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Effect of Salicylic acid and irrigation intervals on yield components of five genotypes of maize (*Zea mays L.*)

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Effect of Salicylic acid and irrigation intervals on yield components of five genotypes of maize (*Zea mays L.*)

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Abstract: This study was carried out during spring and fall growing seasons of 2013 in Alfayadah district –Alhindiya Kerbala governorate to study the effect of different concentration of SA, two periods of irrigation as well as their interaction on the yield and its components of maize plants. Maize cultivars were Almaha, Buhooth, Fajer, Baghdad and Local. Factorial experiment within randomized complete block design (R.C.B.D) was adopted (5*2*5) for SA, irrigation period and cultivars respectively with three replicates. Means were compared using LSD at 0.05 probability level. The 1st addition of SA was at 4-5 true leaves stage and the 2nd addition was one month after the 1st one (50% of male flowering). Results revealed that SA resulted in a significant increase in dry weight of yield (g) at the concentrations of 200 and 150 mg/L SA 68.00% & 32.10% for both seasons respectively. Higher weight of 100 seeds 5.72% was found at 150 mg / L SA during the fall season. The biological yield was also increased by 10.63% & 15.83% at a concentration of 200 mg/L SA for both seasons respectively. Increasing the intervals of irrigation from 7 to 14 days caused a reduction in dry weight of yield by 21.27% and 15.37% and weight of 100 seeds by 9.62% & 5.84% respectively, as well as reducing the biological yield by 10.55% & 17.32% for both seasons respectively. Maize cultivars showed fluctuations in most studied parameters between spring and fall seasons. The interaction between SA & water interval showed a significant increase of most studied parameters concerning yield and its components. The interaction between SA and cultivars significantly affected the above mentioned parameters. The interaction between the three factors had a significant effect on the studied traits.

1. Introduction

Irrigation is one of the environmental factors that have priority in influencing the quantity and quality of the crop through its effect on the stages of emergence, and the plant organs and their growth as water plays a large role in increasing the availability of nutrients absorption, and on the growth, division of cells and photosynthesis. A solvent and a medium carrier of those substances to different parts of the plant [1]. This requires the care of water resources, rationing and not wasting them for the purpose of obtaining the highest productivity with the least amount of water. To achieve this, it is necessary to take care of soil and crop service operations by following some agricultural methods and practices that reduce water consumption and increase the efficiency of its use. Provides good soil coverage with an effective vegetative cover to intercept more of the falling solar radiation during the growing season, depleting the largest amount of soil water and reducing the amount of water lost by evaporation [2]. In addition to following some agricultural applications, which are important applications in arid and semi-arid regions of the world. These aimed to overcome the symptoms of the phylogenetic phenomena that occur in developing plants in harsh environments of drought or water shortage of the ground and spray. The whole plant solutions are one of the organizations plant growth to increase the



growth and yield of adverse biological effects and the arrival of plants to their normal growth . Which required to raise their efficiency without any damage to their organs. Crops under the influence of environmental stresses have led to increased tolerance of plants to stress and improve the growth characteristics of plants by reducing stress damage [3] and [4].

Salicylic acid is one of the newly discovered endogenous plant hormones and helps to induce plants to tolerate biotic and abiotic stress conditions and drought stress [5]. Its physiological roles increase the rate photosynthesis and control of the movement of stomata and play the role of abscisic acid ABA which maintain the vitality of the membrane by reducing the disruption of membranes so reduce the oxidation of fat , the ability that links to amino acids which is one of the most important non-enzymatic antioxidants, that have an important role in reactive oxygen species active during stress [6, 7 and 8]. *Zea mays* is an important economic crops in the Arab world and the whole world. They are third in importance after wheat and rice crops anywhere [9]. The importance of these crops in Iraq's food and industrial security, the structure of agricultural production in Iraq needs to improve agricultural policies towards optimal utilization of agricultural resources and encourage the use of modern agricultural technology , to expand the usage of high-quality, drought-tolerant, high-quality plant varieties so improve the efficiency of natural resource exploitation even reduce waste[10]. Although this crop is a newly grown crop in Iraq, production in the area unit is still low in comparing to the other countries . It fills only a small fraction of domestic consumption [11,12]. The study was carried out to assess the effect of salicylic acid and irrigation treatments on yield of .

2. Materials and Methods:

2-1-Location and design of the experiment:

This study was conducted in Al-Fayadah / Al Khairat / Al-Hindia region, about 30 km southwest of Karbala Governorate for the 2013 season. In two field trials for the spring season 2/4/2013 and the autumn of 21/7/2013 (RCBD) and the randomized complete block design RCBD, as a $5 \times 5 \times 2$ global experiment with three replicates, samples of field soil were taken from different random locations and at a depth of 0-30 cm, -Grain and pH of 7.4, and conductivity EC. of 4.2.

2-2- Seed source:

The maize seed varieties Al-Maha , Fajer, Baghdad , Buhooth106 were obtained from the General Authority for Agricultural Research (GARA). The local varieties were purchased from the local market.

2-3- Preparing the land and implementing the experiment:

The plot was divided into 5 replicates, each with ten experimental units, for a total of 560 m², with dimensions of 28 × 20 m. The plow was plowed by two plows, 50 replicate for the five varieties and 10 for each one. Each experimental unit is separated by a distance of 2 m from the other five for the first cultivar and separated by a distance of 90 cm between them. Each length is 3 m and 75 cm wide, And left a distance 3 - 3.5 as a precautionary border surrounding the experiment and from four sides were the process of agriculture for the spring season 2/4/2013 and the fall of 21/7/2013 and by the 5 seeds in each of hole in the upper third of the goat at a depth of 5 cm and when the integration of germination subsided into two plants. The nitrogen fertilizer was added super phosphate triple 46% P₂O₅ with an average of 100 kg / ha before planting[13], while nitrogen fertilizer was added at 200 and 400 kg / ha and in the first two increments after the emergence of seedlings one month and the second at elongation prior to flowering, and the use of urea fertilizer 46% N as a source of nitrogen[14]. 10% effective ingredient by 6 kg / ha for the prevention of insect pestle *Sesamia critica* , by using the developing tip of the first two times in the stage 4-5 leaves, and the difference after 15 days of the first land was immediately irrigated after planting, and the irrigation system was applied in the second week, and the bushes were removed whenever needed until the growth season was completed.

2-4-Determination of irrigation duration:

The study included two irrigation systems based on field capacity (100% field capacity, 50% field capacity), one irrigated weekly, and the other under water stress during irrigation periods (irrigated every two weeks).

2-5- Preparation of salicylic acid:

A standard solution of Salicylic acid (SA) was prepared by weighing 200 mg and solvent in a few drops of ethyl alcohol and then supplemented to 1 liter with the addition of distilled water to prepare 200 mg/L, followed by a series of dilutions (150, 100, 50) mg/L. It was sprayed on the plants of the field with 2.5 liters of special spray, spraying on leaves and twice during the growing season, the first when the plants reached stage 5-4 leaf [15] and the second month after the plants entered the flowering stage, spraying process in the early morning until full wetness, while the control plants of each class sprayed with distilled water.

2-6 - Weight 100 gm / plant

After mixing the grains of 6 plants of each duplicate of the replicates of treatment. Taken from random samples of grain and counted to 100 tablets and then weighing by sartorius balance type.

2-7 - Grain / plant yield (g):

It was calculated by dividing the weight of the crop to 6 plants on their number.

2-8 - Biological yield (g/ plant):

The weight of plants confined within the same area, which includes the total dry matter weight {(leaves + stems) + grain yield}.

3-Results and Discussion**3-1-Results:****3-1-1-Dry weight of yield per plant (gm.plant⁻¹)****3-1-1-1- Spring season:**

The results indicated in table (1-a) show the positive effect of processing the leaves of maize plants on SA on the dry grain yield of each plant g and in most concentrations. The plants were treated with a concentration of 200 mg/L. 74.02 g and 68.00% compared to the comparison treatment 44.06 g . The spread of the irrigation period has a significant effect on reducing the grain yield per plant from 58.07 to 45.72 g and by 21.27% (relative to the comparison treatment) 58.07 g . The same table shows the variation of maize varieties in the average dry grain yield (g), with the Almaha cultivar having a significant effect on the rest 60.60 g , while Buhooth cultivar gave an average mean 46.06 g . The effect of the binary interaction between the concentration of SA and the irrigation period, indicated the results shown in the table above. There were significant differences in the average of this quality, as the plants were treated with a concentration of 200 mg per liter. From SA, the highest mean was 76.05 g and irrigated every 7 days, while the lowest mean was 26.09. when irrigation every 14 days. The above table indicates significant differences due to the effect of the binary overlap between the concentration of SA and the class. Almaha cultivar gave a concentration of 100 mg/L. of SA. The highest mean of this type was 111.18 g. The effect of the binary interference between the irrigation and the strain period, it is clear that the varieties vary in their response to the different irrigation periods. Almaha cultivar outperforms the rest of the species at an average of this status and at the time of irrigation every 7 days, 92.09 g, while the same species recorded the lowest mean and the duration of irrigation every 14 days reached 29.11 g. The triangular interference shows that the highest mean One plant was given by the combination of the Baghdad cultivar at a concentration of 200 mg/L⁻¹ and irrigation every 14 days at 134.52 g. The lowest mean of

this characteristic was characterized by the combination of a research class at the concentration of the comparison and irrigation 14 days, reaching 0.69 g

3-1-1-2-Fall season:

It is clear from table (1-b) that spraying the leaves of maize plants with concentrations of SA represents a significant increase in the dry grain yield of the plant with high concentrations. The plants were treated with a concentration of 150 mg /L. The increase in irrigation intervals from 7 to 14 days resulted in a significant decrease in the plant yield from 305.12 to 258.22 g with a decrease of 15.37% compared to the comparison and irrigated treatment every 7 days. 305.12 gThe same table indicates the variability of the items among them in the average plant yield The average plant was treated with a concentration of 150 mg/L and the average yield of the plant was treated with a concentration of 150 mg/L and the mean length of irrigation was 14.3 days 392.88 g. In contrast, the lowest mean was found at the concentration of 50 mg/L. And the cultivar, where the Local cultivar recorded the highest average of this attribute amounted to 686.70 g and the concentration of 150 mg/L , while we find that the Al Maha cultivar gave the lowest average of this capacity amounted to 126.94 g at the concentration of the comparison treatment. The mean overlap between the irrigation and cultivar periods indicates significant differences in the mean of this characteristic. Local cultivar recorded the highest average yield of each plant and at the time of irrigation every 7 days, reaching 469.30 g. On the other hand, AlMaha cultivar, 135.17 g. It is clear from the triple interference that the highest average dry grain yield of the plant was characterized by the combination of the Local cultivar at a concentration of 150 mg/L and irrigation every 14 days at 786.98 g, The average of this characteristic was characterized by a combination of the same cultivar but at a concentration of 50 mg/L and irrigated each 14, which was 79.59 g.

Table (1-a): Effect of salicylic acid , irrigation duration , cultivar, and their interaction on plant yield(gm.plant⁻¹) of the spring season.

Conc. of SA mg/L	cultivars	irrigation duration		cultivar*concentration
		7 days	14days	
0.0	Almaha	84.28	1.93	43.11
	Buhooth	62.66	0.69	31.68
	Fajer	16.31	67.23	41.77
	Baghdad	81.00	24.46	52.73
	Local	65.95	36.13	51.04
50	Almaha	120.42	3.65	62.04
	Buhooth	51.69	12.53	32.11
	Fajer	88.32	32.89	60.60
	Baghdad	45.74	57.18	51.46
	Local	53.53	46.39	49.96
100	Almaha	119.68	102.68	111.18
	Buhooth	93.98	77.67	42.17
	Fajer	16.70	37.58	27.14
	Baghdad	14.87	13.80	14.33
	Local	13.41	36.62	25.01
150	Almaha	29.48	21.10	25.29
	Buhooth	41.11	35.94	38.52
	Fajer	47.15	36.58	41.86
	Baghdad	42.43	96.56	69.50
	Local	12.43	99.06	55.74
200	Almaha	106.60	16.20	61.40
	Buhooth	64.33	20.00	85.82
	Fajer	113.30	50.25	81.78
	Baghdad	40.52	134.52	87.52
	Local	25.87	81.33	53.60
L.S.D		56.59		40.02
* irrigation duration Conc. of SA	Conc. of SA mg/L			Mean effect of SA mg/L
	0.0	62.04	26.09	44.06
	50	71.94	30.53	51.23
	100	45.80	42.13	43.97
	150	34.52	57.85	46.18
	200	76.05	71.99	74.02
L.S.D		25.31		17.90
* irrigation duration cultivar	cultivar			cultivar
	Almaha	92.09	29.11	60.60
	Buhooth	62.75	29.37	46.06
	Fajer	56.36	44.90	50.63
	Baghdad	44.91	65.30	55.11
	Local	34.24	59.91	47.07
L.S.D		25.31		17.90
Mean effect of irrigation duration		58.07	45.72	
L.S.D		11.32		

Table (1-b): Effect of salicylic acid , irrigation duration , cultivar, and their interaction on plant yield (gm.plant⁻¹) of the fall season.

Conc. of SA mg/L	cultivars	irrigation duration		cultivar*concentration
		7 days	14days	
0.0	Almaha	88.78	165.10	126.94
	Buhooth	135.18	163.66	149.42
	Fajer	444.70	267.30	356.00
	Baghdad	281.88	273.60	277.74
	Local	335.39	385.62	360.51
50	Almaha	328.92	122.66	225.79
	Buhooth	256.20	149.27	202.74
	Fajer	171.64	139.40	155.52
	Baghdad	287.27	385.64	336.46
	Local	503.64	79.59	291.62
100	Almaha	262.54	84.14	173.34
	Buhooth	207.09	201.32	204.21
	Fajer	258.15	154.72	206.44
	Baghdad	354.53	275.60	315.07
	Local	387.16	346.48	366.82
150	Almaha	259.47	97.86	178.67
	Buhooth	153.69	201.41	177.55
	Fajer	256.48	421.17	338.83
	Baghdad	136.39	456.98	296.68
	Local	586.41	786.98	686.70
200	Almaha	446.55	206.09	326.32
	Buhooth	266.53	171.57	219.05
	Fajer	555.37	128.01	341.69
	Baghdad	130.29	154.17	142.23
	Local	533.88	637.18	585.53
L.S.D	161.67			114.32
* irrigation duration Conc. of SA	Conc. of SA mg/L			Mean effect of SA mg/L
	0.0	257.18	257.18	254.12
	50	309.53	309.53	242.42
	100	293.89	293.89	253.17
	150	278.49	278.49	335.68
	200	386.52	386.52	322.96
L.S.D	72.30			51.31
* irrigation duration cultivar	cultivar			cultivar
	Almaha	277.25	135.17	206.21
	Buhooth	203.74	177.45	190.59
	Fajer	337.27	222.12	279.69
	Baghdad	238.07	309.20	273.64
	Local	469.30	447.17	458.23
L.S.D	72.30			51.31
Mean effect of irrigation duration		305.12	258.22	
L.S.D		32.33		

3-1-2-Weight of 100 seeds(gm):

3-1-2-1- Spring season: The results indicated in table (2-a) show that there is no significant effect of SA spraying on the leaves of maize plants in the weight of 100 grains g . 21.00 to 18.98 g 9.62% compared to the comparison treatment 21.00 g , and the difference in maize varieties was found in the weight of 100 grains Baghdad cultivar, with the highest average of 20.71 g, while the Fajer cultivar recorded the lowest average of 18.67 g . The data of the same table showed a significant effect of the interaction between the concentration of SA and the irrigation period in the average of this characteristic. The plants were treated with a concentration of 150 mg/L from SA and irrigated every 7 days. The average height of this capacity was 23.22 g. With the same concentration of SA and irrigated every 14 days showed an average mean of this value and adult 17.45 g . The overlap between the concentration of SA and the cultivar gave a "significant" effect in the average weight of 100 seeds, Buhooth cultivar recorded 150 mg/L highest mean of this capacity was 22.92 g, while the Fajer cultivar gave the concentration of the comparison of the lowest mean of this attribute amounted to 15.56 g . As for the effect of the binary overlap between the irrigation and the variety, the AlMaha showed superiority over 100 seeds at the time of irrigation every 7 days at 22.89 g. On the other hand, it gave 17.50 g when they irrigated every 14 days, and the triangulation between the study factors indicated that the best combination gave a 100-seed weight increase with a research class of 150 mg/L and a 7-day irrigation period of 25.88 g. AlMaha with 50 mg/L and irrigated every 14 days recorded the lowest rate 12.77 g.

3-1-2-2-Fall season:

It is clear from Table (2-b) that the spraying of maize leaf plants with concentrations of SA is represented by increasing the weight of 100 grains g, with the highest increase in concentration 150 mg/L at 31.43 g and an increase of 5.72% compared to the comparison treatment 29.73 g. The spacing of irrigation intervals from 7 to 14 days led to a significant decrease in the weight of 100 seeds from 31.69 to 29.84 g by a percentage 5.84% compared to the comparison treatment 31.69 g . From the same table, the variety of varieties is 100 seede showed an average mean of 24.72 g . As for the effect of the binary overlap between the concentration of SA and the irrigation period, the results indicated in the table above showed a significant effect on the average of this effect. The plants were treated with a concentration of 50 mg/L of SA and the irrigation time every 7 days reached 33.02 g, while the plants treated with a concentration of 100 mg/L and the duration of irrigation every 14 days showed a mean average of this capacity 29.24 g. The bilateral interaction between the concentration of SA and the cultivar gave a "significant" effect in the average weight of 100 seeds, A Local cultivar was recorded at a concentration of 150 mg/L of SA. The highest mean of this was 41.85 g , while the research class gave the lowest concentration of 19.26 g. As for the effect of the double overlap between the irrigation and the strain periods, which showed significant differences in the weight of 100 grains g , the Local cultivar was characterized by the highest average of this status on the rest of the varieties and the duration of irrigation every 7 days, reaching (43.31 g, The lowest mean of the weight of 100 tablets was characterized by the combination of a local variety at a concentration of 200 mg/L and irrigated every 7 days as it reached 45.41 g, while we find that the lowest average of this characteristic was characterized by the combination of a research class concentration of the treatment of comparison, 15.66 g and with the same period of irrigation.

Table (2-a): Effect of salicylic acid, irrigation duration ,cultivar and their interaction on the average weight of 100 seeds of maize (g) of spring season.

Conc. of SA mg/L	cultivars	irrigation duration		cultivar*concentration
		7 days	14days	
0.0	Almaha	20.39	19.99	20.19
	Buhooth	20.50	20.00	20.25
	Fajer	13.59	17.52	15.56
	Baghdad	21.01	22.67	21.84
	Local	21.07	20.12	20.60
50	Almaha	24.44	12.77	18.60
	Buhooth	13.83	22.10	17.97
	Fajer	21.38	16.99	19.18
	Baghdad	22.36	23.40	22.88
	Local	21.70	20.97	21.33
100	Almaha	24.96	18.86	21.91
	Buhooth	18.10	21.02	19.56
	Fajer	19.92	17.17	18.55
	Baghdad	20.77	15.01	17.89
	Local	21.21	21.00	21.11
150	Almaha	23.83	13.72	18.78
	Buhooth	25.88	19.96	22.92
	Fajer	22.00	16.94	19.47
	Baghdad	22.73	18.63	20.68
	Local	21.67	18.00	19.84
200	Almaha	20.83	22.18	21.51
	Buhooth	20.02	16.70	18.36
	Fajer	20.41	20.77	20.59
	Baghdad	20.67	19.80	20.24
	Local	21.67	18.33	20.00
L.S.D		1.89		1.33
* irrigation duration Conc. of SA	Conc. of SA mg/L			Mean effect of SA mg/L
	0.0	19.31	20.06	19.69
	50	20.74	19.24	19.99
	100	20.99	18.61	19.80
	150	23.22	17.45	20.34
	200	20.72	19.56	20.14
L.S.D		0.84		N.S.
* irrigation duration cultivar	cultivar			cultivar
	Almaha	22.87	17.50	20.20
	Buhooth	19.70	20.04	19.81
	Fajer	19.46	17.88	18.67
	Baghdad	21.51	19.90	20.71
	Local	21.26	19.88	20.57
L.S.D		0.84		0.66
Mean effect of irrigation duration		21.00	18.98	
L.S.D		0.38		

Table (2-b): Effect of salicylic acid, irrigation duration ,cultivar and their interaction on the average weight of 100 seeds of maize (g) of fall season.

Conc. of SA mg/L	cultivars	irrigation duration		cultivar*concentration
		7 days	14days	
0.0	Almaha	29.59	28.47	29.03
	Buhooth	15.66	22.86	19.26
	Fajer	31.79	30.72	31.26
	Baghdad	27.39	32.05	29.72
	Local	42.43	36.36	39.39
50	Almaha	31.43	29.56	30.50
	Buhooth	26.36	25.71	26.03
	Fajer	31.16	32.04	31.60
	Baghdad	31.69	32.69	32.19
	Local	44.47	28.24	36.36
100	Almaha	29.51	24.90	27.20
	Buhooth	25.95	26.04	25.99
	Fajer	29.92	29.19	29.56
	Baghdad	29.86	29.42	29.64
	Local	41.05	36.63	38.84
150	Almaha	29.64	32.09	30.86
	Buhooth	27.47	23.81	25.64
	Fajer	27.92	26.49	27.21
	Baghdad	32.17	31.00	31.58
	Local	43.17	40.53	41.85
200	Almaha	30.89	30.05	30.47
	Buhooth	27.53	25.77	26.65
	Fajer	28.43	23.90	26.17
	Baghdad	31.33	29.55	30.44
	Local	45.41	37.92	41.67
L.S.D	1.18		0.84	
* irrigation duration Conc. of SA	Conc. of SA mg/L			Mean effect of SA mg/L
	0.0	29.37	30.09	29.73
	50	33.02	29.65	31.33
	100	31.26	29.24	30.25
	150	32.07	30.78	31.43
	200	32.72	29.44	31.08
L.S.D	0.53		0.37	
* irrigation duration cultivar	cultivar			cultivar
	Almaha	22.87	17.50	20.20
	Buhooth	19.70	20.04	19.81
	Fajer	19.46	17.88	18.67
	Baghdad	21.51	19.90	20.71
	Local	21.26	19.88	20.57
L.S.D	0.53		0.37	
Mean effect of irrigation duration		31.69	29.84	
L.S.D		0.24		

3-1-3-Biological yield(gm):

3-1-3-1- Spring season: Table (3-a) shows that the foliar application of maize plants in SA showed significant differences in the mean biological yield where the plants were treated with a concentration of 200 mg/L of the SA highest mean of the biological yield was 220.28 g with an increase of 10.63% compared to the comparison treatment 199.11 g. The difference in irrigation intervals from 7 to 14 days has a significant effect on the reduction of the biological yield from 217.06 to 194.17 g with an increase of 10.55% that irrigated every 7 days 217.06 g. It is clear from the same table that the varieties of maize vary in the biological value, as we find superiority Almah cultivar morally on the rest of the items in the average 244.07 g, while the Local cultivar gave the lowest mean 169.28 g. The results of the same table showed a significant effect of the interaction between the concentration of SA and the irrigation period. The highest average yield of the plant was 235.40 g and irrigated every 7 days, while the lowest mean was found at a concentration of 163.20 g and irrigation period of 14 days. There were also significant differences due to the effect of the binary interaction between the concentration of SA and the class. The Almaha cultivar recorded the highest average of this characteristic at 283.75 g at the concentration of 150 mg/L 131.07 g and at the concentration of 200 mg/L. As for the effect of the binary interference between the irrigation and species, Almaha cultivar showed the highest mean of this effect during the period of irrigation every 7 days reached 256.37 g, The lowest mean of this type was 144.84 g and irrigated every 14 days. The trilaterally interference indicates that the highest mean of the biological yield was characterized by the combination of 150 mg/L and irrigation every 14 days was 316.33 g. On the other hand, the lowest mean of this trait was characterized by the combination of the local category at the concentration of 200 mg/L which reached 91.80 g and the same duration of irrigation.

3-1-3-2-Fall season:

The results indicated in table (3-b) show that the high concentrations of SA contribute to a significant increase in weight 100 seeds in the high concentrations. The plants were treated with a concentration of 200 mg/L of SA with the highest biological yield of 413.08 with an increase 15.83% compared to the comparison treatment 356.62 g, and it is clear that the spread of the irrigation period from 7 to 14 days has a significant effect on the increase of the biological yield from 338.18 to 396.75 g and 17.32% the comparison 338.18 g, and we find from the same table that the varieties vary among them in the biological record, where the Local cultivar recorded the highest average of the biological yield mean 471.04 g, while Buhooth cultivar recorded the lowest mean 274.09 g. The results showed a significant effect of the interaction between the concentration of SA and the irrigation period in the average biological yield 479.23 g, with a mean concentration of the lowest mean 310.33 g and irrigated every 7 days, as well as significant differences between SA concentration and the cultivar where we find that the highest average of the biological record of the cultivar Local at the concentration of 150 mg/L reached 605.04 g, while showed Buhooth cultivar the concentration of the comparison coefficient was the lowest mean of this trait at 221.84 g. As for the effect of bilateral interaction between the irrigation and cultivar periods, the Baghdad cultivar showed the highest mean yield of 598.60 g at irrigation time of 14 days, whereas Buhooth cultivar showed a mean mean of 250.85 g and the same duration of irrigation. The average concentration of this group was 825.75 g, while the lowest mean was found in the Fajer cultivar combination at the concentration 100 mg/L 187.57 g and the same duration of irrigation.

Table (3-a): Effect of salicylic acid, irrigation duration, cultivar and their interaction on the biological yield (g) of spring season.

Conc. of SA mg/L	cultivars	irrigation duration		cultivar*concentration
		7 days	14days	
0.0	Almaha	244.20	146.33	195.27
	Buhooth	246.20	140.74	193.47
	Fajer	177.65	210.71	194.18
	Baghdad	282.50	169.75	226.12
	Local	224.55	148.47	186.51
50	Almaha	280.54	158.93	219.73
	Buhooth	197.80	162.11	179.95
	Fajer	198.07	137.15	167.61
	Baghdad	178.33	248.99	213.66
	Local	260.21	161.72	210.96
100	Almaha	250.37	259.31	254.84
	Buhooth	243.17	223.51	233.34
	Fajer	154.28	189.64	171.96
	Baghdad	208.54	202.29	205.42
	Local	172.34	175.30	173.82
150	Almaha	251.16	316.33	283.75
	Buhooth	186.10	215.66	200.88
	Fajer	152.76	173.91	163.33
	Baghdad	199.70	240.57	220.13
	Local	141.13	146.92	144.03
200	Almaha	255.58	277.97	266.77
	Buhooth	255.82	187.09	221.46
	Fajer	206.47	207.66	207.06
	Baghdad	288.77	261.30	275.03
	Local	170.35	91.80	131.07
L.S.D		53.62		37.91
* irrigation duration Conc. of SA	Conc. of SA mg/L			Mean effect of SA mg/L
	0.0	235.02	163.20	199.11
	50	222.99	173.78	198.38
	100	205.74	210.01	207.87
	150	186.17	218.68	202.42
	200	235.40	205.16	220.28
L.S.D		23.98		16.96
* irrigation duration cultivar	cultivar			cultivar
	Almaha	256.37	231.77	244.07
	Buhooth	225.82	185.82	205.82
	Fajer	177.84	183.81	180.83
	Baghdad	231.57	224.58	228.07
	Local	193.72	144.84	169.28
L.S.D		23.98		16.96
Mean effect of irrigation duration		217.06	194.17	
L.S.D		10.72		

Table (3-b): Effect of salicylic acid, irrigation duration , cultivar and their interaction on the biological yield (g) of fall season.

Conc. of SA mg/L	cultivars	irrigation duration		cultivar*concentration
		7 days	14days	
0.0	Almaha	308.04	288.41	298.23
	Buhooth	209.51	234.17	221.84
	Fajer	306.09	300.12	303.10
	Baghdad	306.03	723.43	514.73
	Local	421.96	468.44	445.20
50	Almaha	346.44	228.19	287.32
	Buhooth	269.47	222.00	245.73
	Fajer	303.00	236.00	269.50
	Baghdad	374.00	590.05	482.02
	Local	361.72	361.41	361.57
100	Almaha	493.05	208.25	350.65
	Buhooth	287.67	262.11	274.89
	Fajer	307.22	187.57	247.40
	Baghdad	323.93	469.91	396.92
	Local	270.39	502.93	386.66
150	Almaha	406.66	325.87	366.26
	Buhooth	329.94	256.61	293.27
	Fajer	260.60	234.90	247.75
	Baghdad	293.39	752.99	523.19
	Local	384.33	825.75	605.04
200	Almaha	487.60	410.93	449.27
	Buhooth	390.08	279.38	334.73
	Fajer	430.13	312.93	371.53
	Baghdad	249.62	456.64	353.13
	Local	333.65	779.85	556.75
L.S.D		101.73		71.93
* irrigation duration Conc. of SA	Conc. of SA mg/L			Mean effect of SA mg/L
	0.0	310.33	402.91	356.62
	50	330.93	327.53	329.23
	100	336.45	326.16	331.30
	150	334.98	479.23	407.10
	200	378.22	447.95	413.08
L.S.D		45.49		32.17
* irrigation duration cultivar	cultivar			cultivar
	Almaha	408.36	292.33	350.34
	Buhooth	297.33	250.85	274.09
	Fajer	321.41	254.30	287.86
	Baghdad	309.39	598.60	454.00
	Local	354.41	587.68	471.04
L.S.D		45.49		32.17
Mean effect of irrigation duration		338.18	396.75	
L.S.D		20.35		

4-Discussion:

The increase in grain productivity (table-1) is due to the foliar application of SA because of its effect on flowering and increased flower age, which may be a prerequisite for the synthesis of auxin and / or cytokinin [15] or by the effect of SA on the hormonal balance of encouraging hormones growth in the form of "increased Auxin, Gibberellin and Cytokinin. The reduction of the levels of the Abscisic acid is consistent with the increase in relative water content and reduction of the water saturation deficit. This is in line with [16], indicating the increased productivity of varieties of wheat plant equipped with SA under water stress conditions leading to higher levels stimulating growth, especially in the sensitive varieties . It also pointed out that productivity is closely linked with the positive and GA_3 , IAA , Ck. , Relative Water Content , WUE (water use efficiency), negative correlation with Leaf Water Deficit LWD , ABA, and the rate of transpiration and gap hole area, or the increase in grain productivity may occur as a result of high levels of Reduced Glutathion(GSH).

The decrease in cereal productivity (table-1) under water conditions is due to the small size of the seeds, the low number of seeds, the low weight of plant, the low rate of transmission of seed materials and the reduction in grain filling time. which are ready to be accepted [17]. It was noted that the varieties with high growth rates show an increase in grain yield and this is consistent with [18] during their study on seven varieties of corn exposed to water stress, which attributed the reason to the high rates growth in growth stages which can indicate the ability of high growth rates of varieties and that decrease when exposed to water stress conditions.

The reason for the decrease in yield biological(table-2) under water scarcity is due to the small size of seeds and the low number of seeds in one corn clover and therefore the decrease in their weight per plant(table-3) due to the decline of the water content of the fabric and the low rate of transmission of seed materials and reduction in the duration of grain filling, in addition to the water stress leads to maturing quickly before the eggs mature and ready to be accepted[17] , and is due to a decrease in the rates of cell division and elongation, leading to lower growth rates for both vegetative and root populations under water stress conditions [19] . The resulting dry weight reduction of both vegetative and root populations is affected (Table 18) may be due to the reduction of enzymatic activity of photosynthesis under the conditions of water stress [20].

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