and licorice extract

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Abstract

The field experiment was conducted in Anbar Governorate during the 2019 spring season to study the effect of three levels of arginine acid 0, 50 and 100 mg sprayed on the leaves and sprayed with licorice extract at concentrations 0, 1000, 2000 mg L. The experiment was carried out according to the split-plot system using the RCBD design with three replicates. The significance of the differences between the averages of the studied traits was tested according to anLSD test at a probability level of 0.5. The study showed the superiority of plants sprayed with Arginine at the higherrate for all the studied traits (plant height, Percentage of seeds protein (%), Weight of 300 seeds (Gm.**)** andThe Leaf Chlorophyll content (mg^{-1})), as for the effect of spraying treatments with licorice extract, all sprayed plants outperformed withthe higherrate for all studied traits compared to the control treatments. Interaction treatments between arginine acid and licorice extract showed the higherrate for all studied traits compared to the control treatments.

Key words:vital response, corn, arginine, licorice extract

Introduction

The maize (*mays Zea* L) is one of the
essential vital crops in the world[1].
It is believed that its original homeland is North America, due to the presence of patterns thereof, as the importance of corn emerges from its versatility as food and fodder for animals in all its vegetable and seeds parts. Its leaves are an essential material for the manufacture of paper[2]. As for its grains, the most refinedtypes of oils and starch are extracted from it. It is prepared as a concentrated fodder because it contains 81% carbohydrates and 6.10% protein, 6.4% oil, 2% ash and contains some vitamins, including (F, B2, and B1)[3]. Addition of amino acids works before, during or after exposure to stress. To the direct effect on the physiological state of plants resulting from exposure to stress, which works to prevent or repair the resulting damage[4].

The licorice plant Glycyrrhizaglabra belongs to the Leguminosae family, the genus Glycyrrhiza, which includes 20 species, which is a Greek word meaning sweet root, and the licorice root is rich in Glycyrrhizin, whose sweetness is many times higher than the sweetness of sugar cane[5], this substance is found in the form of calcium-potassium salts of calcyrzic acid (Glycyrrhizic acid) It also contains many mineral elements, the most important of which are phosphorous, magnesium, iron, manganese, copper and zinc, in addition to other compounds, including proteins and amino acids by 2-1% and sugars by 15-3%[6]. The intermediate compound of

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mevalonic acid is considered a lion (the initiator of the synthesis of gibberellin in plants). The extract may behave like gibberellin in its physiological effect on plants sprayed with it at concentrations of (1 - 3) g. L - 1 water[7].

Materials & Method

Licorice root extracts available in the local markets were used as shown in Figure 1, and they were dried and cleaned from the dust, then milled with a grinding device until a powder was obtained, to obtain the water extracts, three levels were prepared (0, 1000 and 2000). As for the comparison treatments, spraying with distilled water, the powders were soaked in water for a week to ensure that the most considerable amount of powder was dissolved in water with shaking[8].

The amino acid solution of Arginine produced by the South Korean company was prepared at a concentration of 75 or 150 mg-l-1 chemicals of each, or a potassium nitrate solution made from a company in Mumbai Chemicals Limited in Mumbai, India at a concentration of 1.0 or 1.5 g. L-1 and the control plants were sprayed with water[9]. The number of spraying times was four times during the period of the beginning of plant growth and at an interval of 15 days between spraying and the other. The first spraying was carried out after three weeks of seedlings and on 15\3\2019.

A two-factor experiment was carried out according to a Randomized Complete Block Design (RCBD) with three replications; the experiment included nine treatments with three replications, the first-factor representing spraying with Arginine at a concentration of 0, 50 and 100 mg. 1 litre and spraying with distilled water and the second factor is spraying Licorice extract was extracted in three concentrations of 0, 1000 and 2000 mg. L^{-1}. Thus, the number of experimental units reached an experimental unit. Each of the two agents was sprayed separately; as the second factor was sprayed a day after the first agent was sprayed. The results were statistically analyzed according to the design followed using Genstat program, for statistical analysis, and averages were tested using the least significant difference (Least Significant Differences LSD), and at a probability level of 0.05, the leaf area (dm2) in Watson was measured at the end of the season. The fourth leaf was taken from the growing summit of the plants two weeks after the last spray, dried and taken 0.2 g of dry matter ground and digested according to the method. The amount of nitrogen in the digested samples using a device as described by MicroKjeldhal Phosphorous using a 700-nanometer wavelength Spectrophotometer Use either potassium nitrate as described in the Flame photometer. The total soluble carbohydrates (mg / kg- dry substance) were estimated by the method of phenol - sulfuric acid.

The preparation of the experiment field

. The experiment field was prepared by plowing and then leveling, after that the division was made by 2 * 2; a distance was left between the transactions 1 meter and between the repeaters 1.5 meters.Fertilizer was added before planting to the experiment land[10].Soil samples were collected at different depths in order to study the chemical and physical properties of the soil. The corn seeds were planted in the field and the field was irrigated on the same day. Weeds are removed throughout the growing season.Plants were planted on 15/3/2019.

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Result

1- Plant height:

The study showed (Figure 1) that arginine acid was a significant effected on thecharacteristics of growth, as spraying Arginine at level 100 resulted ina high rate of the plant height was**181 cm**, with a significant decreasecomparedwith the other treatments, the lowest plant height was recorded in the plantsit hasn't been sprayed byArginine reached 145cm in comparison treatments (Control)with a significant drop compared to the rest of the transactions.

As for spraying licorice extract, led to an increase in all the yield characteristics, where the higher rate was recorded in the plants that were sprayed at the level of 2000 mg, where the higher rate was recorded at 186 cm, with a significant difference from the other treatments that were recorded 179cm and 147cm, While the lowest rate (147cm) was recorded in the comparison treatment.

As for the interaction between the two experiment parameters(Arginine and licorice), hasa clear increase was recorded in the treatments that were sprayed with single or interfering solutions, where the higher rate of plant height was recorded when the interaction (100 mg Arginine + 2000 mg licorice) was 198 cm with a significant increase compared withthe other interactions, while the lowest rate of plant height was recorded in the plants that weren't sprayed with Arginine and licorice solutions with a significantly decreasedcomparedwith the other interactions.

The concentration of amino acids from the internal factors, along with the concentration of potassium in the guard cells and the level of abscisic acid ABA are factors affecting the process of opening and closing the stomata, and when the plant is exposed to the effects of high temperature, where the rate of destruction in the plant is higher than the rate of building, and this, in turn, causes slow metabolism inside the plant When spraying with amino acids, especially Arginine, this acts as an osmotic stabilization factor in the cytoplasm of the guard cells, and this also improves the process of opening and closing plant stomata[11].

Table 1 Effect of Arginine concentration (Mg.) and Licoriceconcentration (Mg) on the plant height Cm of corn

Licoriceconcentration (Mg)	**Argininеconcentration (Mg)**			**Average**
	0	**50**	**100**	
0	145	170	181	**165.3**
1000	166	179	184	**176.3**
2000	176	188	198	**187.3**
Average	**162.3**	**179**	**187.6**	
LSD (0.05)	**Argininеconcentration (Mg)= 3.44** **Licoriceconcentration (Mg)= 4.37** **Interaction Arginine× Licorice= 6.56**			

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2.Percentage of seeds protein (%):

It was the results showed in Table 2 that there is a significant effect of Arginine on the rate of seeds protein %, as statistical

analysis results showed the great superiority of plants that were treated with Arginine with a significantly increasedcompared with the plants that weren't sprayed withArginine, as the higher rate of protein in the seeds was recorded 10. 1%in the plants that were sprayed with (100mg L) of Arginine,has a significant variation from allthe treatments that recorded (8.3%, 7.1% and 5.6%)

This may be attributed to the importance of Arginine in vital processes and stimulating growth hormones and amino acids increase the immunity of plants and their vitality to resist severe climate changes and work to chelate nutrients, and this helps not to accumulate these elements in their complex form in the soil or plant, and this raises the level of benefit Nutrients from these elements are easily transported inside the plant[12].The licorice spray didn't record a significant difference in rate of protein seeds.As for

the interaction between the study research, the higher rate of protein seedswas recorded upon the interaction (100 mg arginine with 2000 mg licorice) with significant variation from other interactions, where the rate of protein seeds was recorded at 10.4%, with a significant variation from rest treatment[13]Some amino acids have an essential role in increasing the rate of roots and their spread, especially valine and methionine, and thus the continued movement of water between the soil and the plant, keeping the plant in its healthy state[13].

Table 2:- Effect of Arginine concentration (Mg.) and Licoriceconcentration (Mg) on the Percentage of protein seeds (%) corn

Licoriceconcentration (Mg)	Argininеconcentration (Mg)			Average
	0	**50**	**100**	
0	5.4	6.8	9.1	**7.1**
1000	6.0	7.6	9.6	**7.9**
2000	6.5	8.9	10.3	**8.9**
Average	**5.9**	**7.7**	**9.6**	
LSD (0.05)	**Argininеconcentration (Mg)= 1.22 Licoriceconcentration (Mg)= 0.47 Interaction Arginine× Licorice= 0.81**			

3- **Weight of 300 seeds (Gm.):**

The results of the statistical analysis shown in Table 3 showed the clear effect of Arginine and licorice on the weight of 300 seeds.

Where the results showed that spraying Arginine on the plant led to a significant increase in the weight of 300 seeds, as the higherweight of 300 seeds was recorded when spraying plants with a high level of Arginine (100 mg), reached (110gm), with a significant difference comparedwith rest treatments, while the low rateof weight of 300 seeds in the comparison treatment.

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The spraying of licorice extract led to a significant increase in the weight of 300 seeds, as the higherrate was recorded in the plants sprayed with (2000 milligrams litres) licorice at rate of the weight 300 seeds, amounting to 98 gm. of plants, while the lowest rate was recorded in the comparison treatments. Arate of 66 gm. of the weight of 300 seeds was recorded, with a significant reduction compared with rest treatments.

In the case of interaction between study parameters, the interaction (100 mg L arginine + 2000 mg L licorice) resulted in the higherrate of the weight of 300 seeds, reaching 120 gm. of plants, with a significant reduction compared with rest interactions, while the low rate recorded in control treatment.

Some amino acids have an essential role in increasing the rate of roots and their spread, especially valine and methionine, and thus the continued movement of water between the soil and the plant, keeping the plant in its healthy state[14].Arginine activates the plant's internal resistance to adverse weather conditions, whether in extreme cold or heat waves.

Licorice contains some compounds of activity similar to that of steroid hormones, which makes it have a positive role in the growth and absorption of nutrients.It is attributed to the role of licorice in increasing the strength of vegetative growth and the function of compounds included in its formulation and its containment of organic compounds and major and minor mineral elements such as phosphorous, potassium, magnesium, iron, zinc, manganese, cobalt and reducing and non-reducing sugars that have an influential role in enzymes. The different growth, including the process of photosynthesis, which may increase the efficiency of this process and thus, the production of nutrients in the leaves, causes an increase in their number[15].

Table 4:- Effect of Arginine concentration (Mg) and Licoriceconcentration (Mg) on the Percentage of Total leaf Chlorophyll content (mg^{-1}) corn

Licoriceconcentration (Mg)	Argininеconcentration (Mg)			Average
	0	50	100	
0	109	113	116	**112.6**
1000	112	114	119	**115**
2000	115	118	122	**118.3**
Average	**112**	**115**	**119**	
LSD (0.05)	**Argininеconcentration (Mg)= 2.12 Licoriceconcentration (Mg)= 2.27 Interaction Arginine× Licorice= 2.13**			

4-The Leaf Chlorophyll content (mg^{-1}).

The study showed (Figure 1) that arginine acid had a significant effect on all growth characteristics, as spraying Arginine at level 100 resulted in the higherrate of leaf Chlorophyll content (mg^{-1}) reaching 16.51mg^{-1}, with a significant raise from the rest treatments. In comparison, the low rate of leaf Chlorophyll content was showedin the control treatmentsreached 13.45$mg^{-1}$with a significant reduction compared to the resttreatments.The spraying of licorice extract led to a significant increase in the leaf

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Chlorophyll content, as the higherrate was recorded in the plants that sprayed with (2000 Mglitreslicorice) at a rate of leaf Chlorophyll content, reached to 40.08mg^{-1} of plants, while the low rate recorded incontrol treatments. Arate of 16.51(mg^{-1})of leaf Chlorophyll contentwas recorded in the control treatments, with a significant reductioncompared to rest treatments.

As for the interaction between the study parameters, the higherrate of leaf Chlorophyll content, recorded upon the interaction (100 mg arginine with 2000 mg licorice) with a significant modification comparedwithrest interactions, where the low rate of leaf Chlorophyll content, recorded at the control treatmentswith a significant reductioncomparedwith rest treatments.

Table 4:- Effect of Arginine concentration (Mg) and Licoriceconcentration (Mg) on the Percentage of Total leaf Chlorophyll content (mg^{-1})corn

Licoriceconcentration (Mg)	Argininеconcentration (Mg)			Average
	0	50	100	
0	13.11	17.66	22.84	**17.87**
1000	14.12	19.15	23.11	**18.79**
2000	16.66	21.66	28.13	**22.15**
Average	**14.63**	**19.49**	**24.69**	
LSD (0.05)	**Argininеconcentration (Mg)= 1.02 Licoriceconcentration (Mg)= 1.17 Interaction Arginine× Licorice= 1.22**			

Conclusion

The study showed that Arginine had an exact effect on all study factors, as there was an increase in plant height, weight of 300 seeds, rate of protein in seeds and Percentage of chlorophyll in leaves in plants that were sprayed with Arginine. The same effect was reported for spraying licorice extract, where all study factors increased.The interaction between the two parametersof the study led to apparent positive effects on corn.

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