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Effect of the Hormone Brassinolide and the Polymer Hydrogel on the Biochemistry Traits of Okra (*Abelmoschus Esculentus* L.) under Two Different Irrigation Periods

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Abstract:

Objectives: Effect of hrmone (BR)and (SAP) on the biochemistry traits of okra *Abelmoschus Esculentus* L.under two different irrigation periods.

Mothods: The experiment was conducted in one of the private fields north of Basrah for the growing season 2022-2023. It was included a study of the effect of three factors:the hormone brassinolide(BR) at three concentrations (0,3,6) mg/l and the polymer hydrogel(SAP) at concentrations (0,50,100) g/m² soil, irrigation periods (3,6) days, and their double and triple interactions. It was designed according to (R.C.B.D.) with three replicates for each treatment and the least significant difference test was adopted at the probability level (0.05)

Results: Showed that the treatment of plants with the hormone led to a significant increase in the characteristics of chlorophyll, carbohydrates and stability of the membranes at a concentration of 6 mm / L, and led to a decrease in the concentration of proline, hydrogen peroxide and MDA and the effect of the polymer led to a significant increase in the total chlorophyll content, carbohydrates and membrane stability at a concentration of 100 g / m² soil .While it reduced the concentration of proline, hydrogen peroxide and MDA as well. Irrigation periods of 3 days showed a significant effect on the carbohydrate content of the leaves, while the differences were negligible for the rest of the traits, and the two-way interactions showed a significant effect on all the studied traits.

Conclusions: The triple interactions led to a significant increase in all studied traits at a hormone concentration of 6 mg/L and a 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 except for proline, MDA and hydrogen peroxide.

Keywords: *okra; Brassinolid; hydrogel; irrigation periods.*

1 Introduction

Okra, *Abelmoschus esculentus* L., is one of the important summer vegetable crops in the world. It belongs to the Malvaceae family. It is cultivated in large areas in Asia and Africa. It is believed that its original homeland is Ethiopia, and from there it spread widely in the tropical, subtropical and temperate regions of the world. Okra has nutritional, medical and industrial importance. As it is used in human nutrition being rich in minerals and vitamins, its nutritional importance in trait of containing carbohydrates, proteins and some mineral salts, as each 100 g of fresh green pods contains 36 calories, 87.6% water, 2.1% protein, 0.2% fat and 1.7% Fiber and 8.2% carbohydrates (Hassan and Ali, 2015). In addition to containing antioxidants and thus protecting the body from cancer, diabetes and respiratory diseases, its leaves are also used as feed for animals) (Gemede et al., 2015 and that the fruits of okra have insoluble fibers that work on the integrity of the intestine and colon, and the mucilage of the fruits has a role in reducing the level of cholesterol in the blood (Jones, 2017.)The problem of drought today is one of the problems that the countries of the world suffer from, especially the arid and semi-arid regions, including Iraq. One of the means that can be used in order to increase the plant's tolerance to drought is the use of compounds such as soil-improving polymers. One of these soil-improving polymers is the Super Absoraption Polymers (SAP) type. Ali (2023) showed that the soil-improving polymers contributed to reducing irrigation water and increasing water content. Leaves of chlorophyll, carbohydrates and photosynthetic efficiency of the tomato plant.Studies have shown that the BR has a role in reducing water stress and increasing the moisture content of the soil, as it was found (Maia *et al*.,2020) that the treatment of tomato plants with the hormone BR led to an increase in total chlorophyll and carbohydrates, and increased the stability of membranes and resistance to water stress .Due to the importance of the okra crop and the increasing demand for it, in order to improve the chemical properties under drought stress, and the role of soil-improving polymers and the BR in increasing the soil moisture level and tensile strength, so this experiment was conducted, which aims to know the effect of the (SAP) and the BR in reducing the effects of water stress and to demonstrate their role in improving The chemical traits of the leaves.

2 Materials and Methods

The experiment was conducted during season 2022-2023 in one of the private fields in the Al-Shafi area, north of Basrah province, using an unheated plastic house with dimensions of 50 x 9 m and an area of 450 m 2 using the drip irrigation method. Random samples were taken from different places of the soil of the plastic house before planting, at a depth of 0-30 cm. They were mixed well, then dried under the sun, smoothed, and passed through a sieve with pit 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 traits of the soil and water of the field. The land of the plastic house was plowed twice perpendicularly, leveled, and the soil was sterilized 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 rakes of 45 m in length and 0.60 m in width were adopted, and 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 a distance of 2.5 m at the field entrance and end. 0.80 m between one experimental unit and another. 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, where the irrigation periods represent the main plots, while the polymer treatments counted the sub-plot and the hormone spraying treatments as the plots. Under the sub-Sub-Plots. Thus, the number of treatments reached 18, which is the compatibility between three factors: the BR with three concentrations (0,3 and 6) mg/l and the (SAP) with three concentrations (0,50 and 100) g/m² soil and two irrigation periods (3 and 6) days and with three replications, and the number of experimental units was 54 alone. The improved polymer was added to the soil at a depth of 15-20 cm and then the soil was moistened.The seeds of Al-Husseinawi variety were sown after two days of wetting the soil, i.e. on 2/11/2022, on both sides of the drip line, separating them with a distance of 40 cm between one batch and another. A solution of the BR produced exclusively by Phyto Technology

Laboratories, was prepared. it took 3 mg of the hormone and placed it in a volumetric flask with a capacity of (liter) to which distilled water was added and shaken for five minutes and completed the volume with distilled water to (liter) to obtain a concentration of 3 mg / liter and followed the same steps to prepare a concentration of 6 mg / liter and added with the solution a few Drops of Tween 20 as a dispersant, and three sprays were made during the period of plant growth, with an interval of 15 days between one spray and another. The first spraying was carried out after 20 days of planting, and the experimental measurements were taken from three plants in each experimental unit at the end of the growing season, and they included measurement of the leaves' total chlorophyll content (mg/100g), carbohydrates (mg/100g), proline (µmol/gm), and proline (µmol/gm). MDA) MalonDialdehyde (nmol/g), hydrogen peroxide (micromole/g), and membrane stability %.

Table 1: Some chemical and physical properties of soil and irrigation water for the season 2022-202.

Traits	Values
Degree of electrical conductivity (E.C) (DS.m^{-2}).	2.05
pH	8.02
Total nitrogen (mg/kg)	13.4
Available phosphorus (mg/kg)	2.618
Available Potassium (mg/kg)	2.63
organic matter %	1.46
Soil separators (%)	
Sand	36
Silt	21
Clay	43
soil texture	Sandy clay
Irrigation Water	
Degree of electrical conductivity (E.C) desmins/m	1.83
(pH)	8.46

3 Results and Discussion

3.1 Measurement of total chlorophyll (mg/100g fresh weight) in the leaves

The results from (Table 2) showed that the study factors and their interactions had a significant effect on the leaves content of total chlorophyll.As the plants treated with the hormone brassinolide at a concentration of 6 mg / liter compared to the control plants and treated with the polymer at a concentration of 100 g / m² soil, were significantly excelled on compared to the control plants, and the irrigation periods did not record a significant effect in this characteristic, and the bilateral interactions had a significant effect.The plants treated with the hormone brassinolide at a concentration of 6 mg / L and irrigated for a period of 3 days were superior compared to the lowest content of the control plants irrigated for a period of 6 days. Polymer and irrigation periods had a significant effect when the polymer concentration was 100 g/m² soil and an irrigation period of 3 days, compared to the lowest content of the untreated plants irrigated for a period of 6 days and the triple interaction of the study factors showed a significant effect, as the treatment of the plants with the hormone brassinolide 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 gave the highest content of 34.33 mg / 100 g compared to the lowest content of 19.04 mg / 100 g in the control and irrigated plants for a period of 6 days.

Table 2: Effect of brassinolide and polymer on leaves content of total chlorophyll mg/100g under two different irrigation periods

SAP×ir	Average effect of hormone concentration mg/L			polymer concentration g/m² soil	Irrigation periods (day(
	6	3	0		
20.28	21.61	19.16	20.07	0	3day
23.13	23.35	22.07	23.96	50	
30.00	34.33	32.22	23.44	100	
20.00	19.04	21.19	19.77	0	6day
22.38	23.18	22.17	21.78	50	
24.57	29.21	21.83	22.68	100	
ir	6	3	0		BR×ir
24.47	26.43	24.49	22.49	3	
22.32	23.81	21.37	21.41	6	
	25.12	23.11	12.95		BR
SAP	**6**	**3**	**0**		BR×SAP
20.14	20.23	20.18	19.93	0	
22.75	23.27	22.12	22.87	50	
27.28	31.77	27.03	23.06	100	

L.S.D 0.05

BR× SAP× ir	SAP ×ir	hormone ×irrigation	hormone ×polymer	Irrigation	Polymer	Hormone
7.00	**6.41**	**6.40**	**4.04**	**8.31**	**2.88**	**2.23**

3.2 Measurement of carbohydrate concentration (mg/100gm) dry weight

It was clear from (Table 3) that the plants treated with the hormone brassinolide at a concentration of 6 mg / L compared to the control plants and treated with the polymer at a concentration of 100 g / m² soil significantly compared to the control plants.As the plants treated with the BR at a concentration of 6 mg / liter and irrigation showed from Table (3) the excelled of the plants treated with the BR at a concentration of 6 mg / liter compared to the control plants and treated with polymer at a concentration of 100 g / m² soil significantly compared to the comparison plants. Irrigation periods also recorded a significant effect on This trait was observed at 6 days of irrigation, n period of 3 days gave the highest content of 8.54 mg / 100 g compared to the lowest content of 2.47 mg / 100 g in the control plants that were irrigated for a period of 6 days. The reason for the increase in the total chlorophyll content in the leaves is due to the role of brassinolide in reducing the effect of water stress, protecting the chloroplast from oxidative damage, and increasing the concentrations of enzymatic and non-enzymatic antioxidants). Also, the increase in the total chlorophyll concentration in the leaves is due to the addition of the polymer, which leads to an increase in water use efficiency and an increase in the moisture content of the soil (Khodadadi, 2018). and the bi- interactions had a significant effect, as the plants treated with the BR at a concentration of 6 mg/L and 6 days of irrigation were superior Compared to the lowest content of the control plants irrigated for a period of 3 days, the plants treated with the hormone brassinolide at a concentration of 6 mg / L and the polymer at a concentration of 100 g / m² soil were excelled on compared to the lowest content. day.The triple interaction of the study factors showed a significant effect, where the treatment of the plants with the hormone brassinolide at a concentration of 6 mg / liter and a polymer at a concentration of 100 g / m² soil and an irrigation

And the increase of photosynthetic pigments in plants (Baker, 1991; Al-Ibrahim, 2018).The reason for the accumulation of carbohydrates in the leaves is due to the role of the hormone and the polymer in increasing the concentration of chlorophyll in the leaves, (Table 2), which was reflected in the increase in the activity of photosynthesis and the increase in metabolic products, and this is consistent with (Hussein, 2017 and Abd *et al*., 2023).Also, the irrigation period of 6 days had a significant effect on increasing the concentration of carbohydrates, as it is one of the important adaptations of the plant's response to water stress.

The irrigation period of 6 days had a significant effect on the concentration of carbohydrates, and the accumulation of carbohydrates is one of the important adaptations of the plant's response to drought stress, as it accumulates in plant tissues to provide sufficient energy to resist stress (Abass *et al*., 2019).

Table 3: Effect of BRand SAP on leaf carbohydrate content mg/100g under two different irrigation periods

SAP×ir	Average effect of hormone concentration mg/L			polymer concentration g/m² soil	Irrigation periods (day)
	6	3	0		
3.19	3.35	3.60	2.60	0	3day
4.28	4.22	3.87	4.74	50	
4.79	5.66	3.97	4.74	100	
3.24	3.99	3.25	2.47	0	6day
5.55	6.10	5.51	5.04	50	
7.83	8.54	7.97	6.96	100	
average effect of irrigation	6	3	0		BR and irrigation
4.08	4.41	3.81	4.03	3	
5.54	6.21	5.58	4.83	6	
	5.31	4.70	4.43		average effect of hormone
average effect of Polymer	6	3	0		BB×SAP
3.21	3.67	3.43	2.54	0	
4.91	5.16	4.69	4.89	50	
6.31	7.10	5.97	5.68	100	
			L.S.D 0.05		
BR× SAP× ir	SAP× ir	BR×ir	BR× SAP	SAP	BR
1.69	1.10	0.90	1.26	0.86 0.90	0.69

3.3 Measurement of proline µmol/g fresh weight

The results of the statistical analysis showed, as indicated in Table (4), the significant effect of the study factors on the leaf content of aprolene, where the control plants excelled at a 3-day irrigation period over the plants treated with the hormone brassinolide at a concentration of 6 mg / liter on the plants treated with the polymer at a concentration of 100 g / m² soil. Leaves contain proline, and irrigation periods did not have a significant effect on this trait. The bi- interactions showed a significant effect if the percentage of proline decreased in the plants treated with the hormone proline at a concentration of 6 mg / L and irrigation for a period of 3 days compared to the highest content in the comparison plants irrigated for a period of 6 days. The proline content also decreased in the plants. The treatment with the hormone brassinolide at a concentration of 6 mg / liter and the polymer at a concentration of 100 g / m² soil compared to the highest value in the control plants, and the bi- interaction between the polymer and the irrigation periods showed a significant effect at the concentration of the polymer 100 g / m² soil and an irrigation period of 3 days compared to the highest content in the untreated plants irrigated with a period of 6 days. The three-way interaction of the study factors showed a significant effect, where the treatment of the plants with the hormone brassinolide 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 was significantly excelled. Yuma. The decrease in the concentration of proline in the leaves is due to the role of brassinolide in reducing the effect of stress, scavenging free radicals, and activating enzymatic activities, as it works to increase cellular control of aspic acid and control the closing and opening of stomata (Hassan, 2019). It also has a role in increasing radical ozonation and association with proteins sugars within the endoplasmic reticulum of cells.The low concentration of proline may be due to the role of the polymer in improving the hydraulic properties of the soil, providing sufficient water for growth, reducing the effect of water stress, and improving the transfer of water and mineral elements to the plant body (Zhaoming *et al*., 2020 and Shishk *et al*., 2019).

Table 4: Effect of brassinolide and polymer on leaves content of proline µg/g under two different irrigation periods

SAP and ir	Average effect of hormone concentration mg/L			polymer concentration g/m² soil	Irrigation periods (day)
	6	3	0		
3.90	3.08	3.93	4.70	0	3day
1.99	1.54	1.84	2.50	50	
1.33	0.84	1.63	1.54	100	
4.19	3.05	4.65	4.89	0	6day
2.63	2.04	3.00	2.86	50	
1.26	1.36	0.65	1.78	100	
ir	6	3	0		BR and ir
2.41	1.82	2.46	2.95	3	
2.70	2.15	2.77	3.17	6	
	1.98	2.61	3.06		BR
SAP	6	3	0		BR×SAP
4.05	3.06	4.29	4.79	0	
2.31	1.79	2.42	2.73	50	
1.30	1.10	1.14	1.66	100	
			L.S.D 0.05		
BR× SAP× ir	SAP ×ir	BR× ir	BR× SAP	Ir	SAP	BR
0.87	0.58	0.44	0.66	0.36	0.44	0.35

3.4 Measurement of hydrogen peroxide (µmol/g fresh weight)

It was clear from (Table 5) that the comparison plants irrigated for a period of 3 days were excelled on the plants treated with a concentration of brassinolide 6 mm/L and a polymer of 100 g/m² irrigated for 6 days. The comparison plants excelled at a period of 3 days with the highest content compared to the lowest content in the plants treated with a hormone concentration of 6 mg / L and irrigated for a period of 6 days. The binary interaction between the hormone and the polymer showed a significant decrease in the content of hydrogen peroxide, where the compared plants excelled with the highest content compared to the B6 treatment plants. mg/g BR and 100 g/m² soil SAP and showed the binary interference between Polymer and irrigation periods had a significant effect. The lowest concentration was recorded when the polymer concentration was 100 g/m² soil and an irrigation period of 6 days, compared with untreated plants irrigated with a period of 3 days. The triple interaction of the study factors showed a significant effect, as the treatment of the plants with the hormone brassinolide at a concentration of 6 mg/L and a polymer at a concentration of 100 g/m² soil and an irrigation period of 6 days reduced the hydrogen peroxide content to 4.18. micromol/g compared to the highest content of 8.24 micromol/g in the comparison and irrigated plants. period of 3 days. The results showed an increase in hydrogen peroxide in untreated plants and at a irragation period of 3 days, being one of the signal-transmitting compounds during plant exposure to stress and a role as a catalyst in activating enzymes, activation of protein kinases, and the role of brassinolide in reducing the effect of stress, scavenging free radicals, stimulating gene regulation and stimulating signaling (Hussein (2017 and Al-Qassam, 2022). The polymer also helped to reduce the concentration of hydrogen peroxide, reduce the tensile strength, and modify the osmosis (Al-Ibrahim, 2018; Zhaoming et al., 2020).

Table 5: The effect of brassinolide nd the polymer on the hydrogen peroxide content of the leaves, micromol / g, under two different irrigation periods

SAP and ir	hormone concentration mm/L			polymer concentration g/m² soil	Irrigation periods (day)
	6	3	0		
8.19	7.33	7.08	8.24	0	3day
7.11	6.72	7.58	7.04	50	
6.64	6.12	6.98	6.81	100	
6.93	5.59	7.35	7.86	0	6day
5.84	5.02	6.83	5.66	50	
5.22	4.18	5.46	6.03	100	
avera ir	6	3	0		BR× irr
7.31	6.72	6.86	7.36	3	
6.00	4.93	6.55	6.52	6	
	5.83	6.20	6.94		BR
SAP	6	3	0		SAP×BR
7.56	6.46	7.18	8.05	0	
6.47	5.87	7.21	6.35	50	
5.93	5.15	6.22	6.42	100	
			L.S.D 0.05		
BR× SAP ×ir	SAP ×ir	BR× ir	BR×SAP	Ir	SAP	BR
2.34	1.88	1.78	1.54	2.35	1.13	0.83

3.5 Measuring the stability of membranes (%)

The results from (Table 6) showed that the study factors and their interactions had a significant effect on the stability of the membranes, where the plants treated with the BR at a concentration of 6 mg / L were excelled compared to the control plants, and the treatment with the polymer at a concentration of 100 g / m² soil was significantly superior compared to the control plants, and the irrigation periods did not record a significant effect in this traits. Bi- interactions had a significant effect, where the plants treated with the BR at a concentration of 6 mg / L and irrigated for a period of 3 days were excelled on compared to the lowest percentage of control plants irrigated for a period of 6 days. The bi- interaction between the polymer and the irrigation periods showed a significant effect, where the treated plants excelled with a concentration of the polymer 100 g / m² soil and an irrigation period of 3 days, compared to the lowest value for the untreated plants irrigated with a period of 3 days. The triple interaction of the study factors showed a significant effect, where the treatment of the plants with the hormone brassinolide 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 gave the highest content of 31.33%, compared to the lowest percentage of 5.00% in the comparison plants that were irrigated for a period of 3 days. We note the inverse relationship between the stability of membranes and MDA, as the stability of the membranes increases when the percentage of MDA is reduced and when spraying plants with brassinolide, evidence of its role in resisting water stress and stimulating the formation of antioxidants (Alwan, 2016 and Al-Fatlawi, 2021). The addition of the polymer led to an increase in the stability of the membranes.The spread of CO2 and the increase in the percentage of proteins and carbohydrates as a result of the activation of the photosynthesis process, which increases the process of bioconstruction of plant cells and membranes (Ahmed *et al*., 2021; Zhaoming *et al*., 2020).

Table 6: Effect of brassinolide and hydrogel on the stability of the membranes (%) under two different irrigation periods

SAP×ir	Average effect of hormone concentration mg/L			polymer concentration g/m² soil	Irrigation periods (day)
	6	3	0		
4.44	3.33	4.67	5.33	0	3day
17.22	21.00	20.33	10.33	50	
26.11	31.33	25.33	21.67	100	
8,56	11.33	9.33	5.00	0	6day
15.00	16.67	13.67	14.67	50	
21.67	24.00	23.67	17.33	100	
Ir	6	3	0		BR×ir
15.93	18.56	16.78	12.44	3	
15.07	17.33	15.56	12.33	6	
	17.94	16.17	12.39		BR
SAP	6	3	0		SAP×BR
6.50	7.33	7.00	5.17	0	
16.11	18.83	17.00	12.50	50	
23.89	27.76	24.50	19.50	100	
			L.S.D 0.05		
BR× SAP ×ir	SAP ×ir	BR× ir	BR× SAP	ir	SAP	BR
4.89	2.55	2.73	3.54	2.21	2.04	2.18

3.6 Measurement of MDA (Malon Dialdehyd) (nmol/g fresh weight)

The results from (Table 7) showed that the plants treated with the study factors were excelled in the leaves content of MDA, as the lowest value was recorded for the plants treated with the hormone brassinolide at a concentration of 6 mg / liter, compared to the comparison plants. Irrigation periods had a significant effect on this trait, and the two-way interactions had a significant effect, where the plants treated with the hormone brasenolide at a concentration of 6 mg / L and irrigation for a period of 6 days showed a decrease in the MDA content compared to the highest content in the control plants that were irrigated for a period of 3 days. At a concentration of 6 mg/L and the polymer at a concentration of 100 g/m² soil compared to the highest value in comparison plants.bi interaction between the polymer and irrigation periods had a significant effect at a concentration of the polymer 100 g/m² soil and an irrigation period of 6 days compared to the highest content of the untreated plants irrigated with a period of 3 days. The triple interaction of the study factors showed a significant effect, where the plants were treated with the hormone brassinolide at a concentration of 6 mg/L and a polymer at a concentration of 100 g/m² soil and a period of 6 days. The role of the hormone brassinolide in lowering the MDA value is attributed to the hormone's role in activating antioxidant enzymes, removing free radicals, and protecting membranes from oxidation (Hassan, 2019). And that the polymer has a role in reducing the value of MDA to its role in increasing the absorption of nitrogen and thus building proteins and membranes (Barakat *et al*. 2017 and Abdelaziz).

Table 7: The effect of brassinolide and hydrogel on the leaf content of MDA (nmol / g) under two different irrigation periods

SAP×ir	Average effect of hormone concentration mg/L			polymer concentration g/m² soil	Irrigation periods (day(
	6	3	0		
3.64	2.80	3.74	4.38	0	3day
2.02	1.71	2.30	1.97	50	
1.54	1.17	1.66	1.81	100	
3.15	2.34	3.65	3.47	0	6day
1.84	1.80	1.72	1.99	50	
0.97	0.58	1.12	1.22	100	
Ir	6	3	0		BR×ir
2.40	1.92	2.56	2.72	3	
1.99	1.57	2.16	2.23	6	
	1.75	2.36	2.47		BR
SAP	6	3	0		BR×SAP
3.40	2.57	3.69	3.92	0	
1.93	1.57	2.01	1.98	50	
1.26	0.88	1.38	1.51	100	
			L.S.D 0.05		
BR× SAP ×irr	SAP ×irr	BR× irr	BR× SAP	Ir	SAP	BR
1.15	0.93	0.91	0.71	1.19	0.35	0.45

4 Conclusions

- Treating okra plant with hydrogel andBR have improved the nutritional production.
- Treating the plants with a concentration of 6 mg of theBR and 100 mg of hydrogel polymer in the soil led to a significant increase in yield characteristics, in addition to improving to parameters Irrigation for 6 days.
- The second and third interventions showed superiority in all the studied traits. Treating the okra plant with the BR and hydrogel polymer led to an increase in the plant's tolerance to water stress**.**

Recommendations:

- Conducting studies on the use of soil amendments and other polymers that help plantsEconomically resistant to drought for long peri.
- Use other concentrations of the progestolide hormone and hydrogel polymer.
- The same plant and other irrigation periods.
- Conduct similar studies on other plants to know the role of the polymer and the hormone**.**

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