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EFFECT OF ADDITION OF HUMIC ACID AND PROLINE ACID IN ANATOMICAL CHARACTERISTCS OF *ZEA MAYS* L. PLANTS UNDER WATER STRESS

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Abstract

This study was carried out in the (Adai village) of Baquba during the spring season 2018 in order to find the effect of different concentrations of proline and humic acid and irrigation divergence intervals and their interaction in the anatomical characteristics of maize plants *Zea mays* L. The experiment included spraying plants with concentrations of 0, 100, 200, 300 $mg.L^{-1}$ proline acid and the use of four concentrations of humic acid 0.1, 2, 3 $gm.m^{-2}$ Irrigation intervals were spaced every 5, 10 and 15 days. This experiment involved the study of the number of vascular bundles in the leg, the number of vascular bundles in the middle race of the leaves and the stomatal coefficient of the upper and lower epidermis, and the frequency of the upper and lower epidermis of the yellow maize plants. . The results indicated the following. Significant effect was shown in the case of adding high concentrations of proline and humic acid or spraying them together. Also significant effects were due to overlap between them and reducing the negative effects of water stress due to divergence of irrigation durations.

Key words: Proline acid, humic acid, water stress, Anatomical qualities. *Zea mays* L.

Introduction

The maize crop is one of the economically important grain crops. It is included in human and animal nutrition and in industry. It comes third after wheat and rice in terms of cultivated area and production. Despite the favorable environmental conditions of its cultivation in Iraq, its productivity is still low per unit area, due to the lack of some basic factors including water (Abdullah *et al.,* 2010), where the cultivated area and total production in Iraq in 2014 more than 378061 thousand dunums with a total production of 289288 tons with an average production of 765 kg/dunums (Central Statistical Organization, 2014). In 2015, Iraq's maize production amounted to 183, 240 tons, and the cultivated area was 229, 038 dunums, with a yield of 796.11 kg / dunum based on the cultivated area (Agricultural Statistics Directorate, 2016). In spite of the great importance of this crop and the growing interest in its cultivation in Iraq, there has been a deterioration in its agricultural production and a decrease in the cultivated areas during the last decade, and the most prominent reasons that led to the deterioration of maize production are the problem of drought, scarcity of irrigation water, and poor distribution. In addition, international conflicts over water and the increasing demand for water have reduced their allocation to agriculture (UNWWD, 2008). The construction of dams in Turkey has had a significant impact on the low cost of the Tigris and Euphrates rivers. Iran also built dams on the tributaries of the Tigris River, built a dam on the Alund River, cut water from the city of Khanaqin, then continued to build three diversion dams on the same river, and diverted the water of the Siwan River, which is one of the tributaries of the Diyala River. Dams on seasonal valleys near the Iraqi border to reserve water to ensure they do not cross into Iraqi territory (Addullah, 2012). Drought conditions lead to reduced vegetative and reproductive growth. Thus, the growth of plants is negatively affected under water stress conditions depending on plant type and environmental conditions. Therefore, this requires attention to water sources and non-waste and rationing the use of water for the purpose of obtaining the highest productivity with the least amount of water, following some agricultural applications aimed at overcoming the physiological symptoms of plants

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growing in harsh environments due to drought, and spraying plants with Proline acid Several studies have shown that Proline acid, which is one of the naturally available amino acids in the plant, accumulates significantly when the plant is exposed to many environmental stresses, including water stress compared to other amino acids (Jampeetong and Brix, 2009). Proline acid is a component of the osmotic regulation, or osmotic modification, that will maintain a gradual flow of water in favor of water entering the soil into plant tissues (Yassin, 2001). The use of organic fertilizers is preferred in order to ensure the continuity of high crop production, as they improve soil fertility and increase the growth and development of roots as well as increase the activity of important microorganisms (Tan, 2003). The addition of humic acid to the soil increases nutrient uptake by the plant and humic acid acts as a nutrient-transporting medium from the soil to the plant (Barakat *et al.,* 2015).

Materials and Methods

This study was carried out in (Adai village) of Baquba during the spring season 2018. It carried out a global experiment using the design of randomized complete sectors (RCBD) and three replicates in clay mixture soil. table 1 shows some of the chemical and physical properties of this soil. The experimental parameters included the following: Four levels of Proline acid are 0, 100, 200 and 300 mg.L^{-1} and four levels of humic acid 0, 1, 2 and 3 mg. m^{-2} and spacing of irrigation periods every 5, 10 and 15 days. Each repeater was divided into 16 experimental units. The dimensions of the experimental unit were 2.5 × 2.5 m^2. The number of experimental units was 48 units. Each experimental unit was planted with four lines, the distance from one line to another 75 cm and the distance from one jaw to another on the same line by 30 cm. The Corn seeds were planted at Fajr- 1 date on 15/3/2018 with a depth of 5 cm and at a rate of three seeds per session, Has been added fertilizer triple superphosphate P_2O_5 and an average of 100 kg. ha^{-1} the Before planting, After fertilization with nitrogen fertilizer (urea) By 200kg.ha^{-1} and in two installments the first after the emergence of seedlings and the second at elongation before flowering, and then fertilized with potassium fertilizer (potassium sulfate) by 100 kg.ha^{-1}. Preventive Combat of plants from infection of corn stalk borer (*Sesamia cretica*) By feeding the developing summit by spraying diazinon in two stages the first when forming 4-6 leafs and the second Combat after 15-20 days from the first Combat after the completion of the final growth was measured by the anatomical characteristics of the plants.

Number of vascular bundles the stem: Cross-sectional sections of the stems and were examined numbers vascular bundles Under the minimum power of the compound microscope (x40).

Number of vascular bundles in the main vein for leaf: the cross-sectional sections of the main vein for leaf's Under the minimum power of the compound microscope (x40).

Stomatal index for adaxial and abaxial leaf surface (Stomatal guide): (Khazraji and Aziz, 1989).

Results and Discussion

Number of vascular bundles the stem(Bundle):

The results in table 2 indicate that the irrigation period exceeded every 5 days in giving the highest rate of recipe, reaching 132.98 bundles and it was not significantly different from the treatment of irrigation duration every 10 days, the mean characteristic was 132.33 bundles and it differed significantly from the treatment of irrigation duration. Every 15 days, the average capacity was 126.53 packs respectively. The reason for this is that the divergence of irrigation durations has led to a decrease in stem diameter which has led to an increase in abscisic acid which inhibits the effectiveness of growth hormones responsible for the activation of cambium and increased diagonal cell division (Dawood *et al.,* 2012). The results also show that the addition of Proline acid resulted in superior treatment 300 mg.L^{-1} in giving the highest rate of recipe, reaching 144 bundles and it differed not significantly from all treatments, with the mean capacity at treatment 0, 100 and 200 mg.L^{-1} is 115.41, 128.50 and 135.66 bundles respectively. The reason is due to the superiority of Proline acid the plant stem diameter resulting in an increase in the number of vascular bundles Consequently increase connectivity efficiency Aljashmi (2010), the results of the same table indicate the bilateral overlap between the addition of

Table 1: Some Chemical and Physical Properties of Field Soil Before Planting.

%FC	EC	pH	Moisture content	Organic matter	Sand	Clay	Silt	Soil weaving	Pro-perty
16	2.05	7.3	7.4	10	412.8	332.8	255.2	Clay loam	the value
%	$Decimens^{-1}$	Hydrogen ion concentration	100 gm.ml	gm.km soil	gm.km soil	gm.km soil	gm.km soil	----	measuring unit

Proline acid and irrigation divergence intervals exceeding 300 mg L^{-1} with the duration of irrigation every 5 days in giving the highest recipe rate, reaching 132.98 bundles. Irrigation treatment was not significantly different every 10 days, with an average capacity of 132.33 bundles The results showed that the addition of humic acid resulted in superior treatment of 3 $gm.m^{-2}$ in giving the highest rate of recipe, reaching 137.61 bundles, which differed significantly from the It differed significantly from comparison and treatment 1 $g.m.m^{-2}$ the average quality 124.88 and 127.92 bundles respectively and varied not significantly. On the treatment of 2 $gm.m^{-2}$, the average capacity was 133.15 bundles , due to the fact that the addition of humic acid increased the readiness of nutrients promoting vegetative growth, and this was reflected clearly on the increase of the diameter of the stem, which led to an increase in the number of vascular bundles Nutrient Transporter¡ (Ayas, 2005). The results of the same table show the bilateral overlap between the addition of humic acid and irrigation divergence intervals to the superiority of the treatment of 3 $gm.m^{-2}$ with the duration of irrigation every 5 days, with an average characteristic of 142 bundles. It was significantly different from the comparison coefficients at the irrigation durations every 5, 10 and 15 days as the mean characteristic 128, 126.50 and 119.16 bundles respectively. The results of the same table show the bilateral interaction between the addition of humic acid and Proline acid exceeding treatment 3 $gm.m^{-2}$ humic acid and treatment 300 mg. L^{-1} Proline acid in giving the highest rate of recipe, as it reached 148.66 bundles and It differed significantly from the comparison treatment, as it reached, reaching 112.77 bundles. The results of the same table indicate triple overlap between the study factors exceeding the duration of irrigation every 5 days and treatment 300 mg. L^{-1} Proline acid and treatment 3 $gm.m^{-2}$ Humic acid in giving the highest rate of recipe, reaching 152.67 bundles and was significantly different from the comparison treatment every 5 days, with an average of 116.33 bundles.

Number of vascular bundles in main vein of the leaves:

The results in table 3 indicate that the irrigation interval exceeded every 5 days In giving the highest rate of adjective, as it reached 31.86 bundles and it was not significantly different from the irrigation treatment every 10 days, as it reached 31.57 bundles and it differed significantly from the irrigation treatment every 15 days. The average capacity was 31.15 bundles. The reason for this is that the spacing of the irrigation durations led to a decrease in the diameter of the stem, which resulted in a decrease in the number of vascular bundles in the leaves of the main vein of the leaves due to an increase in the level of abscisic acid, which inhibits the action of cytokines, which is based on the stimulation of vascular tissue differentiation of cambium, (Nezmami *et al.,* 2008). The results of the same table show that the addition of Proline acid resulted in treatment exceeding 300 mg.L^{-1} in giving the highest recipe rate was 32.75 bundles and it was significantly different from the comparison treatment, the mean characteristic was 29.94 bundles and it was not significantly different from the treatment of 100 and 200 mg.L^{-1}, the mean characteristic was 31.15 and 32.24 bundles respectively. The reason is due to the effective role of Proline acid in increasing the leaf area, which led to increase the plant's ability to photosynthesis by controlling the opening and closing of stomata and preserve the chlorophyll pigment from decomposition and thus helps to balance between taking carbon dioxide and water loss through transpiration which is reflected Positively on the number of vascular bundles in the main vein sweat of the leaves (Sadek *et al.,* 2012). The results of the same table indicate a bilateral overlap between the

Table 2: Effect of Different Concentrations of Humic Acid and Proline Acid and Irrigation Durations and Interactions Between the Number of Vascular bundles the stem (Bundle).

Bilateral overlap between the addition of humic acid and irrigation durations	Proline Acid L^{-1}				Humic Acid $mg.m^{-2}$	Extended irrigation
	300	200	100	0		
128	145.33	126	124.33	116.33	0	5 days
125.45	145.33	138.50	132.67	85.30	1	
137.20	149	143.17	132.33	124.33	2	
142	152.67	148	138.33	129	3	
126.50	145.67	125	123.33	112	0	10 days
131.41	142.33	134.67	131.67	117	1	
132.50	143.67	139.33	125.67	121.33	2	
138.91	150.33	144.67	136.33	124.33	3	
119.16	125.33	125	116.33	110	0	15 day
126.91	138.33	133.33	125	111	1	
129.75	140	133.67	127.33	115	2	
131.91	143	136.67	128.67	119.33	3	
10.88	144	135.66	128.50	115.41		Average Proline Acid
5.91			20.47			Triple overlap L.S.D= 0.05

addition of Proline acid and irrigation interval spacing exceeding 300 mg.L^{-1} with the duration of irrigation every 10 days, with an average capacity of 32.81 bundle has differed significantly from the treatment of irrigation every 5 days, with an average capacity of 32.62 bundle. The results of the same table show that the addition of humic acid led to the superiority of treatment 3 gm.m^{-2} in giving the highest rate of recipe, reaching 32.32 bundles and was significantly different from the comparison and treatment 1 gm.m^{-2}, with an average adjective of 30.58 and 31.04 bundles and differed Non-significant treatment was 200 mg. m^{-2}, with an average capacity of 32.63 bundles respectively. The reason is that the addition of humic acid increased the stem diameter of maize plants and this led to an increase in the number of vascular bundles in the vein, which led to an increase in the number of vascular bundles in the middle sweat of the leaves, which increased the conductivity of the vascular bundles and thus increased the growth and development of the plant (Ayas, 2005). The results in the same table show the bilateral overlap between the addition of humic acid and irrigation divergence intervals exceeding 3 gm.m^{-2} and irrigation durations every 5 days in giving the highest rate of recipe, reaching 33.01 bundles and it differed significantly from comparison coefficients when durations of irrigation durations every 5, 10 and 15 days, The average capacity was 31.55, 30.70 and 30.50 bundles respectively. The results of the same table show the bilateral interaction between the addition of humic acid and the addition of Proline acid exceeding treatment 3 g.m^{-2} and treatment 300 mg. L^{-1} in giving the highest rate of recipe, as it reached 33.95 bundles and was significantly different from the comparison treatment, where the average capacity was 29.00 bundles . The results of the same table indicate the triple overlap between the study factors exceeding the duration of irrigation every 5 days and treatment 200 mg. L^{-1} and treatment 3 gm.m^{-2}, giving the highest rate of recipe, reaching 34.40 bundles, which differed significantly from the comparison treatment every 5 days, with an average of 29.02 bundles.

Table 3: Effect of Different Concentrations of Humic Acid and Proline Acid and Irrigation Durations and Interactions on the Number of vascular bundles in main vein of the leaves.

Bilateral overlap between the addition of humic acid and irrigation durations	Proline Acid L^{-1} 300	200	100	0	Humic Acid mg.m^{-2}	Extended irrigation
31.55	31.69	31.77	29.75	29.02	0	5 days
31.09	32.23	32.15	30.45	29.55	1	
32.81	32.93	34.13	32.86	31.33	2	
33.01	33.66	34.40	33.06	30.95	3	
30.70	31.63	31.50	30.53	29.16	0	10 days
31.10	31.80	31.66	30.96	30	1	
31.96	33.86	32.16	31.33	30.50	2	
32.09	34.6	32.61	31.83	30	3	
30.50	31.66	31.16	30.33	28.83	0	15 day
30.94	32.46	31.33	30.50	29.50	1	
31.62	33	32	31.16	30.33	2	
31.58	33.16	32	31	30.16	3	
1.57	32.75	32.24	31.15	29.94		Average Proline Acid
0.27			0.96			Triple overlap L.S.D= 0.05

Table 4: Effect of Different Concentrations of Humic Acid and Proline Acid and Irrigation Durations and Interference on Stomatal index for adaxial leaf surface.

Bilateral overlap between the addition of humic acid and irrigation durations	Proline Acid L^{-1} 300	200	100	0	Humic Acid mg.m^{-2}	Extended irrigation
33.27	34.93	34.17	32.65	31.33	0	5 days
34.09	35.66	34.83	33.55	32.33	1	
34.58	35.56	35.40	34.63	32.73	2	
34.83	38	35.90	34	31.43	3	
31.49	33	32	31.16	29.80	0	10 days
32.75	34.33	33.16	32.50	31	1	
32.54	33.66	32.90	32.13	31.50	2	
32.20	34.66	33	31.16	30	3	
21.42	22.54	21.59	21.15	20.40	0	15 day
21.87	23	22.10	21.60	20.80	1	
22.27	23.50	22.50	22	21.10	2	
22.78	24.12	23.10	22.40	21.50	3	
2.95	31.16	30.05	29.07	27.82		Average Proline Acid
1.68			5.90			Triple overlap L.S.D= 0.05

Stomatal index for adaxial leaf surface:

The results in table 4 showed that the irrigation interval exceeded every 5 days in giving the highest rate of recipe 34.58

and it was not significantly different from irrigation divergence interval every 10 days the average quality 32.24. and it was significantly different from irrigation divergence interval every 15 days the average quality 23.38. As the movement of sentinel cells is a result of bulging pressure, when the plant is subjected to stenosis, the stomata are closed and the entry of carbon dioxide into the interior decreases and the speed of photosynthesis decreases. Therefore, the strain affects growth, leading to a decrease in stomata (Munns, 2002). The results of the same table indicate that the addition of Proline acid resulted in treatment exceeding 300 mg.L^{-1} in giving the highest rate of recipe, reaching 31.16 and was significantly different from the comparison treatment and treatment 100 mg.L^{-1}, the average quality 27.82 and 29.07, respectively, and differed not significantly from treatment of 200 mg.L^{-1}, with an average capacity of 30.05. The reason is due to the role of Proline acid in regulating the ammonia voltage, which increases the cell's ability to draw water from the growth medium and then increase in plant growth and perpetuate cell elongation and perpetuation of stomatal opening, which led to an increase in the stomatal coefficient of the adaxial leaf surface (Aljashmi, 2010) the table shows the binary overlap between addition of Proline acid and Irrigation spacing exceeds treatment 300 mg.L^{-1} with the spacing of irrigation every 5 days in giving the highest rate of recipe, as it amounted to 36.03 and was not significantly different from the treatment of irrigation every 10 days, the average quality was 33.91. The results in the same table show that the addition of humic acid resulted in the superiority of the treatment of 3 gm.m^{-2} by giving the highest rate of recipe 29.93, which differed not significantly from the rest of the treatments, including the comparison treatment, with an average of 28.72, 29.56 and 29.66. Respectively. The reason is due to the role of humic acid in increasing the rate of leaf area and leaf content of chlorophyll, which led to an increase in photosynthesis process, as organic acids have positive effects on the growth and development of the vegetative and root totals and improved utilization of nutrients (Buyukkeskn *et al.,* 2011). The results of the same table show the bilateral overlap between the addition of humic

Table 5: Effect of Different Concentrations of Humic Acid and Proline Acid and Irrigation Durations and Interference Between the Stomatal frequency of adexial leaf surface (stents.cm^{-2}).

Bilateral overlap between the addition of humic acid and irrigation durations	Proline Acid L^{-1}				Humic Acid $mg.m^{-2}$	Extended irrigation
	300	200	100	0		
6169.12	7280.95	6801.35	5827.81	4766.40	0	5 days
6551.04	7825.21	7278.80	5781.00	5319.16	1	
6899.36	8202.46	7288.33	6198.48	5908.20	2	
7556.73	8837.65	8282.92	6825.55	6280.81	3	
5730.68	7028.15	6368.14	5263.47	4262.99	0	10 days
6425.11	7045.11	6872.41	6162.55	5620.40	1	
6910.18	7028.99	7977.72	6867.18	5766.84	2	
7881.15	9876.33	8271.32	7106.12	6270.83	3	
5871.15	6844.37	6671.58	5705.19	4263.48	0	15 day
6532.19	7694.41	7267.92	6700.33	4466.12	1	
6642.13	7303.88	7272.28	6720.81	5271.55	2	
6793.39	7979.13	7276.66	6655.77	5262.00	3	
617.21 / 380.77	7745.55	7302.45	6317.85	5288.23		Average Proline Acid
			1332.70			Triple overlap L.S.D= 0.05

Table 6: Effect of Different Concentrations of Humic Acid and Proline Acid and Irrigation Durations and their Interference on the Stomatal frequency of abexial leaf surface (stents.cm^{-2}).

Bilateral overlap between the addition of humic acid and irrigation durations	Proline Acid L^{-1}				Humic Acid $mg.m^{-2}$	Extended irrigation
	300	200	100	0		
5495.38	6242.25	5316.73	5215.78	5206.78	0	5 days
5700.47	6615.11	5582.44	5368.22	5236.13	1	
5955.21	6719.39	5682.27	5401.00	6018.20	2	
6309.82	8830.33	5897.71	6480.84	6036.41	3	
5400.65	5553.15	5458.07	5381.00	5210.41	0	10 days
5750.11	6827.82	5518.94	5427.32	5226.38	1	
6416.65	6888.50	6374.22	6233.54	6231.05	2	
6535.21	7015.63	6372.11	6412.35	6240.76	3	
5347.59	5815.41	5544.31	5222.02	5216.71	0	15 day
5349.22	5523.72	5326.10	5323.85	5223.21	1	
5501.23	5912.17	5496.81	5369.85	5226.09	2	
5690.37	5941.42	5423.10	5429.67	5967.32	3	
581.88 / 333.06	6490.40	5673.90	5605.45	5586.62		Average Proline Acid
			1165.72			Triple overlap L.S.D= 0.05

acid and irrigation Outweigh the transaction 3 gm.m^{-2} At the time of irrigation every 5 days in giving the highest rate of recipe, as it reached 34.83 and it was not significantly different from the comparison treatment at divergence of irrigation durations every 5 days. The mean difference was 33.27 and was significantly different from the comparison treatment at the divergence of irrigation durations every 10 and 15 days, averaging 31.49 and 21.42 respectively. The results of the same table show the bilateral overlap between the addition of humic acid and the addition of Proline acid exceeding treatment 2 gm.m^{-2} and treatment 300 mg.L^{-1} In giving the highest rate of recipe as 32.26 and differed significantly from the comparison treatment, where the mean attribute was 27.17. The results in the same table show the triple overlap of study factors exceeding the duration of irrigation every 5 days and treatment 300 mg. L^{-1} and treatment 3 gm.m^{-2}, in giving the highest rate of recipe, reaching 38 and was significantly different from the comparison treatment every 5 days, the average characteristic was 31.33.

Stomatal frequency of abexial leaf surface (stents.cm^{-2}) :

The results in table 6 show that the irrigation interval exceeded every 10 days in giving the highest rate of recipe, reaching 6106.19 stents.cm^{-2} It differed not significantly from the treatment of irrigation every 5 days, with an average capacity of 5844.59 stents.cm^{-2}. and differed significantly from the treatment of irrigation every 15 days, with an average capacity of 5497.60 stents.cm^{-2}. This is due to the fact that the exposure of plants to water stress leads to many modifications of plants at the plant level, which leads to the improvement of the ability of the plant to tolerate inappropriate environmental conditions, such as increased sensitivity of cells guarding to close the stem when exposed to water stress to reduce water loss By transpiration and maintaining the fullness inside plant cells, as well as reducing the leafy area, which affected the lacunate frequency of the Stomatal frequency of abexial leaf surface of the maize plants. (Kutlu *et al.,* 2009). The results of the same table show that the addition of Proline acid resulted in treatment exceeding 300 mg. L^{-1} in giving the highest rate of trait, reaching 6426.07 stents.cm^{-2} was significantly different from all coefficients 0, 100 and 200 mg. L^{-1}, with average adjective 5559.12, 5605.45 and 5673.90 stents.cm^{-2} respectively. The reason is that the spraying of maize plants with Proline acid increased the leaf area and the number of leaves, which led to an increase in the stem frequency of the leaves and thus improved breathing and photosynthesis Qazzaz (2010). The results of the same table indicate a bilateral overlap between the addition of Proline acid and irrigation interval spacing exceeding 300 mg.L^{-1} with spacing of irrigation intervals every 10 days in giving the highest rate of recipe, reaching 6878.27 stents.cm^{-2} It was not significantly different from the treatment of irrigation every 5 days, with an average of 6601.77 stents.cm^{-2}. The results in the same table show that the addition of humic acid resulted in superior treatment of 3 gm.m^{-2} by giving the highest rate of recipe, reaching 6178.46 stents.cm^{-2} was significantly different from the comparison and treatment of 1 gm.m^{-2} where the average quality 5550.95 and 5599.93 stents.cm^{-2} The difference was not significant from the treatment of 2 gm.m^{-2}, with an average of 5935.28 stents.cm^{-2} respectively. The reason is that organic acids have positive effects on the growth and development of the vegetative and root totals and improve the utilization of nutrients This, in turn, improved the leafy area, which positively reflected on the Stomatal frequency of the leaves of maize plants (Selim *et al.,* 2009). The results in the same table show the bilateral overlap between the addition of humic acid and the spacing of irrigation durations exceeding 3 gm.m^{-2} and the irrigation duration every 10 days with the highest recipe rate, reaching 6535.21 stents.cm^{-2} was significantly different from the treatments comparison When extended irrigation 5, 10 and 15 day as 5495.38, 5707.65 and 5347.59 stents.cm^{-2} respectively. The results in the same table show the bilateral interaction between the addition of humic acid and the addition of Proline acid exceeding the treatment of 3 gm.m^{-2} and treatment 300 mg.L^{-1}, with an average adjective of 6595.79 stents.cm^{-2} was significantly different from the comparison treatment, where the average adjective was 5211.3 stents.cm^{-2} . The results in the same table indicate the triple overlap between the study factors exceeding the duration of irrigation every 5 days with treatment 300 mg.L^{-1} and the treatment of 3 gm.m^{-2} gave the highest rate of recipe, reaching 8830.33 stents.cm^{-2} was significantly different from the comparison treatment every 5 days, with an average capacity of 5206.78 stents.cm^{-2}.

Conclusions

1- The spraying of maize plants with proline acid affects most anatomical traits.

2- Humic acid had an active role in increasing the vegetative growth of the yellow corn, which was positively relapsed to improve many anatomical traits.

3- The divergence of the irrigation durations between irrigation affected negatively the anatomical indicators, except that the divergence of the irrigation intervals every 10 days was close to the divergence of the irrigation

durations every 5 days.

4- Most of the anatomical and water relations properties increased when using the combination 300 $mg.L^{-1}$ Proline acid and 3 gm^{-2} humic acid and the duration of irrigation every 10 days.

5- Triangular interference had an insignificant effect between irrigation durations every 5 days and 10 days in the studied anatomical traits of maize plants.

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