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Effect of glutamine and proline spraying on some qualitative and physiological characteristics of soft wheat genotypes. Triticum aestivum L.

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Abstract: A field experiment was carried out during the winter season of 2021 in one of the farmers' fields (The al-Batira area is 20 km away from the center of Maysan Governorate) in soil with a silty loam soil texture to know the effect of spraying by glutamine and proline on some Qualitative and physiological traits of soft wheat genotypes (Triticum aestivum L.). The experiment was implemented in a split-plot method using a randomized complete block design (R.C.B.D) with three repetitions. The experiment included a study of two factors; the first was spraying by the amino acids glutamine and proline: the control treatment spraying only distilled water; The second treatment was sprayed by glutamine amino acid at a concentration of 300 mg l^{-1}; the third treatment was sprayed amino acid proline at a concentration of 300 mg l^{-1}; the fourth treatment was a mixture of amino acid gluten + proline at a concentration of 150 mg l^{-1} for each. The second factor includes ten newly introduced genotypes from soft wheat, which are as follows; (Russian V10, ACSAD 133, ADANE 99, ACSAD 59, ACSAD 901, Iranian, Wafiya, Jad (Germanian), Jihan, Bohouth22). Spraying was in two batches, the first at elongation and the second at the flowering stage. The studied traits are total tillers number of plants, plant dry weight (Mg ha^{-1}), moisture percentage, a specific weight (kg ha^{-1}), ash content in grains (%), and flour protein percentage (%). The results were as follows: the cultivar plants outperformed it is Wafiya and gave the highest average of tillers number, which amounted to 436.39 m^2. The cultivar ACSAD 59 excelled in plant dry weight, giving the highest average dry weight of 9.2 Mg ha^{-1}; also, the cultivar ACSAD 133 excelled in the moisture percentage at a rate of 10.79%. The study showed that the genotype ACSAD 901 gave the highest average specific weight of the grain, amounting to 76.87 (kg hec^{-1}), while the genotype ACSAD133 was superior in terms of the percentage of ash in the grain and the percentage of protein in the grain, giving the highest averages of 1.13% and 12.05%. The study showed that the qualitative traits and the physiological could be improved by spraying the amino acids glutamine and proline, especially in the elongation and flowering stage. There was an improvement in the specific and physiological characteristics through spraying these acids and in such stages.

Introduction

Wheat (Triticum aestivum L.) is one of the important and strategic grain crops belonging to the Poaceae family. It represents a staple food for about a third of the world's population. It is considered the most important source of carbohydrates in most countries because it contains vitamins, fats, some mineral salts, and essential amino acids that humans need in their diet (Al-Maeini Al-Obaidi, 2018 and ELsahooke et al., 2021) provide the human body with approximately 25% of calories, carbohydrates, protein, and some acids. The increase in the cultivation of this crop took purpose of reaching self-sufficiency, as the cultivated area of the crop in Iraq for the year 2020 reached about 2143 hectares, with a productivity of 6.3 million tons. While the cultivated area in Iraq for the year 2021 amounted to 857,400 hectares, it produced 6,238.00 tons, with an average of 2.91 t ha^{-1} (Central Agency for Statistics and Information Technology, 2021).

Increasing productivity and working to improve the quality of the crop as a result of the nutritional need of the wheat crop, as most studies have confirmed that the increase in this productivity of crop results from the use of good seeds of cultivars and an increase in the efficiency of agricultural inputs (soil and crop service operations). Despite the serious endeavor by farmers to use newly approved and newly developed wheat cultivars in Iraq to increase productivity, there is still a real problem related to the quality characteristics of grains, especially gluten, which affects their ability to make bread, as most of the local varieties suffer from

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weak gluten in their grains. The functional properties of flour are largely dependent on gluten proteins. Protein is one of the important components in the grain of wheat and determines its suitability for different nutritional characteristics. Wheat gluten is 85-90%, as it produces the best type of bread and consists of protein substances such as Gliadin and Glutenin. It depends on the size of the loaf of bread, the elasticity of the dough and the amount of its swelling, and the degree of his discussion on the quantity of these two components, as the quality of wheat, is good when given a large loaf of acceptable taste and aroma (Dewettinck et al., 2008). The protein content and quality is one of the important measures for the different varieties of importance in determining the function of the final product, as the characteristics of the quality and protein composition of wheat are affected by the genetic factor and environmental conditions (Al-Jilawi, 2017).

Therefore, attention, focus and work began to increase crop productivity in quantity and quality by adopting the best scientific methods to implement crop service operations and working on an integrated system in adding foliar nutrients and fertilizers that contribute to increasing productivity and improving quality (Rollin, 2014).

Recently, attention has increased on the use of amino acids, including glutamine and proline, as glutamine is considered one of the most important amino acids that have an essential role in protein formation, stimulating the photosynthesis process, helping to repair damaged cells, and working to strengthen immunity. Proline is one of the acids an amino that exists in an accessible form and contains a second methyl group. The significant accumulation of proline in plant leaf cells changes the osmotic potential of plant tissue (Sterevaal, 2008; and Lotfietal2010).

Materials and methods

Study site

A field experiment was carried out during the winter season 2021-2022 in the Governorate of Maysan (Al-Batira area, 20 km from the city center) in soil whose chemical and physical specifications are shown in Table (1) to know the effect of spraying by glutamine and proline on some Qualitative and physiological traits of soft wheat genotypes (Triticum aestivum L.).

Table (1) shows the soil's chemical and physical properties before planting in 2021-2022.

Property		Unit	Value
Chemical properties	Electrical conductivity (ECe)	des. m^{-1}	3.4
	pH	-	7.3
	Av. Nitrogen	mg. g^{-1}	3.55
	Av. phosphorus		0.096
	Av. Potassium		0.026
Physical properties	Sand	g kg^{-1} soil	260
	Silt		600
	Clay		140
	Soil texture	-	Silty loam

*The analyzes were carried out in the laboratory of College of Marine Sciences, University of Basra.

Experience factors

The experiment involved studying two factors:

The first: - Sprayed the amino acids proline and glutamine as follows:

A- The control treatment is spraying with distilled water only, symbolized by A0.

B- The amino acid glutamine spray at 300 mg l^{-1}, symbolized by A1.

The first: - Sprayed the amino acids proline and glutamine as follows:

C- The amino acid proline spray at 300 mg l^{-1}, symbolized by A2.

D- Spray a mixture of amino acid glutamine and proline at a concentration of 150 mg l^{-1} for each, symbolized by A3.

The spraying is in two batches; the first is at elongation, and the second is at the flowering stage.

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The second: includes 10 genotypes cultivars of soft wheat (Russian V10, ACSAD 133, ADANE 99, ACSAD 59, ACSAD 901, Iranian, Wafiya, Jad (Germanian), Jihan, Bohouth22).

Experiment design:

The treatments were distributed in a split-plot method using a randomized complete block design (R.C.B.D) with three replicates. Each replicate contains 40 experimental units. The spray treatments were placed in the main plots, and the genotypes were placed in the subplots. The combination was randomly distributed among the factors on the experimental plots, as the number of experimental units was 10 x 4 x 3 = 120.

Studied characteristics

After completing the process of harvesting and threshing the grains and cleaning them for each experimental unit separately, measurements of the yield units were taken as follows:

Tillers number m^2

The total number of tillers was calculated from the area of the two medial lines and converted based on the square meter.

Plant dry weight (Mg ha$^{-1)}$

It was calculated based on the weight of all plant parts above the soil surface taken from the two middle lines after drying.

Moisture percentage (%)

The moisture content of wheat grain samples was estimated in the quality control laboratories affiliated with the Ministry of Commerce - the General Company for Grain Manufacturing, using the Grain Moisture Tester.

Specific weight (kg hecto^{-1})

A hectoliter weight type mld-100 measured the specific weight, the size of a quarter of a liter, in the quality control laboratory of the Ministry of Commerce - the General Company for Grain Manufacturing, after which the results were converted to kg hectoliter^{-1} according to the instructions of the device.

Measurement of ash content in the grain (%)

The protein content and ash content of wheat grain samples were estimated using the standard method described by AACCI Method 39-10.01 using the Infrarmatic device equipped by Perten company using NIR infrared technology to estimate the protein content in small grains in the quality control laboratory of the Ministry of Commerce - State Company grain manufacturing.

Flour protein content (%)

The percentage of flour proteins was examined according to the standard method AACCI Method 39-10.01 using the Infrarmatic device equipped by Perten, which is the infrared reflection (NIR) in the laboratory of the General Company for Grain Manufacturing - by taking an amount of 15 g of the flour sample and placing it in a special glass column for preservation. The sample is placed in the place designated for it in the device. Then the device is left for a short period to obtain the result.

Results and Discussion

Tillers number m2

The results of Table (2) showed that there were significant differences between the genotypes of this trait, as the cultivar, Wafiya gave the highest average number of total strokes, amounting to 436.39 tillers m2, followed by the German Jad genotype and then the Russian V 10 genotype, which gave two averages of 418.43 and 411.21 tillers m2, respectively. When the genotype ACSAD 133 gave, the lowest rate for this trait amounted to 347.52 tillers m2 without significant difference from Bohouth 22 cultivar, which reached 358.67 tillers m2. The difference in cultivars in this trait may be due to the nature of the genetic makeup of the cultivars and their ability to form buds that determine the number of lateral branches and the extent of their ability to produce tillers. These results agreed with the findings of Al-Dulaimi (2018), Abdel-Wahed (2016), and Mikhlif (2019). It was noted from the results of Table (2) that the addition of amino acids showed significant differences between the concentrations, as the addition of a mixture of amino acids consisting of (150 mg l^{-1} glutamine and 150 mg l^{-1} proline) gave the highest average number of metabolites amounted to 414.35 tillers m^2, with a significant difference from the two concentrations of 300 mg l^{-1} glutamine and the concentration 300 mg l^{-1} Proline, which gave averages of 379.66 and 388.50 tillers m^2 respectively, while the concentration of spraying distilled water gave the lowest average number of tillers of 362.98 tillers m^2. The reason may be attributed to the important role of amino acids in improving and increasing the vegetative growth of the plant and thus increasing the formation of tillers, and this is consistent with what Al-Qaisi et al. (2017) and Baqir and Al-

Naqeeb (2019) found that spraying amino acids produced significant and apparent differences in the number of tillers.

The interaction, the combination excelled (ACSAD 901×A3, a mixture of amino acids 150 mg glutamine and 150 mg proline) by giving the highest average number of tillers, which reached 508.73 and without significant difference with some combinations. In contrast, the combination between the genotype (Jihan × concentration of A0 spraying with distilled water) gave the lowest average number of tillers was 252.26, and the reason for this is due to the joint role of the two acids in stimulating vegetative growth, which is reflected in the increase in the formation of tillers.

Table (2) effect of genotypes and amino acid spraying and their interaction on tillers number m^2

A/G		Genotypes (G)										Average
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	
Amino acids (A)	A0	375.62	362.92	332.17	377.42	358.22	330.42	403.07	385.04	252.26	374.46	362.98
	A1	433.76	305.03	364.27	403.81	391.67	344.57	417.44	436.07	374.17	355.42	379.66
	A2	434.36	353.00	373.33	379.43	338.75	373.78	454.48	444.19	405.68	359.85	388.50
	A3	401.10	369.12	380.37	483.02	508.73	388.60	470.57	408.43	415.62	344.97	414.35
Average		411.21	347.52	362.54	410.92	399.34	359.34	436.39	418.43	361.93	358.67	
Treatments		A			G			A*G				
LSD 0.05		24.80			26.33			52.66				

Plant dry weight Mg ha^{-1}

It was noted from the results of Table (3) that the genotype of ACSAD 59 was superior to the rest of the genotypes by giving the highest average dry weight of 9.29 µg ha^{-1} without a significant difference from the cultivar Wafiya and the Russian V10 genotype, which gave averages of 9.25 and 9.18 µg ha^{-1}, respectively. At the same time, Jihan cultivar gave the lowest average of 8.06 µg ha^{-1}, without a significant difference from Bohouth 22, which gave an average of 8.11 µg ha^{-1}. The reason may be attributed to the difference in its ability to accumulate dry matter due to the difference in a number of growth characteristics due to the difference in its genetic makeup (Abdul-Moghni, 2001). These are consistent with the findings of Al-Refai (2015) and Mondal et al. (2015).

The results also showed in the same Table that there were significant differences when adding amino acids in several concentrations, as the mixed spray concentration (150 mg glutamine with 150 mg proline) gave the highest mean dry weight of 9.50 µg ha^{-1}, while the spraying treatment with distilled water gave the lowest average of 8.20 µg. g h^{-1}. The reason for the increase in plant dry weight when spraying with amino acids compared to the comparison treatment that gave the lowest average plant dry weight is due to the role of amino acids as a source of nitrogen and organic sulfur. Amino acids work to improve and increase the absorption of nutrients and water and estimate the rate of assimilation of carbon, which leads to an increase in dry matter and an increase in the outputs of this process, which are used in the growth and development of tillers, and then an increase in the number of tillers (Table 2), which is reflected in the dry weight of the plant.

The results showed that the interaction between genotypes and spraying concentrations of amino acids had a significant effect on the dry weight of the plant, as the combination (cultivar Wafiya × mixture of amino acids 150 mg l^{-1} glutamine with 150 mg l^{-1} proline) gave a higher average plant dry weight it reached 12.68 µg ha^{-1}. Moreover, a non-significant difference from the combination (ACSAD 59 × an amino acid mixture of 150 mg l^{-1} glutamine and 150 mg l^{-1} amino acid proline) gave a crop growth rate of 12.91 µg ha^{-1}. In contrast, the combination between the cultivar (Jihan × concentration of spraying with distilled water) gave the lowest average plant dry weight of 6.59 µg ha^{-1}, with a non-significant difference from the combination (Wafiya × concentration of spraying with distilled water), which gave an average plant dry weight of 7.00 µg ha^{-1}(Table 3).

A/G	Genotypes (G)	Average

		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	
Amino acids (A)	A0	9.62	8.42	8.04	8.58	8.12	7.76	7.00	8.20	6.59	8.46	8.20
	A1	9.61	10.93	7.45	8.55	7.17	10.28	8.68	7.99	8.61	6.71	8.76
	A2	8.98	8.36	8.17	7.60	8.71	9.16	8.63	7.50	7.84	8.67	8.49
	A3	8.53	7.96	9.33	12.41	9.26	9.31	12.68	9.66	9.21	8.61	9.70
Average		9.18	8.92	8.25	9.29	8.32	9.13	9.25	8.34	8.06	8.11	
Treatments		A				G			A*G			
LSD 0.05		0.57				0.58			1.16			

Table (3) effect of genotypes and amino acid spraying and their interaction on Plant dry weight Mg ha^{-1}

Moisture percentage (%)

It was noted from the results in Table (4) that the genotypes had a significant effect on grain moisture, as the cultivar ACSAD 133 recorded the highest average grain moisture of 10.79%, and it did not differ significantly from the two cultivars, Wafiya and ADANE 99, while the German Jad cultivar gave the lowest average for this trait, amounting to 8.66%. Significantly different from the Russian cultivar V10. The reason for the variation in the genotypes of wheat may be in the ratio of moisture to the chemical composition of the wheat grain and the degree of hardness of the grain, as well as the genetic factors affecting moisture content of the wheat grain in addition to hydroscopic nature of the wheat grain. Ijaz et al. (2001) showed that wheat grains have living tissues and a hydroscopic nature. Therefore, the moisture content is greatly affected by the prevailing climatic conditions, such as humidity and temperature during the harvest period, with hard wheat grains, and these results were consistent with what Ali et al. (2018) found, which showed that the genotypes of wheat differ among themselves in the moisture content of its grains.

It was found from the same Table that there were significant differences in the spraying of amino acids, where the mixed concentration A3 (150 mg l^{-1}glutamine 150 mg l^{-1} proline) gave the highest average humidity of 10.6% and a significant difference from the other concentrations, while A0 (spraying with distilled water) gave the lowest average of these The adjective reached 8.70%.

As for the interaction between the two factors, the results showed a significant interaction in the percentage of grain moisture. The combination (Wafiya cultivar A3 × mixture of 150 mg l^{-1} glutamine 150 mg l^{-1} proline) gave the highest average moisture content of 12.70%, with a slightly significant difference from the cultivar ACSAD 133 and the ADANE 99 cultivar. While the combination gave the cultivar Jad with A0 spraying treatment with distilled water, the lowest average moisture content was 6.96%. These results were similar to the results of the factors, which are individual, which means that the reasons discussed above are the same in the interaction results.

Table (4) effect of genotypes and amino acid spraying and their interaction on Moisture percentage (%)

A/G		Genotypes (G)										Average
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	
Amino acids (A)	A0	7.70	9.58	9.19	8.70	9.42	9.22	7.85	6.96	10.58	9.17	8.70
	A1	9.81	10.23	9.74	10.41	10.57	9.74	9.61	9.23	10.15	9.19	9.83
	A2	9.08	11.47	9.92	9.30	9.18	9.62	9.85	9.16	9.97	11.76	9.89
	A3	9.20	11.88	11.15	10.59	8.90	8.86	12.70	9.30	8.33	9.18	10.06
Average		8.95	10.79	10.00	9.75	9.52	9.36	10.01	8.66	9.76	9.82	
Treatments		A				G			A*G			
LSD 0.05		0.73				0.69			1.39			

Specific weight (kg hect^{-1})

It was noted from Table (5) a significant difference between the genotypes in the first season of the study, as the highest specific weight was recorded for the genotype ACSAD 901, without a significant difference for the genotype Jad, whose averages were 76.87 and 76.22 kg hec^{-1}, respectively, while the cultivar recorded ADANE 99 had the lowest average of 72.69 kg hec^{-1} without a significant difference from the ACSAD 133 which gave an average of 72.85 kg hec^{-1}. The variation in the specific weight of the cultivars may be due to the different percentages of the chemical composition of the grains. It has been indicated that the high protein content in the grains has a negative effect on the specific weight. Relatively less qualitative than the cultivars with the lowest protein content, and this is consistent with a number of researchers who indicated that the specific weight of grain differed in different cultivars (Fadel et al., 2005; El-Khayat et al., 2006; Muhammad et al., 2016; and Al-Jayashi, 2020).

Table (5) showed that there were significant differences between the spray concentrations of amino acids, where A2 gave the concentration of proline 300 mg l^{-1} the highest average specific weight of 76.05 kg hec^{-1} with a slightly significant difference from the mixed concentration of amino acids A3 (150 mg l^{-1} glutamine 150 mg l^{-1} proline). While the concentration of spraying with distilled water gave the lowest mean of 73.76 kg hec^{-1}. The reason for the increase in the specific weight of most cultivars may be attributed to their response to the positive effect of amino acids and their role in the biosynthesis of a large variety of non-protein nitrogenous substances such as pigments, vitamins and coenzymes and their effect on the activity of physiological processes and plant growth and thus on production and quality Mohamad, (2006) as well as their work in general As a biostimulant on the growth of leaves and roots and increase plant resistance to unfavorable conditions Calvo et al. (2014).

Table (5) effect of genotypes and amino acid spraying and their interaction on Specific weight (kg hect^{-1})

A/G		Genotypes (G)										Average
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	
Amino acids (A)	A0	70.70	70.18	70.37	75.89	74.18	75.69	75.37	74.46	75.08	75.09	73.76
	A1	76.46	71.34	73.63	75.77	75.71	73.64	75.79	77.11	76.28	74.75	74.78
	A2	76.97	73.58	73.20	75.66	78.60	76.96	75.68	77.53	76.29	75.38	76.05
	A3	77.97	76.30	73.57	76.08	78.98	74.31	73.75	75.76	75.55	76.22	75.72
Average		75.53	72.85	72.69	75.85	76.87	75.15	75.15	76.22	75.80	75.36	
Treatments		A				G				A*G		
0.05 LSD		0.57				1.72				NS		

The percentage of ash in the grain (%)

It was observed from Table (6) that the genotype of ACSAD 133 was significantly superior to the rest of the genotypes by giving the lowest ash percentage in the flour, amounted to 1.13%, while the cultivar Wafiya gave the highest percentage of ash amounted to 1.36%, and with a non-significant difference with some genotypes, and this may be due to the difference in cultivars In ratio of ash in grain to nature of growth of genotypes and the efficiency of photosynthesis and the accumulation of dry matter, especially in the stage of grain fullness, which is reflected in specific weight and weight rate of grain. This result agreed with Fadl et al. (2010) and Al-Jayashi (2020), who indicated that wheat cultivars differed in their ash content. The reason for the variation of wheat cultivars in the ash percentage may be due to the different concentrations absorbed in the nutrients by these cultivars, and this is due to the reductive capacity of the roots (Al-Nouri, 2005).

From the same Table, it was found that a significant difference was found in the ash content of grains when spraying plants with amino acids. Spraying with proline acid A2 at a concentration of 300 mg l^{-1} gave the lowest average ash content in grains, reaching 1.21%, with a non-significant difference from spraying with an A3 mixture of (150 mg l^{-1} glutamine and 150 mg l^{-1} proline), while the treatment of spraying with distilled water gave the highest average ash percentage of 1.30%. This indicates that spraying wheat plants with proline acid positively affected the average ash percentage (%) in grains, which is consistent with the results of Al-Qazzaz (2010), which showed that spraying proline acid improved the quality characteristics of wheat grains. These findings are in line with Abouel-Nader (2019).

Table (6) effect of genotypes and amino acid spraying and their interaction on the percentage of ash in the grain (%)

A/G		Genotypes (G)										Average
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	
Amino acids (A)	A0	1.32	1.14	1.39	1.24	1.25	1.36	1.53	1.27	1.41	1.15	1.30
	A1	1.29	1.08	1.32	1.22	1.28	1.24	1.39	1.21	1.31	1.30	1.26
	A2	1.26	1.07	1.19	1.21	1.12	1.23	1.28	1.26	1.19	1.25	1.21
	A3	1.17	1.21	1.26	1.19	1.20	1.14	1.24	1.16	1.29	1.45	1.22
Average		1.26	1.13	1.29	1.22	1.21	1.24	1.36	1.23	1.30	1.29	
Treatments		A		G			A*G					
0.05 LSD		0.05		0.11			NS					

Flour protein percentage (%)

The protein and gluten content of wheat grains are important indicators of their quality. It was noted from the results in Table (7) that the wheat flour produced from different cultivars varied significantly in its protein content. In the first season, the genotype flour ACSAD 133 was distinguished by giving the highest average protein percentage of 13.33%, while the flour of Bohouth 22 gave the lowest average of 9.95%. The reason for the discrepancy in the flour of cultivars in its protein content may be due to the difference in their grains in the proportions of protein, which is due to the difference in their genetic makeup and to the difference in the ability of their roots and even the vegetative parts to absorb and transfer nutrients, especially nitrogen, as well as the variation in the efficiency of the vegetative system of different cultivars. This result agreed with the results of Seddik et al. (2017) and Al-Jayashi (2020) showed that wheat varieties differed in their response to the milling process, depending on their genetic makeup and climatic conditions.

The results in the same Table showed that the wheat flour resulting from the addition of amino acids differed significantly in its flour protein content, as it gave the mixed concentration A3 between (150 mg l^{-1} glutamine and 150 mg l^{-1} proline) the highest proportion of flour protein amounted to 12.00% and with a slightly significant difference from the two concentrations of glutamine and proline. In contrast, the treatment of spraying with distilled water only (A0) gave the lowest average protein percentage of 10.30%. The addition of free amino acids is a primary nitrogen source in the construction of proteins and enzymes and stimulates energy for vital activities (Mohamed et al., 2015), and this was reflected positively in increasing protein formation. These results were spent with Al-Qaisi et al. (2017), who indicated the significant effect of amino acids in increasing flour's protein content (Table 7).

As for the interaction between the two factors, significant differences were found in the percentage of flour protein. The combination (genotype ACSAD 133×A3 mixture (150 mg l^{-1} glutamine × 150 mg l^{-1} proline) gave the highest average protein percentage of 14.48%, with a significant difference from the rest of the genotypes. The cultivar combination (Bohouth 22 × A0 spraying with distilled water) gave the lowest average protein of flour, which amounted to 8.71%, without a significant difference from the genotype Jihan, which gave an average protein of 9.77%. This is probably due to the joint role of the two acids in increasing the formation of amino acids, which are the basis for building protein.

Table (7) effect of genotypes and amino acid spraying and their interaction on Flour protein percentage (%)

A/G		Genotypes (G)										Average
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	
Amino acids (A)	A0	10.60	12.06	11.01	10.86	10.10	9.92	9.56	10.30	9.77	8.71	10.30
	A1	13.29	13.16	11.11	11.37	10.76	12.01	11.93	11.72	11.97	9.82	11.72
	A2	11.54	13.63	11.25	11.95	11.65	11.42	10.69	11.87	10.34	10.18	11.56
	A3	12.50	14.48	11.92	11.46	12.94	10.41	12.67	12.14	12.21	11.10	12.00
Average		11.98	13.33	11.32	11.41	11.36	10.94	11.21	11.51	11.07	9.95	
Treatments		A			G			A*G				
LSD 0.05		0.28			0.46			0.92				

References

1. **Abdel-Moghni, A. M. T. 2001.** The effect of galtar and ethephon on the growth and yield of some wheat cultivars, Triticum aestivum L. Ph.D. thesis - College of Agriculture - University of Baghdad.
2. **Abdul-Wahid, S. N. 2016.** The role of nitrogen in yield and its components for several bread wheat cultivars. Master's thesis - Department of Field Crops - College of Agriculture - University of Baghdad.
3. **Abu-Al-Nadr, E. I. M. 2019.** Response of cultivars of bread wheat (Triticum aestivum L.) to levels of nitrogen fertilizer and irrigation under gypsum soil conditions. Ph.D. thesis - Department of Field Crops - College of Agriculture - University of Tikrit.
4. **Al-Dulaimi, H. A. 2018.** Response of bread wheat (Triticum aestivum L.) to spraying with amino acids on growth, yield, and quality. Ph.D. thesis. Field Crops Department - College of Agriculture - Anbar University. Iraq.
5. **Al-Gayashi, A. A.H .2020.** Effect of planting dates on some growth, yield, and quality characteristics of several wheat genotypes (Triticum aestivum L.). Ph.D. thesis. Faculty of Agriculture. Muthanna University
6. **Al-Moaini, I. H. A., and Muhammad, O. G. O. 2018.** Scientific foundations for managing, producing, and improving field crops. Ministry of Higher Education and Scientific Research. Al-Qasim Green University. p. P: 1067
7. **Al-Nouri, M. A. A. 2005.** Effect of nitrogen fertilization and supplemental irrigation on the growth, yield, and specific characteristics of some local cultivars of bread wheat (Triticum aestivum L.). Ph.D. dissertation. College of Agriculture and Forestry - University of Mosul.
8. **Al-Qaisi, W. A., Rahaf, W. ., Eman, H. H., and Zina, T. A. 2017.** Response of wheat Triticum aestivum L. to foliar spraying with tryptophan on some growth and yield indicators. Journal of the College of Basic Education - Al-Mustansiriya University, 23 (97): 95-104.
9. **Al-Qazzaz, A. G. M.2010.** The effect of spraying with proline acid on the tolerance of wheat plant Triticum aestivum L irrigated with saline water. Master's Thesis, College of Education - Ibn Al-Haytham, University of Baghdad - Iraq.
10. **AL-Refai, S. I. M. 2015.** Evaluation of the productivity of promising Genotypes of bread wheat in two locations. European Academic Res. (2):12762-12775.
11. **Baqir, H. A., & Al-Naqeeb, M. A. S. 2019.** Effect of some amino acids on tillering and yield of three bread wheat cultivars. The Iraqi J. of Agric. Sci., 50:20-30.
12. **Calvo, P.; Nelson, L.; Kloepper, J.W. 2014.** Agricultural uses of plant biostimulants. Plant Soil, 383, 3–41. [CrossRef].
13. **Central Agency for Statistics and Information Technology. 2021. Annual Report of Wheat Production. Ministry of Planning and Development Cooperation. The Republic of Iraq**.
14. **Dewettinck, K.; Van Bockstaele, F.; Kuhne, B.; Van de Walle, D.; Courtens, T. M. and Gellynck, X.2008.** Nutritional value of bread: Influence of processing, food interaction and consumer perception. J. Cereal. Sci., vol. 48, pp. 243-257..
15. **El-Khayat, G.H., Samaan. J., Manthey. F.A., Fuller. M.F., Brennan. C.S. 2006.** Durum wheat quality: I. some physical and chemical characteristics of Syrian durum wheat genotypes, International Journal of Food Science and Technology, 41:1-8.
16. **Elsahookie, M. M.; S. H. Cheyed and A. A. Dawood. 2021.** Review: Characteristics of Whole Wheat Grain Bread Quality. Systematic Reviews in Pharmacy, 12(1): 593-597.
17. **Fadel, J. A., Saud, R. A., Farouk, F. A., and Ahmed, S. S. 2005.** Some physical and chemical characteristics of a number of Iraqi wheat varieties and their relationship to the characteristics of the resulting bread. Agricultural Science Studies, Volume 32, Issue 1, 2005
18. **Fadl, J. A., Mutahar, S. S., and Muhammad, A. H. 2010.** A comparison of some local and imported wheat varieties' physical, chemical, and rheological characteristics. Department of Food Science. Faculty of Agriculture. Sanaa University. Yemen, Volume 13, Issue 37: 2-52.
19. **Mikhlif, M. K. 2019.** Effect of spraying time with amino acids on the growth, yield, grain quality, and milling of approved varieties of bread wheat (Triticum aestivum L.). Ph.D. thesis. Field Crops Department, College of Agriculture, Tikrit University, Iraq.

20. **Mohamed, A.M., .2006.** Effect of Some Bio-chemical Fertilization Regimes on Yield of Maize. M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt, pp: 70-177.
21. **Mohamed, R.., Ghassan, N., and Rabab, S. 2016.** A study of some physical and chemical properties of some Syrian durum wheat cultivars. Tishreen University Journal for Research and Scientific Studies - Biological Sciences Series, Volume (38), Issue.(1)
22. **Mondal, H.; S. Mazumder.; S.K. Roy.; T.A. Mujahidi and S.K.Paul .2015.** Growth, Yield, and Quality of wheat varieties are affected by different nitrogen levels. Bangladesh Agron. J.18 (1)89-98.
23. **Muhammad, I., S. Ahmed, S. Abdul, H. Wassem and N. Muhamma .2015.** Cumulative Effect of Biochar, Microbes, and Herbicide on Growth and Yield of Wheat Triticum aestivum L. Pat. J. Life Soc., 2221-7630; 1727-4915
24. **Ozturk, A., and Aydin, F. 2004.** Effect of water stress at various growth stages on some quality characteristics of winter wheat. J.Agron. Crop Sci.190: 93-99.
25. **Rollin, G. S. 2014.** Wheat Breeder, Agronomy Wheat Production Handbook. Kansas State Research and Extension, Manhattan, Kansas; pp: 2-7.
26. **Siddig, F. E. A., Hussein, K. A., and Mohsen, A. A. J. 2017.** Effect of different levels of nitrogen fertilizer on some qualitative traits of bread wheat (Triticum aestivum L.) cultivars. Tikrit University Journal of Agricultural Sciences - a special issue of the proceedings of the Sixth Scientific Conference of Agricultural Sciences, March 28-29.