Effect of soaking and spraying with glycine betaine and microelements of two cultivars of bread wheat Triticum aestivum L.

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Abstract

Two experiments were conducted in two fields, one of which was irrigated by rain and the other was irrigated with supplementary irrigation, in the winter season of 2022-2023 in the district of Tel Kayf in the city of Mosul. They were implemented according to a randomized complete block design (RCBD), in Three replicates, in a field experiment arrangement to study the effect of soaking and spraying treatments with glycine betaine and microelements for two varieties of soft wheat (Baghdad 1 and Buhoth 22). The treatments were: 1- Without soaking and spraying 2- Soaking the seeds with glycine betaine 3- Soaking the seeds with the elements Zn, Mn, B, Cu, and Fe 4- Soaking the seeds with the elements Se, Zn, Mn, B, Cu, and Fe 5- Spraying plants with glycine betaine 6- Spraying plants with the elements Zn, Mn, B, Cu, and Fe 7- Spraying plants with the elements Se, Zn, Mn, B, Cu, and Fe. Characteristics were studied: flag leaf area, chlorophyll content index, and number of spikes per square meter, the number of tillers per square meter, the number of seeds per spike, the weight of a 1000 seeds, the grain yield per plant (gm), and the protein yield. The results showed the superiority of the Baghdad 1 variety by giving the highest yields of 1662.32 and 1431.34 gm m^{-2} in the supplementary and rain irrigation experiments respectively, due to its superiority in most of the studied characteristics. Likewise, the treatment of spraying plants with glycine betaine excelled in the supplemental irrigation experiment with the highest yields of 1969.3 gm m^{-2}, due to its superiority in the highest Chlorophyll content (47.4 spad), the highest number of spikes (652 spike m^2), the lowest number of inactive tillers (16 tillers m^2), the highest number of spike seeds (69.5 seed $spike^{-1}$), the highest protein yield (2.15 tons ha^{-1}), and the treatment of spraying the plants with glycine betaine did not differ significantly from the treatment of soaking seeds with this substance, with a yield of 1933.39 g m^2, which did not differ significantly from the characteristics of chlorophyll content (47.2 spad), the number of spikes (639 spike m^{-2}), the number of seeds per spike (68.4 seed $spike^{-1}$) and the weight of 1000 seeds (41.7 gm) and protein yield (2.19 tons ha^{-1}). Also, in the rain irrigation experiment, the treatment of spraying plants with glycine betaine excelled with the highest yield of 1727.68 gm $plant^{-1}$ due to its superiority in the highest flag leaf area (34.35 cm^2), the highest chlorophyll content in the leaves (43.1 spad), the highest number of ears (727 spikes per m^2), and the lowest number of inactive tillers (2.5 tillers m^2), the highest number of seeds of spike (58.65 seed $spike^{-1}$), the highest weight of 1000 grains (93.0 g), and the highest protein yield (1.99 tons ha^{-1}), and the treatment of spraying the plants with glycine betaine did not differ significantly from the two treatments of spraying the plants with the elements. Se, Zn, Mn, B, Cu, and Fe, and soaking the seeds with glycine betaine, with yields reaching 1642.99 and 1533.35 gm^2.

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Introduction

Soft Wheat (*Triticum aestivum*. L) belongs to the family of grass (poaceae) which is the first cereal crop in the world and constitutes the grain trade fifth trade globally Wheat grains are characterized by containing protein gluten, which earns them excellent baker's property (11), and it was called the wheat crop king of grains because of its achievement of food security, it provides humans with most of the energy needed by humans, as well as having a good balance between proteins and carbohydrates in the flour produced from its grains (8) The method of soaking seeds is one of the best methods used and means soaking seeds before planting for a certain period with one of the materials (amino acids, growth regulators, fertilizers, vitamins, salts, etc.) before planting, which has proven its effectiveness and benefits through the association of the stimulation process with the germination process itself (4). Microelements are important factors as they are associated with crops and that nutrient addition has a direct role in increasing production because it plays an important role in many vital processes within the plant (12). Glycine Betaine contributes to the wheat crop by increasing the plant's ability to resist the stress of high temperatures, so it was noted that the plants are thermally stressed for 12 hours and the added glycine betaine has a high amino acid (Proline) and thus contributed to protecting plant cells from osmotic stress (15). The study aims to determine the effect of glycine betaine and microelements on the growth and yield of two wheat cultivars under conditions of limited water supply.

Materials and methods

The fieldexperiments was conducted in the Telkaif district of Mosul city, and in two fields, one of which relied on rain only and the other depends on supplementary irrigation, carried out according to the Randomized Complete Blocks Design was used and in Three, in a split plot arrangement the cultivation was carried out at a distance of (0.2 m) between one line and another, the experimental unit consists of (5 lines) and a length of (1 meter) Thus, the experimental unit has an area of $2m^{-2}$ and dimensions of (1× 2 meters), and the coefficients are distributed to the experimental units randomly and the experimental units and replicate were separated from each other by a distance of (1 m), and the physical and chemical properties of the soil of the Talkaif district Location were analyzed in the laboratories of the College of Agriculture and Forestry / University of Mosul (Table 1), and data were recorded The amount of rain falling during the test season from the weather station in Nineveh Governorate (Table 2). The Duncan's Multiple Range test was adopted to compare the mean coefficients for each source of variance with a significant effect, and the experimental factors were as follows: The first factor: Cultivars (Baghdad 1, buhuth 22) The second factor (spraying and soaking): soaking of seeds is carried out for 12 hours and drying for 48 hours at room temperature, spraying during the 31ZS: 1- Without soaking and spraying 2- Soak the seeds with glycine betaine at a concentration of 100 $mmol.L^{-1}$, 3- Soak the seeds with micronutrients (Zn, Mn, B, Cu, Fe) at a concentration of 1 $g.L^{-1}$, 4- Soak the seeds with micronutrients (Zn, Mn, B, Cu, Fe+Se) at a concentration of 1 $g.L^{-1}$, 5- Spraying plants with glycine betaine at a concentration of 100 $mmol.L^{-1}$, 6- Spraying plants with micronutrients (Zn, Mn, B, Cu, Fe) at a concentration of 1 $g.L^{-1}$, 7- Spraying plants with micronutrients (Zn, Mn, B, Cu, Se+Fe) at

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a concentration of 1 $g.L^{-1}$, Studied traits: 1- flag leaf area (cm^2): Five plants were selected and the area of the leaf was measured for them and then the mean was calculated for them according to the equation provided by. (9) Leaf area = Length x Width x 0.75, 2- Chlorophyll content index (spad): - The chlorophyll content of five leaves from different plants from each experimental unit was measured by the In Framatie device, 3. The number of spikes.m^{-2}: Calculate the number of spikes.m^{-2} For each experimental unit and randomly also at maturity. 4- The number of tillers does not contain spikes.m^{-2}, 5. Number of seeds. $spike^{-1}$: The mean number of grains for 10 spikes taken randomly per experimental unit. 6. The weight of 1000 seeds (g): 1000 grains were counted from each experimental unit randomly and then weighed by a sensitive balance for each experimental unit. 7- Grain yield **(gram. M^{-2})** 8- Crude protein yield ($tons.h^{-1}$): - The protein yield in grains was calculated on the basis of the percentage of protein in the grain multiplied by the grain yield for each treatment (2).

Measurements	Result
N%	0.0058
P ppm	11.85
K available ppm	118
PH	7.4
organic matter %	1.58
Calcium carbonate%	34
EC	2.50
Size distribution of soil particles	
Sand	44.05
Clay	25.95
Silt	30

Table (2) Amount of rainfall (mm) during the experimental season

Agricultural Season	November	December	January	February	March	April	May	Total
2023-2022	49.5	3	73	23.5	69	63	0	281

Results and Discussion

Flag Leaf area (cm^2): The results of Table (3) showed that there are significant differences between the two cultivars, as it significantly excellence buhuth 22 in the description of the Leaf area and recorded a significant mean of (32.471 cm^2) superiority superiority over Baghdad 1 Cultivars, which recorded the lowest significant mean in the description of Leaf area, which amounted to (27.857 cm^2) in the field of supplementary irrigation, while the field of depended rain there were no significant differences between the cultivars in the characteristic of the leaf area. The reason for the difference in leaf space between cultivars may be based on genetics, as the characteristic of leaf space is governed by). The low humidity in 13(quantitative genes the field of depended rain may have led to a

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decrease in the Leaf area in both cultivars, and therefore no significant differences appeared between the cultivars for the effect of sprinkler and soaking treatment levels on the characteristic of the leaf area in the supplementary irrigation field, the treatment of spraying plants with microelements (Cu, Mn, B, Fe, Zn) recorded the highest significant mean (46.7 cm^2), while the level Spraying plants (Zn, Mn, B, Cu, Fe+Se) recorded the lowest significant mean (24.45 cm^2) in the characteristic of Leaf area may be due to the reason for the superiority of spraying microelements to the fact that the elements have a major role in the performance of many functions within the plant through their participation in the process of oxidation and reduction and respiration and the) while the level 3formation of chlorophyll (of spraying plants with glycine betaine significant for the recorded the highest mean characteristic of the leaf area in the field of depended rain as it reached (34.35 cm^2) The non-use of spraying and soaking recorded the lowest significant mean for the characteristic of the Leaf area of (20.95 cm^2) may be the reason for the large role of glycine betaine in protecting the photosynthetic system from).Interaction between 7drought pressure (cultivars and treatment of spraying and soaking with glycine betaine and microelements due to the emergence of differences that reached the limit of moraIIy superior between the cultivars, as it significantly outweighed the interaction of the buhuth 22 with the treatment of spraying plants with the elements (Zn, B, Cu , Mn, Fe) and gave (65.5 cm^2) while the interference was given to the buhuth 22 with the treatment of without soaking and spraying. are the lowest significant rate (22.4 cm2) in the field of supplementary irrigation. The interaction of the Baghdad 1 cultivar with the treatment of spraying the plant with glycine betaine gave the highest significant rate in the field of depended rain reached the area of the flag leaf to (35.6 cm^2) and the lowest significant rate reached (19.9 cm^2) and results when the Baghdad 1 cultivars interactions with treatment without spraying and soaking .

Table (3) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on Flag leaf area (cm^2)

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	29.5 DC	22.4 F	25.95 CD
Soak the seeds with glycine betaine	28.6 DCE	27.9 DCE	28.25 CB
Seed soaking (Zn, Mn, B, Cu, Fe)	30.5 C	27 DCE	28.75 BC
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	28 DCE	25 DEF	26.5 CD
Spraying plants with glycine betaine	24.1 EF	37 B	30.55 B
Spraying plants (Zn, Mn, B, Cu, Fe)	27.9 CDE	65.5 A	46.7A
Spraying plants (Zn, Mn, B, Cu, Fe+Se)	26.4 CDEF	22.5 F	24.45 D
Effect of cultivars	27.857 B	32.471 A	30. mean
Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar	Cultivar	Treatment effect

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	Baghdad 1	Buhuth 22	Spraying and soaking
.Without soaking and spraying	19.9 H	22 G	20.95 E
Soak the seeds with glycine betaine	28.3 C	26.1 D	27.2 B
Seed soaking (Zn, Mn, B, Cu, Fe)	22.2 G	22.7 GF	22.45 D
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	23.9 EGF	24.2 EDF	24.05 C
Spraying plants with glycine betaine	35.6 A	33.1 B	34.35 A
Spraying plants (Zn, Mn, B, Cu, Fe)	25.3 DE	24.5 DEF	24.9 C
Spraying plants (Zn, Mn, B, Cu, Fe+Se)	26.1 D	24.6 DEF	25.35 C
Effect of cultivars	25.9 A	25.314 A	General mean 25.607

Chlorophyll content index (spad): The results shown in Table (4) indicated that there are significant differences between the two cultivars for the characteristic of chlorophyll content index for both fields (supplementary irrigation field and Unirrigated field), as it significantly outperformed the Baghdad 1 by giving it the highest rate in both fields (supplementary and Unirrigated field) and amounted to (44.662 - 39.757 spad) sequentially, the buhuth 22 gave the lowest rate for both fields amounted to (43.205 - 38.452 spad).) sequentially. The reason for the difference between the cultivars of chlorophyll content index may be due to the genetic cultivars of the cultivars used and their interaction with environmental conditions.

Table (4) also showed that there are significant differences between the levels of soaking and spraying treatment of the two fields for the characteristic of chlorophyll content index, as the supplementary irrigation field recorded a significant superiority for the treatment of spraying plants with glycine betaine by giving it the highest rate reached (47.4 spad) and did not differ significantly with the treatment of soaking seeds with glycine betaine, compared to the treatment without soaking and spraying, which reached the lowest rate (38.517 spad), and also the Unirrigated field recorded a significant superiority for the treatment of spraying plants with glycine betaine by giving it the highest rate of (43.084 spad) compared to the treatment without soaking and spraying, which gave the lowest significant rate of (34.284 spad). The reason for the superiority of glycine betaine in both fields is due to the role of the manufacture of glycine betaine in chloroplasts because it plays a major role in protecting the photosynthetic system from the stresses of drought (8). Interaction between the treatment of cultivars and the treatment of soaking and spraying with glycine betaine and the minor element achieved significant differences between its levels and in both the field of complementary and Unirrigated (Table 4), it achieved the interaction between the cultivars Baghdad 1 and the treatment of spraying plants Glycine betaine the highest significant rate reached (49.4 spad) and the lowest significant rate (37.8 spad was for an interaction between the buhuth 22 and treatment without spraying and soaking in the field of supplementary irrigation, while the

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Unirrigated field for the interaction of the Baghdad 1 with the treatment of spraying plants with glycine betaine the highest significant rate reached (43.967 spad) and did not differ significantly from the interaction of the buhuth 22 with the treatment of spraying plants with glycine betaine, while the lowest significant rate was (33.667 spad) had a buhuth 22 with treatment without soaking and spraying.

Table (4) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on Chlorophyll content index (spad)

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	39.233 HI	37.8 I	38.517 D
Soak the seeds with glycine betaine	47.067 B	47.4 AB	47.234 A
Seed soaking (Zn, Mn, B, Cu, Fe)	40.7 GH	43.433 DEF	42.067 C
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	42.8 EFG	44.6 CDE	43.7 B
Spraying plants with glycine betaine	49.4 A	45.4 BCD	47.4 A
Spraying plants (Zn, Mn, B, Cu, Fe)	46.9 B	41.4 FGH	44.15 B
Spraying plants (Zn, Mn, B, Cu, Fe+Se)	46.533 BC	42.4 EFG	44.467 B
Effect of cultivars	44.662 A	43.205 B	mean 43.933
Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	34.9 HI	33.667 I	34.284 E
Soak the seeds with glycine betaine	41.9 B	40.4 BCD	41.15 B
Seed soaking (Zn, Mn, B, Cu, Fe)	36.233 GH	36.833 FG	36.533 D
Seed soaking (Zn, Mn, B, Cu,Fe+Se)	38.1 EFG	37.767 EFG	37.934 C
Spraying plants with glycine betaine	43.967 A	42.2 AB	43.084 A
Spraying plants (Zn, Mn, B, Cu, Fe)	41.433 BC	38.633 DEF	40.033 B
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	41.767 B	39.667 CDE	40.717 B
Effect of cultivars	39.757 A	38.452 B	General mean 39.105

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Number of spikes.m-²:

Significantly outperformed the Baghdad 1 cultivar in the field of supplementary irrigation (Table 5) and gave (581.043 spike.m-²) and outperformed the buhuth 22 in Unirrigated field and gave (651,086 Spike m^{-2}), This variation between genotypes may be attributed to genetic differences between these genetic structure. This result agreed with the results of others who found significant differences between the genetic structures of the wheat crop in the number of spikes per unit area, including (1 ، 5 ،16) and the lowest significant rate in the field of supplementary irrigation was for the buhuth 22 and amounted to (548.614 Spike.m-²) and in Unirrigated field gave Baghdad 1 the lowest significant rate of (637,871 Spike. m-²), the reason is due to the superiority in the characteristic of the number of seedlings on the principle of compensation, as the lower the height of the plant, the number of seedlings increases, and also depends on the nature and genetic structure of the cultivars in terms of their ability to increase the number of seedlings.

The results of Table (5) showed that there were differences that reached the limit of morally superior between the levels of soaking treatment and spraying with glycine betaine and microelements in the field of complementary and Unirrigated field, as the treatment of spraying glycine betaine morally superior exceeded and gave (652-727 Spike. m-²) in the field of complementary and Unirrigated field respectively, and there was no difference up to the morally superior limit .

in the Location of supplementary irrigation from soaking with glycine betaine, as it gave (639.3 Spike. m^{-2}) and the lowest significant rate of (440.35 Spike. m^{-2}) at the supplementary irrigation field and (564.65 Spike. m^{-2}) at the Unirrigated Location, obtained from non-soaking and spraying, may be due to the positive relationship between effective spraying and chlorophyll content, as we note in Table (4) for the chlorophyll content index that the treatment of spraying with glycine betaine is exceeded.

The interaction in the field of supplementary irrigation between cultivars, soaking and spraying with glycine betaine and microelements showed significant differences between its levels, the interaction of the buhuth 22 with the treatment of spraying plants with glycine betaine gave the highest significant rate reached (655.3 Spike.m^{-2}) and did not differ significantly from the interaction of the buhuth 22 and the treatment of soaking seeds with glycine betaine, and the lowest significant rate reached (374.7 Spike. m^{-2}) was from the interaction buhuth 22 with treatment without soaking and spraying, the highest significant rate in the Unirrigated field was from the interaction of buhuth 22 with the treatment of spraying plants with glycine betaine and amounted to (751.3 Spike.m^{-2}) and the lowest significant rate amounted to (564.3 Spike. m^{-2}) and resulted from the interaction of the Baghdad 1 cultivar with treatment without soaking and spraying

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Table (5) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on Number of spikes.M^{-2}

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	506 EF	374.7 G	440.35 D
Soak the seeds with glycine betaine	631.3AB	647.3 AB	639.3 A
Seed soaking (Zn, Mn, B, Cu, Fe)	476.3 F	558.7 DC	517.5 C
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	563.3 C	580.3 C	571.8 B
Spraying plants with glycine betaine	648.7 AB	655.3 A	652 A
Spraying plants (Zn, Mn, B, Cu, Fe)	627.7 AB	496.7 EF	562.2 B
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	614 B	527.3 DE	570.65 B
Effect of cultivars	581.043 A	548.614 B	mean 564.829
Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	564.3 G	565 G	564.65 E
Soak the seeds with glycine betaine	678.3 BCD	693.3 BC	685.8 B
Seed soaking (Zn, Mn, B, Cu, Fe)	610.7 F	610.3 F	610.5 D
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	612.7 EF	613.7 EF	613.2 D
Spraying plants with glycine betaine	702.7 B	751.3 A	727 A
Spraying plants (Zn, Mn, B, Cu, Fe)	646.7 DEF	660.7 CD	653.7 C
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	649.7 DE	663.3 CD	656.5 C
Effect of cultivars	637.871 B	651.086 A	General mean 644.479

Number of tillers does not contain spikes. m^{-2}**:**

The performance of the two cultivars differed under the field of supplementary irrigation and Unirrigated field (Table 6), the cultivars gave Baghdad 1 the highest significant rate for the number of ineffective tillers and amounted to (21.743 tiller.m^{-2}) and gave the cultivar buhuth 22 the lowest significant rate and amounted to (26.443 Shata.m^{-2}) in the field of supplementary irrigation, either in Unirrigated field gave the Baghdad 1 the lowest Morally superior rate of (10.443 Shata.m^{-2}) and gave the buhuth 22 the highest significant rate of (14.271 tiller. m^{-2}). The performance of the cultivars is due to the different interaction of genetic structures with environmental conditions.

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The lack of addition of glycine betaine and microelements by soaking and spraying caused a significant increase in the number of tillers does not contain spikes as it reached (22.35 tiller. $^{-}$ m^{-2}) in the field of Unirrigated field and the lowest significant rate reached (2.5 tiller. m^{-2}) and the spraying of plants with glycine betaine, in the field Unirrigated , field of supplementary irrigation gave soaking with glycine Betaine the highest significant rate of (39 tiller. m^{-2}) and lowest rate of (12.5 tiller. m^{-2}) resulted from soaking seeds with microelements. This is due to the role of glycine betaine and microelements in supporting plant growth and thus increasing the ability of plants to increase the number of spikes that have been given and thus decrease the number of ineffective tillers.

The interaction between the cultivars Baghdad 1 and the treatment of soaking seeds with microelements (Fe, Cu, B, Mn , Zn) gave the lowest significant rate of the number of tillers ineffective and amounted to (3.3 tiller. m^{-2}) in the field of supplementary irrigation and the highest significant rate of (47 tiller. m^{-2}) and the interference of the buhuth 22 with the soaking of seeds with the microelements (Fe, Cu, B, Mn, Zn, Se) did not differ significantly for the interference of buhuth 22 and the treatment of spraying plants with elements (Fe, Cu, B, Mn, Zn) in the field Unirrigated field gave the interaction of the Baghdad 1 with the treatment of spraying plants with glycine betaine the lowest significant rate for the number of tillers ineffective (1.7 tiller. m^{-2}) and did not differ significantly from the interaction of the buhuth 22 with the treatment of spraying plants with glycine betaine, while the highest significant rate was for the interaction of the buhuth 22 with treatment without soaking and spraying and amounted to (25.7 tiller m^{-2}.).

Table (6) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on Number of tillers does not contain spikes. m^{-2}

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	18 DEFG	16.7 A	17.35 D
Soak the seeds with glycine betaine	29 BC	21 E	25 C
Seed soaking (Zn, Mn, B, Cu, Fe)	3.3 H	21.7 D	12.5 E
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	31 B	47 A	39 A
Spraying plants with glycine betaine	17.3 EFG	14.7 G	16 D
Spraying plants (Zn, Mn, B, Cu, Fe)	27.3 BC	44 A	35.65 B
Spraying plants (Zn, Mn, B, Cu, Fe+Se)	26.3 C	20 DEF	23.15 C
Effect of cultivars	21.743 B	26.443 A	mean 24.093
Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	19 B	25.7 A	22.35 A
Soak the seeds with glycine betaine	7G	12.3 E	9.65 E

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Seed soaking (Zn, Mn, B, Cu, Fe)	14.7 D	17.3 BC	16 B
Seed soaking (Zn, Mn, B, Cu,Fe+Se)	13.7 DE	15.3 CD	14.5 C
Spraying plants with glycine betaine	1.7 H	3.3 H	2.5 F
Spraying plants (Zn, Mn, B, Cu, Fe	9.3 F	13.7 DE	11.5 D
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	7.7 GF	12.3 E	10 E
Effect of cultivars	10.443 B	14.271 A	General mean 12.357

Number of seeds in spike:

The results of Table (7) indicate that there are significant differences between the two cultivars for the characteristic of the number of grains in spike in both fields (supplementary and Unirrigated field) as it significantly outperformed the Baghdad 1 in both fields and recorded the highest mean of (67.943 - 59.257 grains.spike^{-1}) while the buhuth 22 recorded the lowest significant mean for both fields and amounted to (64.814 - 54.443 grains.spike^{-1}) respectively. The reason for the difference in the performance of the two cultivars may be due to the different interaction of genetic genes with environmental conditions, for the effect of soaking and spraying treatment, they affected superior morally in the characteristic of the number of grains in the spike for both fields (Unirrigated and supplementary irrigation) in the field of supplementary irrigation outweighed the treatment of spraying plants with glycine betaine and gave the highest superior morally mean of (69.8 grains spike^{-1}.) and did not differ morally superior from soaking seeds with glycine betaine and soaking seeds microelements(Fe, Se, Cu, B, Mn, Zn +Se)

As and spraying plants with microelements (Fe, Cu, B, Mn, Zn) and the lowest significant rate of(58.95 grains. spike^{-1}) for the treatment Without soaking and spraying. In the field of Unirrigated outweighed the treatment of spraying plants with microelements (Fe, Se, Cu, B, Mn, Zn) gave the highest Morally superior mean of (62.05 grains spike^{-1}) and

did not differ Morally superior from spraying plants with glycine betaine and soaking seeds with elements (Fe, Se, Cu, B, Mn, Zn) and soaking seeds with glycine betaine and without soaking, spraying, while the treatment of soaking seeds with elements (Fe, Se, Cu, B, Mn, Zn) gave the lowest significant rate in the number of grains in spike and amounted to (50 grains.) The characteristic of the number of grains in spike is directly proportional to the area of the leaf, as the larger the leafy area (Table 3) provides the largest amount of food manufactured to go to the emerging flowers. for the interaction between cultivars and transactions, Table (7) showed the existence of significant differences, as it significantly outweighed the interaction between the Baghdad 1 with spraying plants with glycine for the supplementary irrigation field, which gave the highest rate of (73.3 grains.spike^{-1}) and did not differ significantly from the interaction of the Baghdad 1 and spraying plants with elements (Fe, Cu, B, Mn, Zn)

and gave the interaction of non-soaking and spraying with the two cultivars (Baghdad 1. Buhuth 22) The lowest significant rate reached (60.6 – 57.3 grains spike^{-1}) . As for the Unirrigated field, the interaction between the

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Baghdad 1 with a treatment without soaking and spraying by giving it the highest rate of (64.4 grains.spike^{-1}) while the interaction of treatment without spraying and soaking for the buhuth 22 was the lowest significant rate of (49 grains.spike^{-1}).

Table (7) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on Number of seeds in spike

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	60.6 F	57.3 F	58.95 D
Soak the seeds with glycine betaine	68 BCDE	68.7 BCD	68.35 AB
Seed soaking (Zn, Mn, B, Cu, Fe)	65 DE	64.7 E	64.85 C
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	69.7 BC	65 DE	67.35 AB
Spraying plants with glycine betaine	73.3 A	66.3 CDE	69.8 A
Spraying plants (Zn, Mn, B, Cu, Fe)	71.3 AB	65.7 DE	68.5 AB
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	67.7 BCDE	66 CDE	66.85 BC
Effect of cultivars	67.943 A	64.814 B	mean 66.379
Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	64.4 A	49 B	56.7 AB
Soak the seeds with glycine betaine	57.9 AB	55.7 AB	56.8 AB
Seed soaking (Zn, Mn, B, Cu, Fe)	60 AB	55.1 AB	57.55 AB
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	50 AB	50 AB	50 B
Spraying plants with glycine betaine	62.1 AB	55.2 AB	58.65 AB
Spraying plants (Zn, Mn, B, Cu, Fe)	59.4 AB	53 AB	56.2 AB
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	61 AB	63.1 AB	62.05 A
Effect of cultivars	59.257 A	54.443 B	General mean 56.85

weight of1000 grains (g):

In the field of complementary irrigation, the performance of the two cultivars did not differ (Table 8) as there were no significant differences among them in the weight of 1000 grains, but the difference was achieved in Unirrigated filed, as the culivars achieved buhuth 22 the highest morally superior rate and gave (37.934 g) to the weight of 1000 grains, and the cultivars Baghdad 1 achieved the lowest morally superior rate and reached (36.287 g). The variation between wheat cultivars may be due to the weight of 1000 grains due to the genetic difference in varieties.

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While the effect of soaking and spraying treatments gave differences morally superior effect of the weight of grains for each field (Unirrigated and complementary irrigation), where the field recorded complementary irrigation significant superiority for soaking seeds with glycine betaine, as it gave the highest significant rate of the weight of 1000 grains and amounted to (41.7 g) and did not differ morally superior from the treatment of spraying the plant with glycine betaine, but the minimum rate of the effect of treatment for without soaking and spraying as it gave (37.7 g), while the Unirrigated field has recorded the highest significant rate of the level of spraying with glycine betaine and soaking seeds glycine betaine and gave (39 - 38.8 g) respectively, while the lack of soaking and spraying got the lowest significant rate in the weight of 1000 grains, as it reached (34.25 g), and the reason may be due to the work of glycine betaine to protect the plant from drought and therefore the plant does not resort to the demolition of chloroplast (8).

As for the interaction between cultivars, soaking and spraying with glycine betaine and microelements, Table (8) showed that there are significant differences for all the two fields, as the data in the table showed for the irrigation field Complementary superiority of the interaction between the Baghdad 1 and soaking the seeds with glycine betaine significantly by giving it the highest rate of (42.3 g) for the characteristic of the weight of 1000 grains and did not differ significantly from the buhuth 22 with the treatment of spraying plants with glycine betaine and soaking the seeds with microelements (Fe, Cu, B, Mn, Zn) and soaking the seeds with microelements (Fe, Se, Cu, B, Mn, Zn). While the lack of soaking and spraying for the buhuth 22 recorded the lowest significantnteraction rate of (37.4 g), while the results of the field of Unirrigated interference classified buhuth 22 with the treatment of spraying plants with glycine betaine had a significant rate of (39.8 g) and did not differ significantly from the interaction of the buhuth 22 for the treatment of soaking seeds with glycine betaine (39.7g) and the lowest rate of interaction was (33.7 g) for interaction between the buhuth 22 for treatment without soaking and spraying.

Table (8) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on weight of one thousand grains (g)

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	38 EF	37.4 F	37.7 D
Soak the seeds with glycine betaine	42.3 A	41.1 AB	41.7 A
Seed soaking (Zn, Mn, B, Cu, Fe)	37.23 DEF	40.7 ABC	38.965 BC
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	39.3 BCDEF	40.5 ABCD	39.9 BC
Spraying plants with glycine betaine	40.5 ABCD	41 ABC	40.75 AB
Spraying plants (Zn, Mn, B, Cu, Fe)	38.9 CDEF	37.65 BCDEF	38.275 C
Spraying plants (Zn, Mn, B, Cu, Fe+Se)	39.5 BCDE	39.9 BCDE	39.7 BC
Effect of cultivars	39.39 A	39.75 A	mean 39.57

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Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	34.8 ED	33.7 E	34.25 C
Soak the seeds with glycine betaine	37.9 AB	39.7 A	38.8 A
Seed soaking (Zn, Mn, B, Cu, Fe)	33.81 CD	38.1 AB	35.955 B
Seed soaking (Zn, Mn, B, Cu, Fe+Se	35.9 CD	38.2 AB	37.05 B
Spraying plants (Zn, Mn, B, Cu, Fe)	38.2 AB	39.8 A	39 A
Spraying plants (Zn, Mn, B, Cu, Fe)	36.6 BCD	36.94 AB	36.77 B
Spraying plants (Zn, Mn, B, Cu, Fe+Se	36.8 BC	39.1 A	37.95 AB
Effect of cultivars	36.287 B	37.934 A	General mean 37.111

Grain yield (gram. M^{-2}):

The results shown in Table (9) indicated a difference in the performance of the Baghdad and Buhuth 22 in the field of supplementary irrigation, the Baghdad 1 cultivars gave the highest significant rate (1662.321g.m^{-2}) compared with the buhuth 22, which gave the lowest morally superior quotient and amounted to (1533.664 g. m^{-2}), and no significant differences appeared between the two cultivars Baghdad 1 and Buhuth 22 the reason may be that the superiority of the grain yield depends on the characteristic of the number of spikes and the number of grains in spike and on the number of days of vegetative growth (table 5, 7), which reflects positively on the increase in grain yield.

While the treatment of soaking and spraying affected the quality of grain yield for the field of supplementary irrigation, as the treatment of spraying plants with glycine betaine exceeded by giving it the highest morally superior mean of (1969.325 g. m^{-2}) and did not differ significantly from the treatment of soaking seeds with glycine betaine, while the lowest significant rate was (1066.6 g.m^{-2}) for treatment without soaking and spraying, while the transactions for the Unirrigated field for the characteristic of grain yield exceeded the treatment of spraying plants with glycine betaine, which gave the highest morally superior mean of (1727.68 g.m^{-2}). compared to the lowest morally superior mean given to him as a transaction without spraying and soaking amounted to (1129. 135 g.m^{-2}) the reason may be due to the direct relationship between grain yield and chlorophyll content, and this is noted in Table (4) with the superiority of foliar spraying with glycine betaine.

It is clear from the results of the table received that the interaction between the Baghdad 1 cultivars with the treatment of spraying plants with glycine betaine achieved the highest significant rate with its weight (2039.19 g.m^{-2}) and did not differ significantly from the treatment of soaking seeds with glycine betaine for both cultivars Buhuth 22 and Baghdad 1, and the lowest significant mean for the interaction between the buhuth 22 for treatment without soaking and spraying amounted to (900.81 g. m^{-2}), while the Unirrigated field recorded significant differences for the interaction between the

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buhuth 22 with the treatment of spraying plants with elements (Se, Cu, B, Mn, Fe, Zn) by giving it the highest mean of (1755.34 g.m-2) and did not differ significantly from the interaction of buhuth 22 for the treatment of spraying plants with glycine betaine, but the lowest significant mean of (962.85 g. m^{-2}) for an interaction between the treatment without soaking and spraying for the buhuth 22.

Table (9) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on Grain yield (gram. M-2)

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	1232.39 F	900.81 G	1066.6 C
Soak the seeds with glycine betaine	1925.47 AB	1941.3 AB	1933.385 A
Seed soaking (Zn, Mn, B, Cu, Fe)	1250.16 F	1567.22 CDEF	1408.69 B
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	1628.63 BCDE	1611.74 BCDE	1620.185 B
Spraying plants with glycine betaine	2039.19 A	1899.46 ABC	1969.325 A
Spraying plants (Zn, Mn, B, Cu, Fe)	1833.15 ABC	1346.98 EF	1590.065 B
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	1727.26 ABCD	1468.14 DEF	1597.7 B
Effect of cultivars	1662.321 A	1533.664 B	mean 1597.993
Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking	1295.42 BCD	962.85 D	1129.135 E
Seed soaking (Zn, Mn, B, Cu, Fe)	1499.68 ABC	1567.02 ABC	1533.35 ABC
Seed soaking (Zn, Mn, B, Cu, Fe)	1361.37 ABCD	1320.68 BCD	1341.025 CDE
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	1146.57 CD	1221.49 CD	1184.03 DE
Spraying plants with glycine betaine	1713 AB	1742.36 A	1727.68 A
Spraying plants (Zn, Mn, B, Cu, Fe)	1472.7 ABC	1392.25 ABC	1432.475 BCD
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	1530.63ABC	1755.34 A	1642.985 AB
Effect of cultivars	1431.339 A	1423.141 A	General mean 1427.24

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Protein Yield(gm-^{2}):

Table (10) indicates that there are significant differences between the cultivars of the supplementary irrigation field, as the Baghdad 1 cultivar exceeded the characteristic of protein yield by giving it the highest significant mean of (1.895 tons.h^{-1}), while the buhuth 22 recorded the lowest significant mean of (1.703 tons. h^{-1}) while the Unirrigated field did not record any significant differences between the varieties. Percentage of protein with protein yield.

The effect of soaking and spraying treatments had a significant effect for both The two fields for the characteristic of protein yield as it significantly outperformed the two treatments of soaking seeds with glycine betaine and spraying plants with glycine betaine, as they gave the highest mean of (2.185 - 2.154 tons.h^{-1}) sequentially compared to the comparison treatment that gave the lowest significant mean of (1.22 tons.h^{-1}) for the supplementary irrigation field, for the Unirrigated field, it was the highest significant mean recorded by the two treatments of spraying plants with glycine betaine and spraying plants with elements (Zn, Fe, Mn, Cu, Se, B) and (1.993-1.99 tons.h^{-1}) sequentially compared to the comparison treatment that recorded the lowest significant mean of (1.448 tons.h^{-1}).

The interaction in the field of supplementary irrigation between cultivars, soaking and spraying with glycine betaine and microelements showed significant differences between its levels, the interaction of the Baghdad 1 cultivars with soaking the seeds with glycine gave the highest significant rate of (2.279 tons.h^{-1}) and did not differ significantly from the interaction of the Baghdad 1 cultivars with spraying plants with glycine betaine and the lowest significant rate of (0.989 tons.h^{-1}). It was the intervention of the buhuth 22 with without soaking, and the Unirrigated field gave the highest significant rate of (2.113 tons.h^{-1}) and it was from the interaction of spraying plants with microelements (Zn, B, Se, Cu, Mn, Fe) with the buhuth 22 and the lowest significant rate was from the interaction of buhuth 22 with treatment without soaking and spraying and amounted to (1.224 tons.h^{-1}).

Table (10) Effect of cultivars, soaking, and spraying with glycine betaine and microelements on Protein Yield (tons.h^{-1})

Supplementary irrigation			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	1.45 DE	0.989 F	1.22 C
Soak the seeds with glycine betaine	2.279 A	2.091 ABC	2.185 A
Seed soaking (Zn, Mn, B, Cu, Fe)	1.393 EF	1.701 BCDE	1.547 B
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	1.855 ABCDE	1.817 ABCDE	1.836 B
Spraying plants with glycine betaine	2.203 A	2.104 ABC	2.154 A
Spraying plants (Zn, Mn, B, Cu, Fe)	2.173 AB	1.537 DE	1.855 B

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Spraying plants (Zn, Mn, B, Cu,Fe+Se)	1.911 ABCD	1.685 CDE	1.798 B
Effect of cultivars	1.895 A	1.703 B	mean 1.799
Without irrigation (dependent on rain only)			
Spraying and soaking treatment	Cultivar Baghdad 1	Cultivar Buhuth 22	Treatment effect Spraying and soaking
Without soaking and spraying.	1.671 ABCD	1.224 D	1.448 B
Soak the seeds with glycine betaine	1.752 ABC	1.811 ABC	1.782 AB
Seed soaking (Zn, Mn, B, Cu, Fe)	1.74 ABCD	1.64 ABCD	1.69 AB
Seed soaking (Zn, Mn, B, Cu, Fe+Se)	1.452 CD	1.524 BCD	1.488 B
Spraying plants with glycine betaine	1.966 ABC	2.019 AB	1.993 A
Spraying plants (Zn, Mn, B, Cu, Fe)	1.791 ABC	1.695 ABCD	1.743 AB
Spraying plants (Zn, Mn, B, Cu,Fe+Se)	1.867 ABC	2.113 A	1.99 A
Effect of cultivars	1.748 A	1.718 A	General mean 1.733

Conclusions:

The Baghdad 1 cultivars excelled in most of the traits studied under supplementary irrigation and there was no significant difference between the two cultivars for some traits in the field of Unirrigated, the addition of glycine betaine and microelements by spraying led to an increase in yield and most of the traits studied under the conditions of Unirrigated and supplementary irrigation.

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