Effect of irrigation periods and Brassinolide growth regulator on the yield and components of Maize (*Zea Mays* L.)

Aad Abd Allah ALBakri[1] Safaa Abd AL-hassan AL-Zubaidy[2]

[1]* Department of Field Crops, College of Agriculture - Al.Qasim Green University, Babylon ,Iraq.

[2]* Department of Field Crops, College of Agriculture - Al.Qasim Green University, Babylon ,Iraq.

Email :aadalbakri177@gmail.com

Abstract

A field experiment was carried out during season 2021 at the Nile experiments Station located 10 km east of Hilla city. In a sandy clay soil mixture, to study the effect of irrigation periods and spraying concentrations of the growth regulator brassinolide on yield and its components of maize. The experiment was carried out using a randomized complete block design in the split plot and with three replications. The experiment included two factors: irrigation periods every 6, 8 and 10 days, main plot and spraying the growth regulator brassinolide at concentrations of 0, 2, 4, 6 and 8 mg. L^{-1}, sub plot. The seeds of the Baghdad 3 variety were sown. The results showed that the irrigation period 6 days was significantly superior in number of ear , number of rows in the ear, number of grains in a row, number of grains in ear, weight of 500 grains , and grain yield, which amounted to 1.60 ear plant $^{-1}$, 15.96 row ear $^{-1}$ and 35.44 grain row $^{-1}$, 564.9 grain ear $^{-1}$, 157.73 g and 8.93 ton ha^{-1} respectively, while the 8 day irrigation period achieved a significant superiority in biological yield amounting to 24.98 ton ha^{-1}. The spraying concentration also exceeded 8 mg L^{-1} of brassinolide significantly increased yield of components the number of rows ear^{-1}, number of grains row^{-1}, number of grains row^{-1}, weight of 500 grains, yield of grains, biological yield, and harvest index, which amounted to 16.36, row ear^{-1}, 34.95, row^{-1}, 573.3, 158.78 g, and 8.63 ton ha $^{-1}$ 27.14 tons ha^{-1} and 34.45%, respectively. The interactions showed a significant effect on the studied yield characteristics, and the interaction treatment between the 6 day irrigation period and the spraying at a concentration of 8 mg L^{-1} gave the highest averages for the yield and its components.

Key words: maize, irrigation period, brassinolide growth regulator.
*The search was extracted from the first researcher

Introduction

The corn crop (*Zea maize* L.) has a lot of importance to give it to the world, as it is considered one of the pillars of food security, as it comes after the wheat and rice crops. Because the crop contains carbohydrates, protein, and oils, as well as vitamins, as it is used as food for humans and animal fodder, and industrially, it is used in many industries, such as the biofuel industry (ethanol), which contributes to reducing environmental pollution (4). Total area planted with maize for the year 2020 about 405.4

 ISSN 2072-3875

3787 and 4469 kg h^{-1}, dry matter 315 and 320 gm, weight of 500 grains 132 and 124 gm, and grain yield 3473 and 4149 kg h^{-1}respectively compared to irrigation treatment every 5 days. (17) concluded that there were significant differences for the treatments of irrigation periods 5 and 10 days on the components of maize yield, the number of ear, the number of rows ear^{-1}, number of grains row^{-1}, weight of 500 grains, and grain yield $plant^{-1}$. Irrigation period 5 day gave the highest average of 1.2 ears $plant^{-1}$, 16.70 rows ear^{-1}, 38.72 grains row^{-1}, 146 g, 221.11 gm $plant^{-1}$, sequentially. (15) explained when plants were treated with brassinolide regulator at a concentration of 5 mg. L^{-1} to improve the components and yield of corn kernels, With a relative increase of 11.47% in the number of grains row^{-1}, 9.22% for weight 500 grains gm, and 15.85% for grain yield. The results of (9) when treated with brassinolide regulator at a concentration of 0.5 ppm with different irrigation levels showed a significant increase in yield and its components for maize, which gave the highest The average grain yield was 2.55 ton ha^{-1}, biological yield 6.52 ton ha^{-1}, weight 1000 grains 171.6 gm, and harvest index 38.79% compared to the comparison treatment, which gave the lowest average of 2.25 ton $ha^{-1}$and 5.99 ton ha^{-1}, 170.5 gm and 37.43%, respectively. In order to study the effect of irrigation periods and spraying concentrations of the growth regulator brassinolide on yield and its components of maize.

thousand acres produced 419.3 thousand tons, and average production amounted to 1,343 acres, a decline of 21.3% from last season (25) Irrigation scheduling within a period of time is one of the issues related to crop growth and productivity and an effective means for optimal use of water, which is reflected on the field characteristics and consequently on the yield and its components. Increasing the absorption of nutrients and their readiness through its effect on the stages of emergence and formation of plant organs and their growth, in the growth and division of cells and the regularity of the photosynthesis , as well as its role as a solvent and a medium that transports nutrients to the various parts of the plant, as well as the basic cycle in the photosynthesis in which it takes place Dry matter production and plant temperature dampening (19).

Many researches indicated the role of plant growth regulators to improve and increase the yield, such as the growth regulator brassinolide, which has a major role in plant growth and development, cell division and elongation, as well as responding to many environmental stresses such as high temperatures and drought by contributing to the regulation of opening and closing stomata and the process of carbon metabolism (13) .(14) showed that the use of three irrigation periods of 5, 10 and 15 days had a significant effect on the characteristics of maize yield, Irrigation treatment every 10 and 15 days had a significant effect in reducing biological yield, as it reached

design, in the order of split-plots, and with three replications.it included irrigation periods (6, 8 and 10 days) in the main plots, while the sup-plots included spraying concentrations of the growth regulator prasinolide (0, 2, 4, 6 and 8 mg. L-1 . The land of the

Material and Methods

Afield experiment was carried out during the season 2021 in Babil Governorate - Nile Experiment Station located 10 km east of Hilla city. The experiment was applied according to the RCBD randomized complete blook

ISSN 2072-3875

Number of grains ear^{-1}: It is calculated from an average of ten ear.

Weight of 500 grains: It was calculated after neglecting 500 grains of the ten plant aegis, taken randomly after drying the seeds and the stability of moisture by 15.5%, then weighed with a sensitive scale(18).

Grain yield ton ha^{-1}: It was extracted after adjusting the weight on the basis of a moisture content of 15.5% by multiplying the yield of one plant (gm) by the plant density 53333 plants ha^{-1} (18).

Biological yield ton ha^{-1}: according to the random sample plants being harvested from above the soil surface, then dried aerobically under sunlight, then dried by electric oven at a temperature of 65 ° C for 72 hours, then dried at a temperature of 105 ° C for three hours Until the weight was stable in the Graduate Studies Laboratory Department of Field Crops - College of Agriculture - Al-Qasim Green University, then weighed when the weight was stable (1).

Harvest index (%): dividing the grain yield / biological yield × 100.

The results of the experiment were statistically analyzed according to the method of analysis of variance using the randomized complete block design (R.C.B.D), and the significant differences between the treatments were calculated at the level of significance 0.05 for the least significant difference LSD, the program of Genstat was used in the statistical analysis(26).

1.42 ear plant $^{-1}$, with a decrease rate of 11.25% compared to the 6 day irrigation period that achieved the highest average It reached 1.60 ear plant $^{-1}$ and the reason may be attributed to the decrease in the number of ear with the spacing of irrigation periods, as this reduces the leaf area and thus affects the efficiency of the

experiment was plowed, the settlement was completed, and the fertilizer recommendation was added.

The repetitions were divided into a secondary experimental unit amounting to 15 experimental units for one repeater, the distance between one replicate and another 2 m for the work of the waterways and the crop service corridors. Intervals were left between the experimental units within 1 m to ensure that there was no interference between the experiment transactions. The plots were distributed randomly within the blook and thus the total Experimental units (5 x 3 x 3 = 45 experimental units). Random samples were taken from field soil at a depth of 0-30 cm for different locations and analyzed in the Laboratory of the Water and Soil Management Division in El-Moradia, The results of the soil analysis were PH(1.19), Ec (1.5)dS.m^{-1} ,Available N (63) . p (22) ,k (15) mg.kg^{-1}. Soil texture : sandy soil.

Sowing was carried out on 15/7/2021 by placing 2-3 seeds in the holl after testing the percentage of germination that reached 98%. Upon completion of full maturity, the characteristics of the yield were calculated.

Number of ear per plant^{-1}: The number of ear was calculated for ten plants in the random sample for each experimental unit and the average was taken.

Number of rows ear^{-1}. The row of the ear according to the number of rows, as an average of ten acorns for each experimental unit.

Results and discussion

Number of ear per plant^{-1}: The results of Table 1 showed significant differences as a result of the effect of irrigation periods, as the 10 day irrigation period caused a significant decrease in the characteristic of the number of ear for the lowest average of

ISSN 2072-3875

stimulates the specialization of wood and inhibits the specialization of phloem, which contributes to increasing the transport of water and nutrients (16). As for the interaction between irrigation periods and spray concentrations of the regulator brassinolide, 6 day irrigation period and spraying with a concentration of 6 mg L^{-1} were superior by giving the highest average number of ear of 1.86 ear plant $^{-1}$, which did not differ significantly from the 6 day irrigation period and the concentration of 8 mg L^{-1}, which amounted to 1.76 ear plant $^{-1}$, while irrigation period of 10 days and spraying concentration of 0 mg L^{-1} gave the lowest average amounted to 1.26 ear .

photosynthesis and some other physiological processes that lead to a decrease in the number of ear (20). The results also showed that increasing the concentrations of the growth regulator brassinolide spray led to a significant increase in the number of ear, as the concentration 6 mg L^{-1} gave the highest mean of 1.62 ear plant $^{-1}$, which did not differ significantly from the concentration 8 mg L^{-1}, compared to the treatment of spraying with a concentration of 8 mg L^{-1} and 0 mg L^{-1}, which gave the lowest mean for the characteristic 1.35 ear Plant^{-1}, the reason may be due to the role of brassinolide, which has an important role in the development of vascular tissue by increasing the number and size of transport vessels, as it

Table 1. Effect of irrigation periods and concentrations of brassinolide growth Regulater and Interaction between them in the number of ear plant^{-1}.

irrigation periods	brassinolide concentrations(mg L^{-1})					mean
	0	2	4	6	8	
6	1.36	1.53	1.50	1.86	1.76	1.60
8	1.43	1.43	1.33	1.46	1.53	1.44
10	1.26	1.36	1.43	1.53	1.53	1.42
Average	1.35	1.44	1.42	1.62	1.61	
LSD (p=0.05)	irrigation periods		brassinolide concentrations		Interaction	
	0.06		0.05		0.10	

growth phase may impact on traits such as high plant, number of leaves and Diameter of stem which reduced the outputs of the construction process of photosynthesis and reflected on reducing the Number of rows ear (21). The rows in the ear when the spraying concentrations of brassinolide increased, as the concentration exceeded 8 mg L^{-1} giving the highest average of 16.36 rows ear^{-1}, while the treatment of no spray gave the lowest average of 14.27 rows ear $^{-1}$, The reason is that the treatment of the plant

Number of rows ear^{-1}: - The results of Table 2 showed that the 10 day irrigation period caused a decrease in the number of rows in the ear, as it gave the lowest average for the trait amounted to 14.54 rows ear $^{-1}$, with a decrease rate of 8.49% compared to the 6 day irrigation period, which gave the highest average number of rows The rows reached 15.96 rows ear $^{-1}$, which did not differ significantly with the 8 day irrigation period, where it reached 15.33 row ear $^{-1}$, The reason may be Water shortage in the vegetative

ISSN 2072-3875

differed significantly for this characteristic, as the interaction treatment between irrigation period of 6 days and spraying concentration of 8 mg L^{-1} achieved the highest average number of rows in the ear reached 17.10 rows ear^{-1}, while the irrigation period was 10 and the concentration 0 mg L^{-1} The comparison treatment was the lowest average of 13.55 rows ear^{-1}. with the growth regulator brassinolide contributed to improving the characteristics of vegetative growth, which led to an increase in photosynthesis homologues, which was positively reflected in the formation of a greater number of rows in the ear. This result is consistent with the results of (2). As for the interaction between the two factors of the study, it

Table 2. . Effect of irrigation periods and concentrations of brassinolide growth Regulater and Interaction between them in number of rows ear^{-1}

irrigation periods	brassinolide concentrations(mg L^{-1})					mean
	0	2	4	6	8	
6	14.75	15.67	15.88	16.44	17.10	15.96
8	14.53	14.80	15.30	15.32	16.71	15.33
10	13.55	14.05	15.29	14.54	15.27	14.54
Average	14.27	14.84	15.49	15.43	16.36	14.27
LSD (p=0.05)	irrigation periods		brassinolide concentrations		Interaction	
	0.66		0.44		0.85	

fertilization failure (12). This result agreed with (8). As for brassinolide concentrations, they significantly increased the number of grains in the ear, as the concentration of 8 mg L^{-1} gave the highest mean for the phenotype, reaching 573.3 grain ear^{-1}, while the concentration 0 mg L^{-1} gave the lowest average for the trait. It reached 416.8 grain ear^{-1}, and the reason for the increase could be attributed to the role of brassinolide in increasing the fertility and vitality of pollen grains and stimulating flower holding as a result of improving and increasing vegetative growth indicators(3).

Number of grains ear^{-1}: - The results of Table 3 showed that there were significant differences between the irrigation periods , as the 10 day irrigation period caused the number of grains in the ear to be reduced to the lowest average of 430.1 grain ear^{-1}, with a decrease of 23.86% compared to the 6 day irrigation period Which gave the highest average of 564.9 grain /ear^{-1}. The disturbance of physiological processes in plants as a result of changing some growth factors such as lack of water during flowering may affect the readiness of pollen grains for fertilization of the ovaries (Asynchronization), which reduces the number of grains in the ear due to

ISSN 2072-3875

Table 3 . Effect of irrigation periods and concentrations of brassinolide growth Regulater and Interaction between them in Number of grains ear^{-1}

irrigation periods	brassinolide concentrations(mg L^{-1})					mean
	0	2	4	6	8	
6	469.6	537.8	564.1	620.4	632.7	564.9
8	421.1	426.2	521.3	532.2	591.6	498.5
10	359.6	399.2	455.1	441.0	495.5	430.1
				531.2		
Average	416.8	454.4	513.5	531.2	573.3	
LSD (p=0.05)	irrigation periods		brassinolide concentrations		Interaction	
	29.54		23.01		41.82	

concentration of 0 mg L^{-1}. The lowest average for the trait was 148.56 gm. The reason for the increase is attributed to the mechanism of action of the brassinolide, which stimulates the genes of gibberellins and auxins that affect the increase in cell division and elongation, including the endosperm cells, which constitute 80% of the weight of the seed and thus increase the weight of the bean (6). The interaction between the two factors of the study differed significantly in this characteristic, as the interaction treatment between irrigation period of 6 days and spraying with a concentration of 8 mg L^{-1} achieved the highest average weight of 500 grain reached 164.33 gm, while the interaction treatment of 10 days and spraying with a concentration of 2 mg L^{-1} gave the lowest Average reached 140.33 gm.

Weight 500 grain :- The results of Table 4 showed significant differences as a result of the effect of irrigation periods for this trait, as the 10 day irrigation period caused a significant decrease in the trait weight of 500 grain for the lowest average of 148.07 gm compared to the 6 day irrigation period, which achieved the highest average of 157.73 gm. This may be due to the fact that the weight of the grain decreases under water tension as a result of the lack of nutrients reaching it, especially when the period of fullness is short (10). The spraying of the growth regulator concentrations of brassinolide had a significant effect on weight grain, as the concentration of 8 mg L^{-1} gave the highest average 158.78 gm, which did not differ significantly from the concentration 6 mg L^{-1}, which amounted to 158.11 gm, while the spray treatment gave a

Table 4. Effect of irrigation periods and concentrations of brassinolide growth Regulator and Interaction between them in the average weight 500 grain gm.

irrigation periods	brassinolide concentrations(mg L^{-1})					mean
	0	2	4	6	8	
6	154.33	154.33	154.67	164.33	161.00	157.73
8	150.33	151.00	152.00	157.67	159.33	154.07
10	141.00	140.33	150.67	152.33	156.00	148.07
Average	148.56	148.56	152.44	158.11	158.78	
LSD (p=0.05)	irrigation periods		brassinolide concentrations		Interaction	
	1.02		0.97		1.67	

ISSN 2072-3875

role of brassinolide, which was clear in improving water relations and reducing the transpiration process, which was reflected in growth, cell elongation, leaf expansion, an increase in the rate of plant growth and the accumulation of dry matter, and that this increase in growth was positively reflected in an increase in the components of the yield: the number of ear, number of rows, number of grains in the ear and the weight of grains Influencing grain yield, this result is in agreement with (7). The interaction between the two factors of the study had a significant difference in the average grain yield, as the interaction treatment between the 6 day irrigation period and spraying with a concentration of 8 mg L^{-1} achieved the highest average grain yield amounted to 10.07 ton h^{-1}, while the interaction treatment between the 10 day irrigation period and the concentration 0 mg L^{-1} averaged 6.01 ton h^{-1}.

Grain yield ton ha^{-1}: - The results of Table 5 showed a significant effect of irrigation periods on grain yield, as the 10 day irrigation period caused a significant decrease in the total grain yield, with an average of 6.67 ton ha^{-1}, with a relative decrease of 25.30% compared to the 6 day irrigation period, which achieved the highest The average amount was 8.93 ton h^{-1}. The reason for the decrease in yield may be due to the decrease in the access of water and nutrients, specifically during the period of filling the grain, which leads to its small size and shrinkage, so the average weight of 500 grain decreased. This result agreed with the results of (22). As for the concentrations of brassinolide spray, the concentration of 8 mg L^{-1} achieved the highest average grain yield of 8.63 ton h^{-1}, with a relative increase of 15.99% compared to the spray treatment with a concentration of 0 mg L^{-1}, which gave the lowest average of 7.25 ton h^{-1}. This may be due to The

Table 5 . Effect of irrigation periods and concentrations of brassinolide growth Regulater and Interaction between them in the average Grain yield ton h^{-1}.

irrigation periods	brassinolide concentrations(mg L^{-1})					mean
	0	2	4	6	8	
6	8.17	8.25	8.41	9.75	10.07	8.93
8	7.56	8.14	8.10	8.33	8.55	8.13
10	6.01	6.44	6.69	6.96	7.26	6.67
Average	7.25	7.61	7.73	8.34	8.63	
LSD (p=0.05)	irrigation periods		brassinolide concentrations		Interaction	
	0.11		0.10		0.19	

highest average biological yield of 24.98 ton h^{-1}. The reason may be attributed to the increase in the yield and its components, which led to its increase (23). It is noticed from the same table that there is a significant effect on the biological yield with increasing concentrations of

Biological yield ton ha^{-1}: The results of Table 6 showed that there were significant differences in the average biological yield due to the effect of the irrigation periods. The 10 day irrigation period recorded the lowest average of 23.25 ton h^{-1}, while the 8 day irrigation period achieved the

ISSN 2072-3875

number of leaves, leaf area index, stem diameter, chlorophyll content, yield and its components, which was positively reflected. to increase the biological yield, This is consistent with what was found by (5). As for the interaction between irrigation periods and regulator spray concentrations, the 8 day irrigation period and 8 mg L^{-1} spraying outperformed by giving the highest average of 29.77 ton h^{-1}, while the irrigation period gave 10 days and a spraying treatment of 0 mg L^{-1}, the lowest average was 20.66 ton h^{-1}. brassinolide spray, where the concentration of 8 mg L^{-1} gave the highest mean of biological yield amounted to 27.14 ton h^{-1}, while the comparison treatment (spraying distilled water) gave the lowest mean for the character reached 21.28 ton h^{-1}, the increase in biological yield with the increase in the concentrations of the growth regulator brassinolide is attributed to the effective role of the brassinolide regulator in the elongation and growth of cells and the accumulation of dry matter, which led to an increase in growth indicators,

Table 6 . Effect of irrigation periods and concentrations of brassinolide growth Regulater and Interaction between them in the average Biological yield ton ha^{-1}.

irrigation periods	**brassinolide concentrations(mg L^{-1})**					**mean**
	0	**2**	**4**	**6**	**8**	
6	21.68	22.02	22.59	26.38	26.82	23.90
8	21.50	22.66	23.14	27.84	29.77	24.98
10	20.66	23.07	23.71	23.96	24.83	23.25
Average	21.28	22.58	23.14	26.06	27.14	
LSD (p=0.05)	**irrigation periods**		**brassinolide concentrations**		**Interaction**	
	0.08		0.10		0.17	

on this trait, as it was significantly superior to the spraying with a concentration of 8 mg L^{-1} giving the highest mean of 34.45 %, which did not differ significantly from spraying with a concentration of 6 mg L^{-1} which amounted to 34.35%, while the concentration gave 0 mg L-1 was the lowest average of the trait was 32.64%, and the reason is due to the physiological role of the growth regulator brassionolide in regulating and transferring the dry matter from the vegetative part (the source) to the components of the yield, number of ear, number of rows, number of grains, and the weight of 500 grain, which caused an increase in the yield

Harvest index (%): The results of Table 7 showed that the increase in irrigation periods caused a decrease in the average harvest index, as the 10 day irrigation period gave the lowest average for the trait, which amounted to 29.15%, compared to the 6 day irrigation period, which achieved the highest average of 37.36 % possibly due to the low weight of the trait. The grain as a result of short filling time and lack of dry matter accumulation, which was reflected in the decrease of grain yield when treated with irrigation 10 days, and this is consistent with what was found by (11). The spraying of the growth regulator concentrations of brassinolide had a significant effect

ISSN 2072-3875

which did not differ significantly from the treatment of the interaction of irrigation every 6 days with a spray of 6 mg L^{-1}, which amounted to 37.56%, compared with the lowest average of 28.10% for the interaction treatment between irrigation period of 10 days and spraying at a concentration of 0 mg L^{-1}.

of Grain thus reflected on the increase in the harvest index. These results are in agreement with the results of (24). As for the interaction between irrigation periods and regulator spray concentrations, the interaction treatment between the 6 day irrigation period and spraying a concentration of 8 mg L^{-1}, which gave the highest mean of the harvest index, was 37.70%,

Table7 . Effect of irrigation periods and concentrations of brassinolide growth Regulater and Interaction between them in the average Harvest index %.

irrigation periods	brassinolide concentrations(mg L^{-1})					mean
	0	2	4	6	8	
6	36.56	37.32	37.67	37.56	37.70	37.36
8	33.28	33.92	35.00	35.91	35.72	34.17
10	28.10	28.94	29.20	29.60	29.95	29.15
Average	32.64	33.39	33.95	34.35	34.45	
LSD (p=0.05)	irrigation periods		brassinolide concentrations		Interaction	
	0.21		0.20		0.35	

Conclusions:

Irrigation period of 6 days had a significant effect in increasing most yield indicators and its components for yellow corn. The 8-day irrigation period also achieved a significant superiority in rationing irrigation and improving and increasing the biological yield. The treatment of spraying with the growth regulator pracinolide at a concentration of 8 mg L^{-1} was significantly superior in improving most of the studied traits under drought conditions, which was positively reflected on the increase in yield.

Reference

1- **A.O.A.C**. (1975) . Association of Official Analytical Chemists . Official method of analysis . A.O.A.C. 10th (Ed.) republished by A.O.A.C. Washington , D. C., U. S. A. , V. 58 (4) . pp : 115.

2- **Anjum**, S. A., Wang, L. C., Farooq, M., Hussain, M., Xue, L. L., & Zou, C. M. (2011). Brassinolide application improves the drought tolerance in maize through modulation of enzymatic antioxidants and leaf gas exchange. Journal of Agronomy and crop science, 197(3), 177-185.

3- **Antony**.E., K. Sridhar and V. Kumar.2017. Effect of chemical sprays and management practices on Brachiaria ruziziensis seed production Field Crops Research 211:19-26.

4- **Capehart**, T and O. Liefert. 2017. First Forecast for 2017/18 Lowers Corn Supply and Use Feed outlook. Economic Research service. United States Department..

5- **Desoky**, E. S. M., Mansour, E., Ali, M., Yasin, M. A., Abdul-

under Water Availability. Agro. J., 110(3): 983-995.

11- **Nikju**, M. B., H. R.Mobasser and H. R. Ganjali. 2015.Influence of variety on biological yield, harvest index, Percent of protein in *Zea mays*. Biol. Forum, Inter. J., 7(1): 662-667.

12- **Setter**, T.L., B.A. Flannigan and J. Melkonian . 2001. Loss of kernel set due to water deficit and shade in maize , alternate furrow irrigation for maize production in an arid area. Agric . Water Manag., 45:267-274.

13- **Tanveer**, M., Shahzad, B., Sharma, A., & Khan, E. A .2019. 24-Epibrassinolide application in plants: An implication for improving drought stress tolerance in plants. Plant Physiology and Biochemistry, 135, 295-303.

14- **Al-Akedi**, Hadeel Abdul-Razzaq Waheeb. 2015. Effect of duration between irrigations and potassium levels in Some characteristics of the growth and yield of yellow corn. Master Thesis. College of Agriculture - University of Baghdad.

15- **Hassan**, Ali Abdel Hadi. 2019 .Studying the physiological and biochemical effects of stimulants Growth and biofertilizers in the growth and yield of maize under different irrigation levels PhD thesis. faculty of Agriculture . Baghdad University.

16- **Al-Khafaji**, Makki Alwan. 2014. Plant growth regulators and their horticultural applications. College Farming . Baghdad University. Ministry

Hamid, M. I., Rady, M. M., & Ali, E. F. (2021). Exogenously used 24-epibrassinolide promotes drought tolerance in maize hybrids by improving plant and water productivity in an arid environment. Plants, 10(2), 354.

6- **Gao**, Z., X. G.Liang, L. Zhang,S. Lin, X. Zhao, L.Li – zhou ,S. Shen and S.Li-Zhou.2017. Spraying exogenous 6- benzyladenine and Brassinolide at tasseling increases maize yield by enhancing source and sink capacity.Field Crops Research, 211,1-9.

7- **Hu**, S., D.L. Sanchez, C. Wang, A.E. Lipka. Y. Yin,C. A. C. Gardner and T. Lubbersted. 2017. Brassinosteroid and gibbrerllin control of seedling traits in maize(zea mays L.). Plant Science. 263: 132-141.

8- **Marino**, R., L. Gianfranceschi, C. Frova, and M. S. Gorla. 2004. Gene expression profiling in response to water stress in maize developing kernels by DNA micro array. Proceeding of the XL VIII Italian Society of Agriculture Genetics-SIFV-SIGA.Joint Meeting Lecce Italy-15/18September,2004.Ephrath, Hesketh.1991.

9- **MEENA**, B. P., et al. Performance of summer maize (*Zea mays*) under varying irrigation levels and agro-chemicals in sub-humid southern plains of Rajasthan. Indian Journal of Agronomy, 2017, 62.1: 54-58.

10- **Nielsen**, D. C. and J. P. Schneekloth .2018. Drought Genetics Have Varying Influence on Corn Water Stress

of Higher Education and Scientific Research, Iraq.

17- **Al-Roumi**, Abdul Karim Hussein. 2017 . The effect of planting distances between plants and irrigation times in Yield and its components of yellow maize (*Zea mays L.*). Babylon University Journal.applied Sciences . Issue (6), volume (25).

18- **Al-Sahoki**, Medhat Majeed (1990). Maize, its production and improvement, University of Baghdad, Ministry of Higher Education and Scientific Research, pg. 400.

19- **Al-Sahoki**, Medhat Majid, Ayoub Obaid Al-Falahi and Ali Fadam Al- Mohammadi, 2009. Crop Management The soil is breeding for drought tolerance. Iraqi. J. Agri. Sci.40 (2): 1-28.

20- **Al-Alusi**, Abbas Ajil Muhammad. 2005. Response of strains and hybrids of yellow maize under inadequate and inadequate Nitrogen and water. PhD thesis - College of Agriculture - University of Baghdad.

21- **Al-Alusi**, Abbas Ajeel and Medhat Majeed Al-Sahoki. 2006. Response of strains and hybrids of yellow maize Effect of irrigation duration 1- Genetic-physiological components. Tikrit University Journal of Agricultural Sciences, 6(3):116-129.

22- **Al Shibr**, Blessed be the Merciful Hamdallah.2021. Effect of bio-vaccine and irrigation duration on growth and yield of maize Yellow and its readiness for some elements. Master's thesis. College of Agriculture, University of Al-Qadisiyah.

23- **Al-Qaisi**, Fahd Hussein Ali. 2017. The role of wheat and tillage residues in the growth and yield of yellow corn Under different irrigation levels. Master's thesis. College of Agriculture. Al-Qasim Green University.

24- **Al-Mashhadani**, Ahmed Jamil Mahmoud. 2018. Response of growth parameters and yield of maize to regulator Brassinolide growth. Master Thesis. Baghdad University.

25- Directorate of Agricultural Statistics _ central Statistical Organization / Iraq (2020)

26- Steel , G.D., and J. H. Torrie.1960. Principles and Procedures of Statistics. Mc Graw. Hill book company, Inc.New Yourk .

ISSN 2072-3875