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Effect of the hormone brosnolide and soil-enhancing polymer on the growth and yield of plants Okra (*Abelmoschus esculentus* L.) under two different irrigation periods

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Abstract
The experiment was conducted in one of the private fields north of Basra for the growing season 2022-2023. To study the effect of the hormone brosnolide, soil improver polymer and different irrigation periods on some growth and yield characteristics of okra plant. The experiment included a study of the effect of three factors: the hormone brosnolide at three concentrations (0, 3, 6) mg l and the polymer hydrogel at concentrations (0, 50, 100) g m² soil, and irrigation periods (3, 6) days, and their double and triple interactions. The experiment was designed according to (R.C.B.D.) Complete Blocks Design Randomized with three replicates for each treatment, and the least significant difference test was adopted at the probability level (0.05). The results showed that treating plants with the hormone brosnolide led to a significant increase in all studied traits, as the concentration exceeded 6 mg l in each plant height, fresh weight, dry weight, pod weight, single plant yield, and total yield. The effect of the soil-enhancing polymer led to a significant increase in all the studied traits at a concentration of 100 g m² soil, except for the yield of one plant, as the treated plants excelled at a concentration of 50 g m² soil. Irrigation periods of 3 days significantly affected all the studied traits. The binary interactions also showed a significant effect on all the traits studied. The triple interactions led to a significant increase in all the studied traits at a hormone concentration of 6 mg l and polymer at a concentration of 100 g m² soil and an irrigation period of 3 days compared to the control treatment and an irrigation period of 6 days.

Keywords: okra plant; hormone brosnolide; hydrogel polymer; two irrigation periods.

Introduction

Okra *Abelmoschus esculentus* L. belongs to Malvaceae family. It is one of the most important summer vegetable crops in the world. It is cultivated in large areas in Asia and Africa. It is believed to be native to Ethiopia, and from there, it spread widely in the world's tropical, subtropical and temperate regions (Saifullah, 2009). Okra has nutritional, medical and industrial importance, as it is used in human nutrition; it is rich in minerals and vitamins, as each 100 g of fresh green pods contain, on average, 81.6 g of water, 36.00 calories, 2.10 g of protein, 0.20 g of fat, 8.20 g of carbohydrates, and 1.70 g of fat, fiber, 84.00 mg calcium, 90.00 mg phosphorus, 1.20 mg iron, 185.00 micro carotene, 47.00 mg ascorbic acid, 0.08 mg riboflavin, 0.04 mg thiamine, and 0.60 mg niacin (Benchasri, 2012, Al-Hasany,et al.,2020).

It also contains carbohydrates in a gel form, as it is used as a substitute for plasma. The mucilage of fruits has a role in reducing the cholesterol level in the blood, which reduces the risk of heart disease (Jones, 2017; Kurmaret al., 2010). The stems of the okra plant are important in the paper industry, and its leaves are used as animal fodder, and the gelatinous substance extracted from the stems, roots and fruits works to filter Sugarcane juice and glue used to stick leaves (Akineie, Temikotan, 2007). The problem of drought today is one of the problems that the world's countries suffer from, especially the arid and semi-arid regions, including Iraq, especially after the low levels of the Tigris and Euphrates rivers, the lack of rainfall and the high temperatures (Al-Hasany,et al.,2021).

These soil-improving polymers are high adsorption (SAP) Super Absorption Polymers. Al-Halfi et al. (2015) indicated that the use of soil conditioners led to an increase in the productivity of water use efficiency and an increase in plant height and dry weight of the vegetation, as indicated by Al-Ibrahim (2018) that the polymers that can Water retention led to an increase in vegetative growth, an increase in plant productivity,

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and a decrease in the plant's need for water. Al-Shudaifi et al. (2019) also found that soil-improving polymers contributed to maintaining the soil's moisture content and reducing irrigation water. Studies also showed the positive role of the hormone brosnolide in reducing water stress (Branch, 2011, Aljaberi, et al., 2020). Al-Shammari and Al-Jubouri (2016) found that treating dill plants with the hormone brosnolide significantly increased root size, length, stem diameter, and dry weight.

Due to the importance of okra crop and the increasing demand for it to improve growth and productivity under drought stress, the role of soil-improving polymers and the hormone brosnolide increase the soil moisture level and tensile strength. So this experiment was conducted, which aims to know the effect of the hydrogel polymer and the brosnolide hormone in reducing the effects of water stress and showing their role in improving Vegetative growth and yield.

Materials and methods

The experiment was conducted during the agricultural season 2022-2023 in one of the private fields in Al-Shafi area, north of Basra Governorate, located at latitude "30 48' 42" and longitude 46' 35 47º. Using the drip irrigation method, an unheated plastic house with dimensions of 50 x 9 m and an area of 450 m 2. Random samples were taken from different places in the soil of the plastic house before planting at a depth of 0-30 cm. They were mixed well, dried under the sun, smoothed, and passed through a sieve with holes of 2 mm. Samples were also taken from the irrigation water. Chemical and physical analyzes of these samples were conducted at the Science Center Al-Bahar - Basra University.

Table (1) shows some chemical and physical properties of the soil and water of the field. The land of the plastic house was plowed twice perpendicularly, smoothed, leveled, and sterilized the soil by solar sterilization, as it was covered with used polyethylene cover for a month, with the edges of the cover fixed to the ground (Alwan, 1981). The cover was lifted, then plowed again, and six lines were adopted with a length of 45 m and a width of 0.60 m. The distance between one line and another was 0.70 m. A distance of 0.95 m was left on each side of the field, and 2.5 m was at the entrance and end of the field. One manifold was divided into nine experimental units with a 5 by 4 m length. A distance of 0.563 m was left between one experimental unit and another. The decomposed animal manure was added to the manure before planting at a rate of 1.5 tons / plastic house. A drip irrigation system was installed, and the treatments were distributed randomly to the experimental units according to the Randomized Complete Block Design (R.C.B.D) according to the split-split-plot design. The irrigation periods represent the main plots, while the polymer treatments are counted as the sub-plot and the hormone spraying treatments as the sub-sub-plots. Thus, the number of transactions reached 18 factorial transactions, which is the number of experimental units for one replicate (2 x 3 x 3) with three replicates, and the total number was 54 experimental units.

The improved polymer was added and dispersed under the soil at a depth of 15-20 cm with two concentrations (50 or 100) g m² soil, and then the soil was moistened. The seeds of Al-Husseinawi variety were sown after two days of wetting the soil, on 11.02.2022, on both sides of the drip line, separating them from a distance of 40 cm between one hole and another. In each hole, 3 seeds.

A solution of the hormone brosnolide, produced exclusively by Phyto Technology Laboratories, was prepared with two concentrations (3 or 6) mg l, as it took 3 mg of the hormone and added 5 ml of ethanol to it as a solvent, then completed the volume to 1 liter of distilled water to obtain a concentration of 3 mg l, and followed the same steps to prepare a concentration of 6 mg l. A few drops of Tween 20 were added to the solution as a dispersant material, and three sprays were made during the period of plant growth, with an interval of 15 days between one spray and another. Full wetting by using a 5-liter hand sprayer. Control treatment plants were sprayed with distilled water only, taking into account the separation of treatments by using a piece of cardboard as a barrier to avoid the effect of spray from neighboring treatments.

Experimental measurements were taken from three plants in each experimental unit at the end of the agricultural season. They included measuring plant height (cm) from the soil surface to the highest leaf of the growing apex with a measuring instrument and measuring the weight of the vegetative total (g) after uprooting the plant and isolating the root zone, and weighing it with a sensitive balance and measuring, the dry weight of the vegetative total (g) after drying the uprooted plants and isolating the root from them in an electric oven at a temperature of 70 degrees Celsius. Also, the characteristics of the yield were measured,

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

which included the weight of the pods (g), the yield of one plant (g), and the calculation of the total yield, t ha^{-1}.

Table (1) some chemical and physical properties of soil and irrigation water for season 2022-2023

Attributive	Unit	Value
E.C	des. m^{-1}	2.05
pH	-	8.02
Total Nitrogen	mg. g^{-1}	13.4
Available phosphorus	mg. g^{-1}	2.618
Available Potassium	mg. g^{-1}	2.63
Organic matter	%	1.46
	Soil separates	
Sand	%	%36
Silt	%	%21
Clay	%	%43
Soil texture	sandy clay	
	Irrigation Water	
E.C	des. m^{-1}	18.36
pH	-	8.46

Results and Discussion

Plant height (cm)

It is clear from Table (2) that the study factors and their interactions had a significant effect on plant height, as the plants treated with the hormone brosnolide at a concentration of 6 mg l and treated with the polymer at a concentration of 100 g m² were significantly superior compared to the comparison plants. Significantly affected, as the plants treated with the hormone brosnolide at a concentration of 6 mg / L and irrigated for 3 days were superior, as they gave a height of 140.00 cm, compared to the lowest height of the comparison plants irrigated for 6 days, which amounted to 106.2 cm. The plants treated with the hormone brosnolide at a concentration of 6 mg/L and the polymer at a concentration of 100 g/m² soil excelled, as the plant height reached 149.4 cm, compared to the lowest plant height of 106.5 cm in comparison plants. g / m² soil and an irrigation period of 3 days, compared to the lowest height of 113.1 cm for untreated plants irrigated for 6 days.

The triple interaction of the study factors showed a significant effect, as the treatment of the plants with the hormone brosnolide at a concentration of 6 mg/liter and a polymer at a concentration of 100 g / m² soil and an irrigation period of 3 days resulted in the highest height of the plant reaching 154.2 cm compared to the lowest height of 103.7 cm for the control plants, which were irrigated for 6 days.

The reason for the superiority of the treatments with the hormone brosnolide in plant height is due to the role of the hormone in stimulating cells to divide and elongate and activate the genes responsible for the formation of (RNA) in the cell chromosomes, especially the activation of mRNA, and this is identical to what was found by (Khattab, 2000, Yusef, 2006, and Alwan, 2016). The role of polymers in Increasing

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

vegetative growth, increasing plant height, providing water for plants, and preserving the moisture content of the soil.

Table (2) Effect of brosnolide and the polymer on plant height (cm) under different irrigation periods

Hormone concentrations mg l^{-1}	Polymer g m^2 soil	Irrigation periods		Interaction Hormone* Polymer
		3 days	6 days	
0	0	106.4	103.7	106.5
	50	109.5	106.0	107.8
	100	111.2	109.0	110.1
3	0	117.1	111.3	114.2
	50	121.2	116.1	118.7
	100	122.4	118.4	120.4
6	0	129.7	124.3	127.0
	50	136.1	136.7	136.4
	100	154.2	144.6	149.4
				Average Hormon
Interaction Hormone* Irrigation	0	110.0	106.2	108.1
	3	120.2	115.3	117.7
	6	140.0	135.2	137.6
				Average Polymer
Interaction Polymer * Irrigation	0	118.7	113.1	115.5
	50	122.3	119.6	120.9
	100	129.2	124.0	126.6
Average Interaction		123.4	118.9	
LSD 0.05				

Hormone	Polymer	Irrigation	Hormone* Polymer	Hormone* Irrigation	Polymer * Irrigation	Hormone* Polymer* Irrigation
3.10	5.70	11.24	8.64	8.87	9.13	12.99

Fresh weight (g)

The results showed in Table (3) that the study factors and their interactions had a significant effect on the fresh weight, as the plants treated with the hormone brosnolide at a concentration of 6 mg/liter were superior to the polymer treatment at a concentration of 100 g / m^2 soil. With the hormone brosnolide, a concentration of 6 mg/L and an irrigation period of 3 days, it gave a fresh weight of 753 g, compared to the lowest weight of the comparison and irrigated plants for 6 days, which amounted to 538.6 g.

The plants treated with the hormone brosnolide at a concentration of 6 mg/L and the polymer at 100 g/m^2 soil excelled as the fresh weight reached 804.7 g compared to the lowest weight of 551.0 g in the control plants. The dual interaction between the polymer and the irrigation periods showed a significant effect, as the fresh weight of the plant reached 682.8 g at a concentration of 100 g / m^2 soil and an irrigation period of 3 days, compared to the lowest fresh weight of 605.7 g for the untreated and irrigated plants for 6 days.

The triple interaction of the factors of the study showed a significant effect if the plants were treated with the hormone brosnolide at a concentration of 6 mg/liter and a polymer of 100 g / m^2 soil and an irrigation period of 3 days. The highest fresh weight of the plant was 817.7 gm, compared to the lowest fresh weight of 546.3 gm for the comparison and irrigated plants for 6 days.

The reason is due to the role of the hormone brosnolide in increasing the vegetative content of the plant and improving the rate of the photosynthesis process, which leads to an increase in sugars, proteins and starch in

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

the leaves and the accumulation of these substances in the vegetative body (Alwan, 2016). The hormone also has a positive role in reducing the harmful effects of water stress Increasing the concentration of enzymatic and non-enzymatic antioxidants, scavenging free radicals, increasing vegetative and flowering growth (Hussein, 2017), and the role of hydrogel polymer in retaining water, decreasing the plant's need for water, and increasing plant productivity (Al-Ibrahim, 2018).

Table (3) Effect of brosnolide and the polymer on Fresh weight (g) under different irrigation periods

Hormone concentrations mg l^{-1}	Polymer g m^2 soil	Irrigation periods		Interaction Hormone* Polymer
		3 days	6 days	
0	0	555.7	546.3	551.0
	50	555.7	520.3	539.0
	100	564.3	547.3	555.8
3	0	592.7	630.7	611.7
	50	637.3	615.3	626.3
	100	666.3	618.3	642.3
6	0	668.7	661.3	656.0
	50	774.0	693.7	733.8
	100	817.7	791.7	804.7
				Average Hormon
Interaction Hormone* Irrigation	0	559.2	538.6	548.6
	3	632.1	621.4	626.8
	6	753.4	715.6	734.5
				Average Polymer
Interaction Polymer * Irrigation	0	605.7	612.8	609.2
	50	656.3	609.8	633.1
	100	682.8	652.4	667.6
Average Interaction		648.3	625.0	
LSD 0.05				

Hormone	Polymer	Irrigation	Hormone* Polymer	Hormone* Irrigation	Polymer * Irrigation	Hormone* Polymer* Irrigation
22.54	28.49	108.57	44.49	90.61	84.03	86.84

The dry weight of shoot system (g)

Table (4) shows that the study factors and their interactions had a significant effect on the dry weight, as the plants treated with the hormone brosnolide at a concentration of 6 mg/liter and the polymer at a concentration of 100 g / m^2 soil were significantly superior compared to the comparison plants, and the irrigation periods did not show a significant effect on this characteristic. The treatment with the hormone brosnolide, a concentration of 6 mg/L, and an irrigation period of 3 days gave a dry weight of 160.7 g, compared to the lowest weight of the comparison plants irrigated for a 3-day, which amounted to 107.8 g. The plants treated with the hormone brosnolide at a concentration of 6 mg/l and the polymer at 100 g/m^2 soil were superior, as the dry weight was 179.2 g compared to the lowest weight of 105.5 g for the comparison plants. Irrigation for 3 days compared to the lowest dry weight of 116.4 g for untreated plants irrigated for 3 days. The three-way interaction of the study factors showed a significant effect, as the treatment of the plants with the hormone brosnolide at a concentration of 6 mg/l and a polymer of 100 g/m^2 soil and an

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

irrigation period of 3 days resulted in the highest dry weight of the plant reaching 184.3 g compared to the lowest dry weight of 105.7 g for the comparison and irrigated plants for 6 days.

The reason for this is due to the role of the hormone brosnolide in stimulating cells to cell division and elongation, activating the enzymes responsible for vegetative growth, increasing the rate of photosynthesis, and increasing the accumulation of sugars, proteins and starch in the leaves and the vegetative body (Bera, Maity 2009). The role of the soil-enhancing polymer in increasing the vegetative and flowering growth rates (Simon and Tous, 2014).

Table (4) Effect of brosnolide and the polymer on dry weight of shoot system (g) under different irrigation periods

Hormone concentrations mg l^{-1}	Polymer g m^2 soil	Irrigation periods		Interaction Hormone* Polymer
		3 days	6 days	
0	0	106.3	105.7	105.5
	50	106.7	105.0	105.8
	100	111.3	119.7	115.5
3	0	114.7	139.7	127.2
	50	125.0	140.7	132.8
	100	134.3	125.3	129.9
6	0	129.3	144.7	137.0
	50	168.3	154.3	161.3
	100	184.3	174.0	179.2
				Average Hormon
Interaction Hormone* Irrigation	0	107.8	110.1	108.9
	3	124.7	135.2	129.9
	6	160.7	157.7	159.2
				Average Polymer
Polymer Interaction * Irrigation	0	116.4	130.0	123.2
	50	133.3	133.3	133.3
	100	143.3	139.7	141.5
Average Interaction		131.0	134.3	
LSD 0.05				

Hormone	Polymer	Irrigation	Hormone* Polymer	Hormone* Irrigation	Polymer * Irrigation	Hormone* Polymer* Irrigation
6.30	8.01	24.31	12.50	19.40	18.39	21.49

Yield and its components:

Pod weight:

Table (5) showed that the treatment of plants with the hormone brosnolide had a significant effect on the weight of the pod at a concentration of 6 mg/L and the polymer at a concentration of 100 g/m^2 soil compared to the comparison plants, while the irrigation periods did not show a significant effect on the weight of the pod. The dual interaction of the hormone brosnolide and the polymer significantly affected the pod weight. It gave a pod weight of 3.83 g when the hormone concentration was 6 mg/L and the polymer at a concentration of 100 g/m^2 soil, while it gave the least pod weight of 2.63 g for the compared plants.

The interaction between the hormone and irrigation periods had a significant effect on pod weight, as the highest pod weight was 3.56 g at a hormone concentration of 6 mg/L and an irrigation period of 3 days, compared to the lowest pod weight of 2.62 g for untreated plants and a 3 day irrigation period. The binary

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

interference of the polymer and the irrigation periods had no significant effect on the pod's weight. The triple interaction of the hormone, the polymer and the irrigation periods had a significant effect on the pod weight, which gave the highest pod weight of 4.10 g at a hormone concentration of 6 mg/l and a polymer concentration of 100 g/m² soil and an irrigation period of 3 days, while it gave the least pod weight of 2.61 gm for untreated plants and a 3 day irrigation period.

The reason is attributed to the role of the hormone brosnolide in increasing vegetative growth, yield, and chemical characteristics, which is consistent with what he found (Al-Ani, 2021). Also, the soil-enhancing polymer has a role in improving physiological characteristics. The result is an increase in sugary and protein substances as a result of an increase in the rate of photosynthesis processes, as an increase in the amount of hydrogel (100 g / m² soil) to increase productivity, reduce the water requirement of the plant, and increase the profitability of higher and more water-saving (Al-Ibrahim, 2018).

Table (5) Effect of brosnolide and the polymer on Pod weight (g) under different irrigation periods

Hormone concentrations mg l^{-1}	Polymer g m^2 soil	Irrigation periods		Interaction Hormone* Polymer
		3 days	6 days	
0	0	2.61	2.66	2.63
	50	2.62	2.89	3.18
	100	2.64	2.57	3.12
3	0	3.27	3.10	2.75
	50	3.35	3.09	3.22
	100	3.06	3.02	3.34
6	0	3.51	3.18	2.61
	50	3.51	3.11	3.04
	100	4.10	3.57	3.83
				Average Hormon
Interaction Hormone* Irrigation	0	2.62	2.70	2.66
	3	3.23	3.07	3.15
	6	3.56	3.31	3.43
				Average Polymer
Polymer Interaction * Irrigation	0	2.98	2.98	2.98
	50	3.16	3.05	3.10
	100	3.26	3.05	3.16
Average Interaction		3.14	3.03	
LSD 0.05				

Hormone	Polymer	Irrigation	Hormone* Polymer	Hormone* Irrigation	Polymer * Irrigation	Hormone* Polymer* Irrigation
0.34	0.27	0.28	0.48	0.40	0.34	0.65

One plant yield:

The results indicated in Table (6) that the study factors and their interactions had a significant effect on the plant yield, as the plants treated with the hormone brosnolide at a concentration of 6 mg/liter to the polymer treatment at a concentration of 50 g / m² soil were significantly superior in the yield of one plant compared with the comparison plants, and the irrigation periods did not record a significant effect in these Characteristically, the dual interaction between the hormone and the polymer had a significant effect on the yield of one plant, reaching 174.8 g/plant at a hormone concentration of 6 mg/L and a polymer concentration of 100 g/m² soil, compared to the lowest yield of 124.8 g/plant in comparison plants.

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

As for the bilateral interaction of the hormone and the irrigation periods, the treated plants were significantly superior when they gave a yield of 170.7 g/plant at a hormone concentration of 6 mg/L and an irrigation period of 3 days, compared to the lowest yield of 120.1 g/plant in the comparison plants and a 6-day irrigation period. Irrigation for 3 days was significant in the yield of one plant, reaching 161.3 g/plant, compared to the lowest yield of 140.1 g/plant for untreated plants and an irrigation period of 6 days. The results showed that the triple interaction of the study factors had a significant effect on the yield of one plant. The highest yield was recorded at 178.7 g/plant when the plants were treated with the hormone brosnolide at a concentration of 6 mg/L and a polymer of 100 g/m² soil and an irrigation period of 3 days, compared to the lowest yield of 114.3 g/plant for the comparison plants, and an irrigation period of 6 days.

The increase in the amount of yield is due to the accumulation of photosynthetic materials in the fruits due to the increase in the vegetative growth rate and the increase in the fresh weight of the plant (Shamkhi and Obaid, 2016). The increase in plant yield due to the increase in cell elongation and division, and thus an increase in vegetative growth, is consistent with (Al-Tabajali, 2012). Polymerdora has a role in increasing the amount of productivity, and the reason for the increase in yield is attributed to the increase in vegetative growth due to the accumulation of metabolites resulting from the photosynthesis process in the leaf (Marchner, 2012).

Table (6) Effect of brosnolide and the polymer on one plant yield under different irrigation periods

Hormone concentrations mg l^{-1}	Polymer g m^2 soil	Irrigation periods		Interaction Hormone* Polymer
		3 days	6 days	
0	0	135.3	114.3	124.8
	50	137.3	119.3	128.3
	100	144.0	126.7	135.3
3	0	152.0	150.0	151.0
	50	172.3	162.7	167.5
	100	159.7	152.0	155.8
6	0	159.0	156.0	157.5
	50	174.3	167.0	170.7
	100	178.7	171.0	174.8
				Average Hormon
Interaction Hormone* Irrigation	0	133.9	120.1	129.0
	3	161.3	154.9	158.1
	6	170.7	164.7	167.7
				Average Polymer
Interaction Polymer * Irrigation	0	148.3	140.1	144.4
	50	161.3	149.7	155.5
	100	160.8	149.9	155.3
Average Interaction				
LSD 0.05				

Hormone	Polymer	Irrigation	Hormone* Polymer	Hormone* Irrigation	Polymer * Irrigation	Hormone* Polymer* Irrigation
11.84	6.67	1 8.97	14.28	16.80	14.35	20.34

Total yield (t ha):

Table (7) showed that the study factors and their interactions had a significant effect on the total yield of plants, as the plants treated with the hormone brosnolide at a concentration of 6 mg / L and the treatment

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

with a polymer at a concentration of 100 g / m² soil and irrigation periods of 3 days were significantly superior compared to the control plants and at an irrigation period of 6 days. The polymer had a significant effect, as the plants treated with the hormone brosnolide, a concentration of 6 mg/L and the polymer 100 g/m² soil, yielded a total yield of 7.02 ton/ha, compared to the lowest total yield of 4.99 ton/ha for the control plants.

The results showed that the plants treated with the hormone prosnoide at a concentration of 6 mg/L and an irrigation period of 3 days were significantly superior in total plant yield. It gave a total yield of 6.84 tons/ha compared to the lowest yield of 4.80 tons/ha for the control and irrigated plants with an irrigation period of 6 days. Moreover, an irrigation period of 3 days gave the lowest yield of 5.60 tons/ha for the compared plants and an irrigation channel of 6 days.

The triple interaction of the study factors also showed a significant effect on the total plant yield and gave the highest yield of 7.21 tons/ha at a hormone concentration of 6 mg/L and a polymer concentration of 100 g/m² soil and an irrigation period of 3 days, while the lowest yield was 4.57 tons/ha for the comparison and irrigated plants with a period of 6 years. One day, the reason for this is due to the role of the hormone brosnolide in stimulating cells to cell division, increasing the rate of photosynthesis, and increasing the accumulation of sugars, proteins, and starch in leaves and the vegetative body (Bera and Maity 2009). Also, the soil-enhancing polymer can improve physiological characteristics and yield. Increasing the amount of hydrogel (100 g / m² soil) increased productivity, reduced plant water requirements, and increased profitability and higher water savings (Al-Ibrahim, 2018).

Table (7) Effect of brosnolide and the polymer on total yield (t ha) under different irrigation periods

Hormone concentrations mg l^{-1}	Polymer g m² soil	Irrigation periods		Interaction Hormone* Polymer
		3 days	6 days	
0	0	5.41	4.57	4.99
	50	5.49	4.77	5.13
	100	5.74	5.06	5.40
3	0	6.08	6.00	6.04
	50	6.89	6.50	6.70
	100	6.48	6.08	6.28
6	0	6.34	6.24	6.29
	50	6.97	6.68	6.82
	100	7.21	6.84	7.02
				Average Hormon
Interaction Hormone* Irrigation	0	5.55	4.80	5.17
	3	6.48	6.19	6.34
	6	6.84	6.58	6.71
				Average Polymer
Interaction Polymer * Irrigation	0	5.94	5.60	5.77
	50	6.45	5.98	6.22
	100	6.48	5.99	6.23
Average Interaction		6.29	5.86	
				LSD 0.05

Hormone	Polymer	Irrigation	Hormone* Polymer	Hormone* Irrigation	Polymer * Irrigation	Hormone* Polymer* Irrigation
0.46	0.27	0.25	0.57	0.71	0.64	0.84

ISSN NO: 2771-8840
Date of Publication: 20-06-2023

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