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Response of different cultivars of wheat *Triticum aestivum* L. to spraying by growth regulator (Ethephon)

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Abstract

A field experiment was carried out at Al-Hartha Research Station, which is one of the agricultural fields of the College of Agriculture, University of Basra (30 km north of the center of Basra Governorate), during the winter season 2021-2022. In order to study the effect of spraying by growth regulator (ethephon) at a concentration of 2.25 ml l^{-1} at tillering and elongation stages on growth, yield and quality of ten cultivars of bread wheat (*Triticum aestivum* L.): Al-Baraka, Al-Rasheed, Ibaa-99, Babil, Mawaddah, Bohouth-22, Bengal, Jad, Wafeya and Jihan), a factorial experiment was applied according to a randomized complete block design (RCBD) with three replications. The results showed that wheat cultivars differed significantly in most of the character of the study. The cultivar Bohuth-22 recorded the highest grain yield and harvest index of 5.652 t ha-1 and 35.21%, respectively, due to its superiority in spikes number of 395.00 spikes m, but did not differ significantly from the two cultivars Mawaddah and Al Baraka in grain yield, as they recorded 5.323 and 5.085 t ha -1 respectively as a result of their superiority in one or more of the yield components. The results also showed the superiority of the Babil cultivar in the qualitative character, as it recorded the highest percentage of wet protein and gluten, with an average of 13.43 and 32.78% for the traits, respectively. The results showed that spraying wheat plants by ethephon increased spikes number per m^2, grains number per spike, and 1000 grains weight. This was reflected in an increase in the grain yield, with an average of 5.043 t ha-1, the highest protein content in an average of (13.63%). The spraying of ethephon positively increased the proportion of wet gluten in wheat grains. The effect of the interaction between the cultivars and spraying with ethephon on spikes number and percentage of wet gluten. The combination between cultivar Bohuth-22 and the plants sprayed by ethephon was superior in spikes number per m, with an average of 452 spikes m-1, and the combination between cultivar Babel and plants sprayed with ethephon excelled in the percentage of wet gluten in the grains 37.34 %.

Keywords: Wheat cultivars، ethephon، gluten، yield

Introduction

Cereal crops are among the oldest crops known to human because it is the main food source (Al-Anbari, 2004). Wheat crop (*Triticum aestivum* L.) is one of the most important cereal crops in the world and one of the most important strategic crops in the world; it comes first in terms of cultivated area and production. It is the main source of food for more than a third of the world's population, which supplies the human body with about 25% of calories, carbohydrates, proteins, and some amino acids, and that is why it is called the king of cereal crops (Costa et al. 2013). Its importance is because its grain contains gluten, the basic protein for producing an appropriate flour quality for manufacturing bread. One of the most advantages that made the wheat crop importance to humans because its grains contain proteins and carbohydrates in a balanced manner, as the high content of gluten is the main reason that makes the dough high elasticity and thus, the production of bread with large sizes and high specifications (Peltonen, 1995).

Although Iraq is one of the original places for the emergence of wheat and one of the countries where the success factors of its cultivation are available, its productivity is still below the required level when compared to global production, as its production rate in Iraq reached 1,930 t ha^{-1}. In contrast, the global production rate reached 3.51 t ha^{-1} (USDA, 2022). Since the production rate of the wheat crop is low, we must pay attention to this crop to improve production in quantity and quality through good management of the harvest and the introduction of all modern technologies in the field of cultivation and service of this crop, including the introduction of new varieties with high production, and choosing the appropriate varieties for the region is one of the most important techniques that lead To the increase in the proportion of protein, gluten and specific yield of cereals (Al-Ani et al., 2017). The advancement of the reality of crop cultivation requires continuous research in developing varieties and subjecting them to tests to determine their suitability to the environment of the cultivation area.

As well as the treatment of wheat cultivars with growth regulators increases the productivity of the crop by improving the growth character and components of the crop, and one of the problems that cause losses in the yield by up to 35% is the phenomenon of sluggishness due to the weakness of the stem and the increase of nitrogen in the soil (Al-Ubaidi, 2001) as well as the phenomenon of the emergence of sand for these reasons, several methods have been used to solve these problems, including both encouraging and discouraging growth regulators, as proven by recent studies carried out in different regions of the world because of their significant role in the physiological processes of plants through Modification of photosynthesis and respiration, especially the growth regulator Ethephon, which works to release ethylene gas (C2H4). It is one of the commonly used growth impediments with cereal crops, especially wheat. It has proven its ability and effectiveness in preventing sluggishness and the attendant losses in the yield due to ethylene gas released from ethephon in Plant tissues that inhibit auxin transport in stem tissues and thus reduce the ability to stimulate stem elongation (Al-Naqeeb and Hashem, 2016). Hence, it reduces the elongation of main stems,

providing a greater amount of metabolites and their transport (Dahnous et al., 1982).

Several studies have shown a difference between cultivars in the character and quality of the yield components. Al-Aboudi (2019) indicated during his study of several wheat cultivars that they differed significantly in yield components. Also,. Al-Salami (2021) pointed out in his study of four wheat varieties that there is a significant difference in the components and quality of the yield. (Al- fahdawi (2021) in his study, there is a significant difference between wheat cultivars in the trait of grain yield and the quality of the resulting grains.

As for the effect of ethephon on wheat cultivars, Ahmad et al. (2020) noted that it was less achievable. The results of Al-Samer's (2022) study on the wheat crop showed that the spraying of ethephon significantly affected grain yield. Hence, this study aimed to know the effect of spraying ethephon on the yield, components, and quality of the different cultivars of wheat crops.

Materials and Methods

A field experiment was carried out at the Agricultural Research Station of the College of Agriculture - University of Basra at the Al-Hartha site, which is located at longitude 47.44° in the west and latitude 30.39° north and in silt loam soil whose chemical and physical properties are shown in Table (1) during the winter agricultural season 2021-2022 to know the response of ten cultivars of wheat to spraying with ethephon growth regulator. The experiment factors included two factors, the first cultivation of ten cultivars of wheat crop approved by the Ministry of Agriculture, are: (Al-Baraka, Al-Rasheed, Ibaa-99, Babel, Mawaddah, Bohouth-22, Bengal, Jad, Wafia Jihan) for spraying with ethephon growth regulator, by a concentration of 2.25 ml l^{-1} and no spraying as control tretment, symbolized by A1 and A0, respectively. The different treatments were randomly distributed within each plot. The soil allocated for cultivation was prepared and then divided according to the design used; the planting was done on lines with a distance between one line and another of 20 cm, meaning that the number of lines is 10 lines with a length of 3 m. A distance of 1 m was left between an experimental unit and another, and a distance of 2 m between plots. The seeds of wheat cultivars were sown on 15.11. 2021 with a seeding rate of 120 kg ha-1 (Abu El-Eis, 2004). Urea fertilizer (46% N) was used as a source of nitrogen fertilizer with an amount of 120 kg N ha-1 (Al-Abdullah, 2015) added in two batches (half of the amount after seedling emergence and the other half at the elongation stage (Davis et al., 2002). Phosphate fertilizer was also added with an amount of 100 kg P2O5 ha-1 in the form of triple super phosphate fertilizer (20% P) in one batch when planting (Jdoua, 1995), and potassium fertilizer was added at a rate of 120 kg K in the form of potassium sulfate (K2O 52%) in the form of two batches The first is after the emergence stage. The second is at the elongation stage (Al-Abedy, 2011). Weeding operations were carried out to remove the growing bush in the field during the season several times whenever the need arises. Irrigation was carried out continuously and according to the need of the crop.

Athephon was sprayed on the vegetative part of plants at a concentration of 2.25 ml l-1 and an amount of 750 l ha-1 at two stages of formation of tillers ZG25 and the

beginning of elongation ZG30 (Zadoks et al., 1974), using a 16-litre portable sprinkler, with a diffuser (bright cleaning solution) was added to it at a rate of 1.5 cm 3 per 10 liters of solution. As for the comparison treatment, it was sprayed with distilled water only, and the spraying process was carried out in the early morning to avoid the rise in temperatures, a nylon barrier was used between the plates during spraying to prevent the transfer of the solution between the experimental units. The plants were harvested when they reached the stage of full maturity with different dates according to the variety and treatment, as it extended from 15.04.2022 to 01.05.2022. The studied characters are : Spikes number (spike m) , Grains number in the spike (grain spike^{-1}) , 1000 grains weight(g) , (Grain yield (t ha^{-1}), Harvest index (%), Protein percentage in grains and The percentage of wet gluten in grains (%)

Table (1) Some physical and chemical properties of field soils before planting

Properties		Unit	Value
ECe		dS m^{-1}	11.40
pH		-	7.66
Organic matter (OM)		g Kg soil^{-1}	11.8
$CaCo^3$		g Kg soil^{-1}	264
Available elements	N	ppm	49.6
	P		8.5
	K		126
	S		89.2
Dissolved positive ions	Ca^{+2}	Meq l^{-1}	23.5
	Mg^{+2}		26.1
	Na^{+}		53.7
	K^{+}		2.2
Dissolved negative ions	$SO_4^{=}$	Meq l^{-1}	31.3
	HCO^{-3}		3.9
	Cl^{-}		68.8
Soil Separators	Sand	g kg soil^{-1}	60
	Silt		688
	Clay		252
Soil texture	–	–	Silt loam

Results and discussion

4-1- Spikes number (spike m^2):

The results of Table (2) show that the cultivars differed significantly in the character of spikes number per m, as the Bohuth-22 cultivar recorded the highest average of the character of spikes number per meter, which amounted to 407.8 spikes m², and did not differ significantly from Mawaddah cultivar, which had an average of 400.3 spikes m₂, with an increased rate of 47.11 and 44.41%, respectively, compared to Al-Rasheed cultivar, which recorded the lowest average of 277.2 spikes m² and did not differ significantly

from Al-Baraka cultivar, which had an average of 294.2 spikes m². The cultivar's difference in spikes number may be due to the genetic differences between the cultivars and the cultivar's ability to form spike-bearing and produce the largest amount of photosynthesis products (Hucl and Baker, 1988). This result agreed with what he found (Al-Abdullah, 2015) and (Al-Jiashi, 2020) and (Al-Salami, 2021).

The results of Table (2) indicated a significant difference between the treatment of spraying with ethephon and the treatment of non-spraying for the number of spikes. The plants sprayed with ethephon outperformed by recording the highest average of 374.1 spikes m² with an increase of 17.24%. The non-spraying treatment recorded the lowest average of 319.1 spikes m². The reason may be the increase in the number of stems due to the addition of the growth retardant ethephon, which reduces the ability of auxin to stimulate stem elongation. Thus, the plant produces the largest number of mature spikes (Dahnous et al., 1982). This result agrees with what was reached (Al Safi, (2014). and (Al-Zubaidi and others, 2016) and (Al-Samer, 2022).

Table (2) showed a significant interaction between the cultivars and ethephon, as Bohouth-22, whose plants were sprayed with ethephon, recorded the highest average number of spikes of 452.0 spikes m, while the non-sprayed al-Rasheed cultivar recorded the lowest average of 251.3 spikes m.

Table (2) Effect of cultivars, ethephon, and their interaction on spikes number (spike m^2)

Cultivar	Ethephon levels ml L^{-1}		cultivar average
	A0	A1	
Al-Baraka	271.3	317.0	294.2
Al-Rasheed	251.3	303.0	277.2
Ibaa-99	336.3	353.7	345.0
Babil	311.3	367.0	339.2
Mawaddah	374.7	426.0	400.3
Bohouth-22	363.7	452.0	407.8
Bengal	328.0	371.3	349.7
Jad	336.3	401.3	368.8
Wafeya	326.3	395.0	360.7
Jihan	291.7	354.7	323.2
Ethephon average	319.1	374.1	
Lsd $_{0.05}$			
Cultivar	Ethephon levels		Interaction

17.67	7.90	24.99

4-2- Grains number in spike (grain spike^{-1})

The results of (Table 3) showed that the cultivars differed significantly in the character of the number of grains in the spike, as Al Baraka cultivar recorded the highest average of 75.97 grains spike, which differed significantly from all cultivars with an increase of 56.47% and 55.24% compared to Mawaddah and Jihan cultivars, which recorded The lowest average was 48.55 and 48.93 grains spike, respectively. The reason for the varietal cultivars difference in the number of grains in the spike may be attributed to the genetic variation between the cultivars, and this result matched the results of (Al-Aboudi, 2019), (Al-Jabri, 2020) and (Al-Fahdawi, 2021).

It was noticed from the results of Table (3) that the plants sprayed with ethephon significantly outperformed in the trait of a number of grains per spike compared with the plants not sprayed with ethephon, as the plants sprayed with ethephon recorded the highest average of 59.56 grains spike with an increase of 9.03% compared to the non-sprayed plants that scored the lowest The average for this trait was 54.18 grains spike, and the reason for the increase in the number of grains in the spike when treating the plant with growth regulators may be due to the increase in the area of the flag leaf and the increase in the content of the flag leaf from chlorophyll. The increase in its area and content of chlorophyll has encouraged the plant to produce the highest number of grains in the spike (Al-Safi, 2014), and this result is consistent with the findings of (Al-Safi, 2014) and (Al-Zubaidi, 2016).

Table (3) Effect of cultivars, ethephon, and their interaction on grains number in spike (grain spike^{-1})

cultivar	Ethephon levels ml L^{-1}		cultivar average
	A0	A1	
Al-Baraka	70.73	81.20	75.97
Al-Rasheed	55.40	61.53	58.47
Ibaa-99	52.63	58.73	55.47
Babil	55.40	56.67	56.03
Mawaddah	41.90	55.20	48.55
Bohouth-22	55.60	57.27	56.43
Bengal	52.40	53.80	53.10
Jad	53.73	57.33	55.53

Wafeya	55.60	64.37	59.99
Jihan	48.40	49.47	48.93
Ethephon average	54.18	59.56	
L s d $_{0.05}$			
cultivar	Ethephon levels		Interaction
4.424	1.979		N .S

4-3- 1000 grain weight (g)

The results of Table (4) show that the cultivars differed significantly in the trait of the weight of 1000 grains, as Al-Baraka cultivar recorded the highest average for this trait of 45.85 g and did not differ significantly from Babil cultivar, which averaged 44.36 g, with an increased rate of 30.14 and 25.91%, respectively, in comparison with Bengal cultivar, which gave the lowest weight of 1000 grains, with an average of 35.23 g. The discrepancy between the cultivars in the character of the weight of 1000 grains is due to the difference in the number of spikes in Table (2), as their increase leads to a decrease in the weight of 1000 grains in addition to the difference in the genetic composition of the cultivars. The result, along with the findings of (Al-Abdullah, 2015), (Hadhili and Al-Hassan, 2017), (Al-Aboudi, 2019), (Al-Jiashi, 2020) and (Al-Fahdawi, 2021) that the varieties differ in the characteristics of the weight of 1000 grains depending on the difference in genetic structures and components The other outcome.

It was observed from the results of Table (4) that there was a significant difference between the plants that were sprayed with ethephon and the plants that were not sprayed with ethephon in the weight of 1000 grains, as the plants sprayed with ethephon recorded the lowest weight of 1000 grains, with an average of 39.41 g, with a decrease of 9.44% compared to the control treatment of no spray that recorded The highest average was 43.13 g, and the reason for the reduction of the weight of 1000 grains is attributed to the role of ethephon in increasing the number of spikes (Table 2) and increasing the number of grains in the spike (table 3), and thus increasing competition for the products of carbon metabolism and other elements and their distribution on more sites, which reflects on the weight of One grain, this result is consistent with what was found by (Al-Samer, 2022) that the treatment of spraying wheat plants with ethephon, and wheat with ethephon, led to a decrease in the average weight of 1000 grains.

It was noted from the results of Table (4) that there was no interaction between the cultivars and ethephon in the weight of 1000 grains.

Table (4) Effect of cultivars, ethephon, and their interaction on 1000 grain weight (g)

cultivar	Ethephon levels ml L^{-1}		cultivar average
	A0	A1	
Al-Baraka	48.33	43.36	45.85
Al-Rasheed	43.24	42.64	42.94
Ibaa-99	42.43	37.13	39.78
Babil	46.48	42.24	44.36
Mawaddah	44.96	40.61	42.79
Bohouth-22	43.14	39.17	41.15
Bengal	35.67	34.79	35.23
Jad	42.08	37.57	39.83
Wafeya	42.52	38.78	40.65
Jihan	42.47	37.86	40.16
Ethephon average	43.13	39.41	
Lsd $_{0.05}$			
cultivar	Ethephon levels		Interaction
1.754	0.784		N. S

4-4- Grain yield (t ha^{-1})

Table (5) showed through its data that there was a significant difference between the cultivars in the grain yield trait, as Bohouth-22 outperformed by recording the highest average for this trait, amounting to 5.652 t ha-1. It did not differ significantly from the two cultivars, Mawaddah and Al-Baraka, whose averages reached 5.323 and 5.085 t ha-1, respectively. With an increase of 36.36, 28.42 and 22.68%, respectively, compared to the Jihan cultivar, which gave the lowest average for grain yield, which amounted to 4.145 t ha-1, and did not differ significantly from the Babil, Bengal, Jad and Al-Rasheed cultivars whose averages reached 4.217, 4.485, 4.605 and 4.700 t ha-1, respectively, and the reason for the increase in grain yield for the two cultivars Buhouth-22 and Mawaddah may be the relative increase in one of the yield components, which is the spikes number in Table (2), while the Baraka cultivar outperformed as a result of its superiority in the character of the number of grains in the spike, Table (3), and weight 100 grains Table (4), which relates to the genetic structures that these cultivars have that distinguish them from the rest of the varieties, and this result matched what was found by (Abdul-Razzaq, 2016), (Al-Aboudi, 2019), (Al-Jabri, 2020) and (Al-Fahdawi, 2021) that Varieties differ in this trait due to different genetic structures.

It was observed from the data of Table (5) that there was a significant difference in the yield of grains between the treatment of spraying with ethephon and the

treatment of no spraying for the cultivated wheat cultivars, as the plants sprayed with ethephon excelled by recording the highest average for this trait amounting to 5.043 t ha-1 with an increase of 9.39%, while the treatment of no spraying recorded the lowest The average amount was 4.610 tons/ha. The reason for the increase in grain yield may be attributed to the increase in the number of fertile ears (Table 2) due to spraying with ethephon, in addition to its role in increasing the number of grains in the spike (Table 3), which compensated for the decrease in the weight of 1000 grains (Table 3) (4). This result is consistent with the findings of (Safi, 2014), (Al-Zubaidi et al., 2016), (Jaddoa 2017) and Ahmad et al. (2020) and (Al-Samer, (2022).

Reformulate no significant effect of the interaction between the cultivars and the spraying of plants with ethephon on the grain yield trait.

Table (5) Effect of cultivars, ethephon, and their interaction on grain yield (t ha^{-1})

cultivar	Ethephon levels ml l^{-1}		cultivar average
	A0	A1	
Al-Baraka	4.960	5.210	5.085
Al-Rasheed	4.570	4.830	4.700
Ibaa-99	4.910	5.150	5.030
Babil	3.860	4.573	4.217
Mawaddah	5.027	5.620	5.323
Bohouth-22	5.380	5.923	5.652
Bengal	4.220	4.750	4.485
Jad	4.400	4.810	4.605
Wafeya	4.860	5.180	5.020
Jihan	3.910	4.380	4.145
Ethephon average	4.610	5.043	
Lsd $_{0.05}$			
cultivar	Ethephon levels		Interaction
0.5833	0.2609		N. S

4-5- Harvest Index (%)

The results of Table (6) showed that there was a significant difference in the trait of harvest index among the cultivars included in the study, as Bohouth-22 scored the highest average for this trait, which amounted to 35.21%, and 32.22 and

31.85%, respectively, while the Jihan cultivar recorded the lowest average for the index of harvest of 27.94% and did not differ significantly from Babil, Jad, Bengal and Mawaddah cultivars whose averages reached 28.00, 29.71, 30.25 and 30.65%. The description of the harvest guides the difference in the characterc of the grain yield Table (5) and the description of the biological yield, as the varieties differ in their efficiency in the distribution of materials resulting from the carbon metabolism process and their transfer from the source to the estuary. This result corresponds to (Al-Abdullah, 2015) and (Al-Jabri, 2020) and (Al-Fahdawi, 2021), who indicated that the varieties differ in the character of the harvest guide.

Table (6) showed no significant effect of spraying with ethephon and the interaction between the factors included in the study in the trait of harvest index.

Table (6) Effect of cultivars, ethephon, and their interaction on harvest Index (%)

Cultivar	Ethephon levels ml l^{-1}		cultivar average
	A0	A1	
Al-Baraka	34.55	31.48	33.02
Al-Rasheed	32.49	31.96	32.22
Ibaa-99	32.29	31.42	31.85
Babil	26.72	29.29	28.00
Mawaddah	29.41	31.89	30.65
Bohouth-22	34.30	36.12	35.21
Bengal	30.09	30.40	30.25
Jad	30.99	28.43	29.61
Wafeya	34.34	31.55	32.95
Jihan	28.67	27.21	27.94
Ethephon average	31.38	30.95	
Lsd $_{0.05}$			
Cultivar	Ethephon levels		Interaction
3.418	N. S		N. S

4-6- Protein content in grains (%)

The results of Table (7) confirm the existence of a significant difference in the character of the protein content in the grains, where the Babil cultivars excelled by recording the highest average for this trait, amounting to 13.43%. It did not differ significantly from the Bengal, Jihan, Al-Rasheed, Wafeya, Al-Baraka and Abaa-99 cultivars, whose averages reached 13.27.

12.93, 12.78, 12.78, 12.70 and 12.45%, respectively, while the Mawaddah variety gave the lowest average of 11.22% and did not differ significantly in the percentage of protein from the Gad variety, which averaged 11.65%, and the reason for this difference may be because the percentage of protein in cereals is one of the traits. Genetic and that the difference between the studied cultivars in their genetic makeup leads to a difference in their protein content as well as the inverse relationship between grain yield and protein content (McNeal et al., 1972), as the cultivars that recorded the highest grain yield in Table (13) gave the lowest protein percentage in their grain, This result was confirmed by what was found by (Al-Aboudi, 2019), (Al-Jaw'ani, 2020) and (Al-Salami, 2021) that the varieties differ in the percentage of grain protein due to their different genetic structures.

It was noticed from Table (7) that there was a significant difference between the plants sprayed with ethephon and the non-spray treatment, as the plants sprayed with ethephon excelled in the character of the percentage of protein in the grains, which recorded the highest mean of 13.63% compared with the non-spray treatment that gave the lowest mean for this trait amounted to 11.48%. The reason for the increase in the percentage of protein in grains when treating wheat varieties with ethephon may be attributed to its role in increasing the leaf area of plants, in addition to the role of ethephon when sprayed on plants in increasing the percentage of chlorophyll in the leaves, which is one of the most important factors involved in the photosynthesis process (Al-Safi, 2014). Thus, the amount of the produced materials increases, which in turn leads to an increase in the proportion of protein. our results agreed with what was found (Al-Safi, 2014) that spraying ethephon on plants led to an increase in the proportion of protein in the grains.

The results of Table (7) showed that there was no significant effect of the interaction between the cultivar factor and the ethephon spray factor on the protein content of the grains.

Table (7) Effect of cultivars, ethephon, and their interaction on protein content in grains (%)

cultivar	Ethephon levels ml l^{-1}		cultivar average
	A0	A1	
Al-Baraka	12.27	13.13	12.70
Al-Rasheed	11.83	13.73	12.78
Ibaa-99	11.17	13.73	12.45
Babil	11.67	15.20	13.43
Mawaddah	10.50	11.93	11.22
Bohouth-22	10.87	13.80	12.33
Bengal	12.53	14.00	13.27

Jad	10.73	12.57	11.65
Wafeya	11.63	13.93	12.78
Jihan	11.63	14.23	12.93
Ethephon average	11.48	13.63	
Lsd $_{0.05}$			
cultivar	Ethephon levels		Interaction
1.057	0.473		N. S

4-7- Wet gluten (%)

The results of Table (8) show that the cultivars differed significantly in the character of the percentage of wet gluten. The Babil cultivars recorded the highest average for this trait, which reached 32.78%. It did not differ significantly from the Bengal, Wafeya, Al-Rasheed, Jihan and Al-Baraka cultivars, whose averages reached 32.09, 31.87, 31.02, 30.87 and 30. .02%, respectively, while the Mawaddah cultivar gave the lowest wet gluten ratio, with an average of 27.10%, and did not differ significantly from Jad cultivar, which had an average of 28.16%. This is determined by the genetic structure of the cultivar, as gluten is part of the protein and has a positive correlation with it, as the percentage of wet gluten in the dough reflects the percentage of protein. It is one of the good indicators of the quality of the variety's grain (Fadl et al., 2010). This result agrees with what was reached (Al-Jawani, 2020), (Al-Jiashi, 2020) and (Al-Fahdawi, (2021).

The results of Table (8) proved that the plants sprayed with ethephon significantly outperformed the non-sprayed plants, as the plants sprayed with ethephon gave the highest average of wet gluten, amounting to 33.18%. The non-spray treatment recorded the lowest average for this trait, amounting to 27.55%. The reason may be attributed to the role of ethephon in Increasing the percentage of protein in cereals Table (7), and thus the percentage of wet gluten in the resulting flour increases after grinding the grains.

Table (8) showed a significant interaction between wheat cultivars and spraying treatment with ethephon, as Babel cultivar, after spraying with ethephon, recorded the highest average of 37.34%. In contrast, the unsprayed Mawaddah cultivar recorded the lowest wet gluten, averaging 25.19%.

Table (8) Effect of cultivars, ethephon, and their interaction on Wet gluten (%)

cultivar	Ethephon levels mlL^{-1}		cultivar average
	A0	A1	
Al-Baraka	29.71	31.23	30.47
Al-Rasheed	28.58	33.45	31.02
Ibaa-99	26.89	33.47	30.18

Babil	28.21	37.34	32.78
Mawaddah	25.19	29.01	27.10
Bohouth-22	26.15	33.71	29.93
Bengal	30.57	33.60	32.09
Jad	25.81	30.51	28.16
Wafeya	28.01	34.11	31.06
Jihan	26.34	35.39	30.87
Ethephon average	27.55	33.18	
Lsd $_{0.05}$			
cultivar	Ethephon levels		Interaction
2.439	1.091		3.450

Conclusions

The study shows the wheat cultivars vary in the character of the grain yield through the variation in the components of the yield and the existence of a difference in the qualitative characteristics. Also, it concluded that spraying wheat plants with ethephon increases grain yield and improves its quality by increasing the proportion of protein and wet gluten.

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