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Evaluation Of Some Qualitative Traits And Quality Of Flour For Several Cultivars Of Bread Wheat By The Effect Of Humic Acid And Storage Periods

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Abstract

In this study, ten genotypes of bread wheat (Jihan, Adana, Aras, Aksad, Clark, Florka, Tham 6, Alaa, IPA 99, Rizkari) were used under the influence of three levels of humic acid (without, 20 and 40 kg ha-1) during season 2019-2020, Where the experiment was applied in the fields of a farmer in Kirkuk province. Five genotypes with high growth traits and yield were selected (Rizgary, Jihan, IPA 99, Alaa, Clark) for the purpose of storing their grains in jute bags for three periods (after 3 months, after 6 months, after 9 months of storage) in addition to the non-storage to study the quality and quality characteristics (percentage Protein, wet gluten percentage, dry gluten percentage, sedimentation, ash percentage, specific weight and extraction percentage). The most important results were reached: the presence of significant differences for the study factors and their bi-interaction for all the studied traits except for dry gluten for humic factor and the interaction between humic and cultivars for dry gluten and specific weight and the interaction between storage periods and cultivars for protein and ash content. As for the interaction between humic levels and storage periods, it was only significant for the percentage of ash and sedimentation. The Rizgary cultivar was excelled in the traits of protein content (13.2%), specific weight (78.44 $kg.ha^{-1}$), and extraction percentage (75.00%) and Clark cultivar in the trait of wet gluten (39.42%) and dry gluten (39.42%, 13.14%),The fourth storage period was excelled on the percentage of ash (1.84%), the third level of humic acid, and the first storage period for most of the studied traits, as well as the significantly of the third level of acid in its interaction with the cultivar Jihan for sedimentation trait (36.13 ml).The interaction between storage periods and cultivars was non-significant for protein and ash ratio, and this means that cultivars exhibited similar behavior in these traits on the one hand, and on the other hand, there was no significant difference between the first and second storage period in its interaction with Clark cultivar for the ratio of wet and dry gluten. Therefore, it is possible to focus on the maintenance and propagation of cultivars with high protein content and sedimentation value in order to improve these traits of the varieties that are excelled in yield, to improve the specific traits and quality of flour, and to pay attention to the two cultivars, Rizgary and Clark, and to preserve them from mixing for the sake of expanding their cultivation and taking care of them in the future.

Key words: bread wheat, genotypes, humic acid levels, storage periods.

Introduction

Triticum aestivum L. is one of the most important and widespread grain crops, representing 17% of the total cultivated area in the world. One-third of the world's population depends on it for food security, and its production exceeds all other grain crops and is grown within a wide range of environmental differences. The quantity and quality of protein in wheat are one of the most important measures adopted in determining the quality of its close relationship to the quality of the product, Its protein content of amino acids also represents an important feature in determining the nutritional value. In general, proteins are nutritionally incomplete due

to the low percentage of their content of some essential amino acids important in human nutrition, especially lysine and tryptophan. Therefore, the percentage of decrease of these two acids in the Gliadin fraction, which constitutes approximately 50% of the total nitrogen in mature grains, but is rich in glutamine and proline (Bicar et al., 2008). The total estimates indicate the cost of grain loss due to damage caused by insects and microorganisms in grain stored in developing countries and ranged annually from 500 to billion dollars, so the method of grain storage occupies an important place in the economies of developing countries. Whereas, the traditional and inappropriate methods of grain storage may cause significant losses in the physical and chemical properties of the seeds. The storage of wheat is of great importance in the countries that produce and consume it alike, and the economic importance of storing grains increases in the countries with an increasing population. The grain it produces is not equal to the grain it consumes, which necessitates importation and then storage, and it is a basic means that the state relies on to guarantee its residents their food needs (Hassan, 2017).Humic acid is a naturally produced organic acid with a high solubility in water. It is a humic substance that results from the decomposition of organic matter. It lowers the pH of the soil, which increases the plant's ability to absorb nutrients. This leads to an increase in the strength of the growth of the root system and its improvement through increasing the dry and wet weight and increasing the lateral branches of the roots, (Kandil et al. 2016). Among the previous studies that dealt with the performance of cultivars urging the effects of humic acid and storage periods and their interaction is the study of Saida et al. (2010), where the storage periods significantly affected the moisture content of wheat and did not significantly affect protein and gluten, Aldesuquy et al. (2012) found when spraying wheat plants with the amino acid Glycine betaine (GB) showed a significant increase in protein content in the grains of four types of bread wheat (Sakha94, Sensitive, Sakha93, and Resistance), Drromantiene et al. (2013) found that the effect of wheat amino acids improved its quality by increasing the protein and gluten percentage of the grains. Bakry et al. (2013) indicated that wheat treated with humic acid increased the protein content. The study showed Lee Irena and Gvidas (2013) when spraying amino acids with different concentrations on (Sirvinat-1) a significant effect on the sedimentation value when using amino acids at a concentration of (0.5-2.0%), as it achieved a significant increase in the sedimentation 3-4 ml . Attia et al. (2014) observed that increasing the storage periods of wheat grain led to a significant increase in storage efficiency. Saadoun (2015) found that the storage periods of rice grains (barley and white) had a significant effect on the efficiency of grain storage and the quality and quality of the grains, Muhammad (2015) indicated that the storage periods of wheat grains had a significant effect on protein and ash. Accordingly, this study aims to know the extent of the effect of qualitative traits and the quality of flour under the influence of storage periods and humic acid for some types of wheat bread.

materials and methods

A field experiment was conducted in the fields of a farmer in Yaji district / Kirkuk province during the winter season 2019-2020. The experiment included ten genotypes of bread wheat (Jehan , Adana, Aras, Aksad, Clark, Florka, Sham 6, Alaa, IPA 99, Rizkari). Obtaining it from the Seed Testing and Certification Center - Sulaymaniyah, the details of which are shown in Table (1).

Table (1) Names and sources of genotypes of wheat under study

sources	Genotypes	No.
inter cultivar	Jihan	1

adopted/ Sulaymaniyah Seed Testing and Certification Center	**Adana**	**2**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**Aras**	**3**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**Aksad**	**4**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**Clark**	**5**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**Florka**	**6**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**Tham -6**	**7**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**IPA99**	**8**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**Alaa**	**9**
adopted/ Sulaymaniyah Seed Testing and Certification Center	**Rizkari**	**10**

Where the experiment included three levels of humic acid (0, 20, 40 kg.ha^{-1}) in addition to the soil (the main plots), and in each main plot the items were placed within the secondary plot within the Randomized complete block design and with three replicates

. The soil was prepared by Tillage, smoothing, leveling, and dividing according to the design used, where the genotype seeds were sown on 11/16/2019 at a seed average of 120 kg.ha^{-1} (350 seeds were planted per line for all genotypes by calculating the number of seeds based on a weight of 12 grams per line approximately). The experiment land was fertilized with phosphate fertilizer (DAP) at an average of (200 kg H-1) in one batch when cultivation and urea (N46%) as a source of nitrogen with a source (400 kg H-1) in two batches, the first at cultivation and the second at the beginning of the tillering stage. Irrigation and weeding during the season and as needed and the harvest was done on 28/5/2020. Five genotypes (Rizgary, Jihan, Abaa 99, Alaa, Clark) were selected from the cultivars that excelled in growth traits, yield and components and were stored in three periods (after 3 months, after 6 months, after 9 months) in addition to no storage and the data were recorded for the following traits: Protein percentage The percentage of wet gluten, dry gluten, sedimentation, ash percentage, specific weight, and extraction percentage. The grain storage process began on 9/6/2020 on the basis of taking samples of wheat selected according to the storage periods. The data of this experiment were statistically analyzed by the method of analysis of variance according to the design used with the help of the calculator program Excel. The significant differences between the means were tested according to the least significant test (LSD) at the 5% level. The source of the triple interaction for the study factors was considered as the experimental error used in this experiment due to the analysis of the experiment on the basis of one replicate. (Al-Rawi and Khalaf Allah, 2000).

Results and discussion

Table (2) the analysis of variance represented by the mean of squares for levels of humic acid, storage periods ,cultivars and their bi-interaction for quality and flour quality traits, where humic acid had a significant effect at the probability level (1%) for all traits except for the percentage of protein and wet gluten (significant at the probability level of 5%).While it did not reach the statistical significance limits for the dry gluten trait, and the

storage periods on the one hand and the cultivars on the other hand had a significant effect for all the studied traits, as well as the interaction between humic acid and storage periods was highly significant for the sedimentation trait and significant for the ash ratio, and the interaction between humic and cultivars was significant. At the probability level (1%) for all traits except wet gluten percentage, ash percentage and the arrival point (significant at the 5% probability level), while it did not reach the statistical significance limits for the two traits of dry gluten percentage and specific weight. As for the interaction between storage periods and cultivars, it was significant at the probability level (1%) for sedimentation traits, Belchenki test, extraction average and significant at the probability level (5%) for wet and dry gluten and specific weight, but the rest of the traits did not reach the statistical significance limits, and these results are consistent with the results Chen et al.(004(2).Table (2) Analysis of variance representing the levels of humic acid, storage periods and cultivars and their bi-interaction for qualitative traits and flour quality

Table (2) Analysis of variance representing the levels of humic acid, storage periods and cultivars and their bi-interaction for the qualitative traits and quality of flour

extraction	**Specific weight**	**sedimentation value**	**Ash percentage**	**dry gluten**	**wet gluten**	**protein percentage**	**Traits / Degrees of Freedom**	sources of variation
****3.22**	****1.83**	****12.58**	****0.32**	**0.45**	***4.32**	***0.74**	**2**	Humic acid (a)
****12.33**	****17.06**	****72.16**	****0.59**	****20.37**	****155.75**	****16.54**	**3**	storage periods (b)
****42.65**	****69.00**	****40.15**	***0.05**	****9.63**	****87.19**	****5.47**	**4**	Items (c)
0.46	**0.33**	****3.01**	***0.03**	**0.15**	**1.85**	**0.10**	**6**	interaction (axb)
****2.74**	**0.56**	****4.03**	***0.03**	**0.24**	***2.94**	****1.00**	**8**	interaction (axc)
****1.33**	***0.87**	****4.54**	**0.02**	***0.39**	***3.51**	**0.19**	**12**	interaction (bxc)
0.40	**0.29**	**0.79**	**0.01**	**0.18**	**1.20**	**0.18**	**24**	experimental error

protein%

The protein content in wheat grain is an important traits of the grain manufacturing process because of its major role in determining the quality of the flour produced. These proteins are among the best and used in the bread industry, and they depend mainly on genetic factors and the prevailing climatic and agricultural conditions during the growth stage. It is evident from the results of Table (3) that there are significant differences between the levels of humic acid in the percentage of protein, Where the third level (40 kg H-1) recorded the highest percentage of 12.5%, followed by the second level 12.13%, while the first level recorded the lowest percentage of 12.21%, and there were significant differences between the averages of storage periods, where the first period recorded the highest protein percentage of 13.78% It was followed by the second period with an average of 12.17%, while the fourth period recorded the lowest average of 11.37%.These results are consistent with Bakry et al. (2013) and Al Fahdawi (2017). Table (3) showed significant differences between the cultivars included in this study, where the Rizgary cultivar significantly excelled all cultivars by giving it the highest average protein content of .3213.%, followed by Clark cultivar 12.36%,While the cultivar IPA 99 gave the lowest average for this trait, which was 11.44%. The reason for these differences between the cultivars is due to their genetic nature and the extent of their response to physiological processes that affect the formation of the products of photosynthesis. These results are agree with Barut (2017), Al-Azzawi (2017) and Abu Al-Nadr (2019) who found a significant difference between wheat cultivars in the protein content of their grains. The bi-interaction between the levels of humic acid and the cultivars was significant, where the interaction between the third level and the cultivar Rizgary excelled, achieving the highest arithmetic mean of 13.60% with a significant difference from all interactions except for the interaction of the second and first levels with the same cultivar and for the second level with the Alaa cultivar. While the lowest average was 11.40% for the second level with the two cultivars ABA 99 and Ala, and that free amino acids when added are an essential nitrogen source in building proteins and supplying energy for vital processes in the plant (Mohamed et al., 2015 and Popko et al., 2018). and that the benefit of amino acids in the wheat crop can stimulate protein synthesis and improve its quality, as well as reduce the speed of nutrient deficiency because of their easy absorption and use directly in the manufacture of proteins, in addition to their differences in response to wheat cultivars, This result agreed with the results of Al-Dulaimi (2018) and Zangana (2019) research. As for the interaction between humic acid and storage periods (the third level x the first period) and the last with varieties (the first period x Rizkari) it was not significant and thus achieved the highest mean of 14.18% and 14.53% respectively.

Table (3) Arithmetic averages of the effect of humic acid, storage periods and cultivars and their bi-interaction for the protein percentage

storage periods	Humic acid			Humic acid	Cultivars				
	a 1	a 2	a 3		Rizkari(C1)	Jihan (C2)	IPA (C3)	Alaa (C4)	Clark(C5)
b 1	13.56	13.60	14.18	a 1	13.38	12.10	11.48	12.00	12.10
b 2	12.20	11.92	12.38	a 2	12.98	12.58	11.40	11.40	12.33
b 3	11.82	11.68	11.92	a 3	13.60	11.65	11.45	13.15	12.65
b 4	11.26	11.34	11.52	average cultivars	13.32	12.11	11.44	12.18	12.36
average Humic acid	12.21	12.13	12.5	LSD value for cultivars					0.36

L.S.D value for humic levels	0.28	L.S.D value for the interaction between humic and cultivars		0.62
L.S.D value for the interaction between humic and storage periods	N.S			
Cultivars	storage periods			
	b 1	b 2	b 3	b 4
c 1	14.53	13.20	13.33	12.20
c 2	13.40	11.93	11.60	11.50
c 3	13.17	11.37	10.73	10.50
c 4	14.00	11.97	11.57	11.20
c 5	13.80	12.37	11.80	11.47
Average of storage periods	13.78	12.17	11.81	11.37
L.S.D value for storage periods				0.32
L.S.D value for the interaction between storage periods and cultivars				N.S

2: Wet gluten (%)

The percentage of gluten is affected by the percentage of protein in wheat grains, which is determined by the amount of nutrients processed to a high degree, where the good gluten is characterized by its high ability to absorb water compared to the weak gluten, The results in Table (4) indicate that there are significant differences between the average levels of humic acid that the third level (40 $kg.ha^{-1}$) significantly excelled with an average of 35.25%, followed by the second level 34.5%, while the first level gave the lowest average of 34.4%. We also note that there are significant differences between the averages of storage periods, where the first period recorded the highest average for this trait, which amounted to 38.33%, with a significant difference from all other periods, while the fourth period recorded the lowest average (30.73%).In addition to that, there was the state of significant variance between the averages of the cultivars, as Clark cultivar excelled, recording the highest average for this trait, which amounted to 39.42%, with a significant difference from the rest of the cultivars, while the IPA 99 variety gave the lowest average of 5832.%. The binary interaction between the levels of humic acid and the cultivars was significant through the significantly of the third level with the cultivar Rizgary with a mean of 35.5% and a significant difference from all other interactions except the same level with the cultivar Alaa and the second level with the two cultivars Rizgary and Jihan and the first level with the cultivar Clark while the lowest average reached 32.50% for the first level with the cultivar Jihan and the second and third levels with the cultivar IPA 99,Perhaps the significance of these cultivars is due to their high content of good quality protein as well as the nature of the genetic difference between the cultivars. This result is consistent with the findings of Al-Dulaimi (2013), Mutwali et al. (2016), Siddiq et al. (2017), Al-Azzawi (2017) and Abu Al-Nadr. (2019) who found significant differences between wheat cultivars in the percentage of gluten in grain. The interaction between the first storage period with the cultivar Rizgary excelled, achieving the highest average of 43.00%, with a significant difference from all interactions except for the same cultivar with the second storage period.While the interaction between the cultivar IPA 99 with the third storage period was

the lowest percentage of wet gluten (31.00%), and this result is in line with the results of Popko et al. (2018), Baqer (2018), Zangana (2019) and Mikhlif (2019) who found that spraying amino acids on wheat plant It led to an increase in the percentage of wet gluten in grains. As for the interaction between the levels of humic acid and the storage periods, it did not reach the limits of statistical significance. Despite that, the highest arithmetic average reached 38.40% for the third level with the first storage period.

Table (4) Arithmetic averages of the effect of humic acid, storage periods and cultivars and their bi-interaction for wet gluten

storage periods	Humic acid			Humic acid	Cultivars				
	a 1	a 2	a 3		Rizkari(C1)	Jihan (C2)	IPA (C3)	Alaa (C4)	Clark(C5)
b 1	39.00	37.60	38.40	a 1	33.00	32.50	32.75	34.00	39.75
b 2	35.00	36.00	36.80	a 2	34.00	34.50	32.50	33.00	38.50
b 3	33.20	33.80	34.60	a 3	35.5	33.50	32.50	34.75	40.00
b 4	30.40	30.60	31.20	average cultivars	34.17	33.50	32.58	33.92	39.42
average Humic acid	34.4	34.5	35.25	LSD value for cultivars					0.92
L.S.D value for humic levels			0.71	L.S.D value for the interaction between humic and cultivars					1.60
L.S.D value for the interaction between humic and storage periods			N.S						

Cultivars	storage periods			
	b 1	b 2	b 3	b 4
c 1	36.67	35.33	33.33	31.33
c 2	38.00	35.33	32.67	28.00
c 3	37.33	32.33	31.00	29.67
c 4	36.67	35.33	33.33	30.33
c 5	43.00	41.33	39.00	34.33
Average of storage	38.33	35.93	33.87	30.73

periods				
L.S.D value for storage periods				**0.82**
L.S.D value for the interaction between storage periods and cultivars				**1.84**

3: dry gluten (%)

The amount of dry gluten is generally related to the amount of wet gluten, which is obtained after drying the latter at a certain temperature, and its calculation is important in determining the percentage of moisture absorbed by the gluten of different types of wheat when adding water to it. Significant for the three periods, while the fourth period gave the lowest average (10.15%).This is what was observed in the results of Table (5), and these results were consistent with each of Popko et al. (2018)), Al Dulaimi (2018) and Zangana, (2019), who found there significant differences when using amino acids on the wheat plant in the trait of gluten. averages of cultivar in this trait, The Clark cultivar recorded the highest average of 13.14% and at the same time significantly excelled on all the cultivars included in this study, while the cultivar IPA 99 gave the lowest average for this trait (10.94%).The reason for this may be due to the fact that the cultivars, including the Clark cultivar, have high wet gluten, accompanied by high dry gluten, in addition to their difference in protein content, which is positively correlated with the percentage of gluten, and these percentages came in parallel with the percentage of wet gluten. This result agreed with those of Mutwal et al. (2016) and Abu al-Nadr (2019). As well as the presence of the statistical significance of the interaction between storage periods and cultivars through the excelled of (first period x Clark) with the highest arithmetic average of 14.60%, followed by the same cultivar, but at the second period (13.97%), while (the fourth period x Jihan) was the lowest average for this trait and reached 9.20%,This is consistent with Al-Azzawi (2017) when he found that there were significant differences when using amino acids on the wheat crop in this trait. But the levels of humic acid and the interaction between humic acid and storage periods on the one hand and humic acid with cultivars, on the other hand, did not reach the statistical significance limits. Where the interaction between the third level with the first period of storage gave the highest average of 13.8%, and the interactions between the third level with Clark cultivar, achieving the highest arithmetic mean of 13.38%, while the lowest average of 10.8% for the interaction between the first level with Jihan cultivar, this increase is due to the role of acid Hywek increases the availability of the important elements present in the soil, which enhances this by an increase in growth and yield, and this result is consistent with the results of Taha et al. (2006) and Celik et al. 2011).

Table (5) Arithmetic averages of the effect of humic acid, storage periods and cultivars and their bi-interaction for dry gluten

storage periods	Humic acid			Humic acid	Cultivars				
	a 1	a 2	a 3		Rizkari(C1)	Jihan (C2)	IPA (C3)	Alaa (C4)	Clark(C5)
b 1	12.88	12.64	13.08	a 1	11.15	10.80	11.00	11.20	13.13
b 2	11.74	12.14	12.40	a 2	11.35	11.38	10.90	11.23	12.93

b 3	**11.18**	**11.20**	**11.32**	**a 3**	**11.90**	**10.93**	**10.93**	**11.63**	**13.38**
b 4	**10.02**	**10.24**	**10.20**	**average cultivars**	**11.47**	**11.03**	**10.94**	**11.35**	**13.14**
average Humic acid	**11.455**	**11.555**	**11.75**	**LSD value for cultivars**					**0.35**
L.S.D value for humic levels			**N.S**	**L.S.D value for the interaction between humic and cultivars**					**N.S**
L.S.D value for the interaction between humic and storage periods			**N.S**						
Cultivars			**storage periods**						
			b 1		**b 2**		**b 3**		**b 4**
c 1			**12.37**		**11.87**		**11.20**		**10.43**
c 2			**12.53**		**11.77**		**10.63**		**9.20**
c 3			**12.37**		**11.23**		**10.23**		**9.93**
c 4			**12.47**		**11.63**		**11.27**		**10.03**
c 5			**14.60**		**13.97**		**12.83**		**11.17**
Average of storage periods			**12.87**		**12.09**		**11.23**		**10.15**
L.S.D value for storage periods									**0.32**
L.S.D value for the interaction between storage periods and cultivars									**0.71**

Ash percentage (%)

The percentage of ash is an expression of the mineral elements that the grain contains, such as calcium, magnesium, and sodium, and that the ash content is an important measure of its relationship to the quality of flour and a strong indicator of flour extraction. The third level (40 kg ha-1) was significant with a mean of 1.8%, followed by the second level (1.70%), while the first level recorded the lowest mean for this trait, 1.55%. We also note that there are significant differences in the averages of storage periods, where the fourth period achieved the highest average for this trait, which amounted to 1.89%, followed by the third period, 1.81%, while the first period gave the lowest average 1.46%, due to the efficiency of the photosynthesis process and the accumulation of dry matter, especially in the stage of filling the bean Which was reflected in the weight of a thousand grains, which raised the percentage of flour extraction in the varieties of jihan, IPA 99 and Alaa , These results agree with the study of Al-Mohammadi (2018), which found significant differences in the ash percentage as a result of the effect of spraying amino acids. It appears that there are significant differences in

the cultivar factor (Table 6), as the cultivar Alaa excelled with a mean of 1.77% and a significant difference between the two cultivars Rizgary and Clark) 1.59% and 1.66%), The effect of the interaction between humic acid and storage periods was significant in this trait, where the interaction between (second level x fourth period) was distinguished by the highest arithmetic mean of 1.97%, and with a significant difference from all interactions except for the same level but with the third period on this side and the third level with the two periods The third and fourth on the other hand, but the interaction between (first level x first period) recorded the lowest average of 1.35% .All interactions were only the same level with cultivar Alaa and the latter with the second level, while the lowest average was 1.51% for the interaction (first level x Rizgary). with environmental conditions, As for the interaction between the storage periods and the cultivars, it was not significant, meaning that these cultivars had a similar behavior and no significant variation occurred in them, and that the differences between the numbers may be due to chance for these traits. They found a difference between the cultivars in the percentage of ash.

Table (6) Arithmetic averages of the effect of humic acid, storage periods and cultivars and their bi-interaction for Ash percentage

storage periods	Humic acid			Humic acid	Cultivars				
	a 1	a 2	a 3		Rizkari(C1)	Jihan (C2)	IPA (C3)	Alaa (C4)	Clark(C5)
b 1	1.35	1.38	1.64	a 1	1.51	1.53	1.52	1.60	1.60
b 2	1.41	1.58	1.79	a 2	1.67	1.75	1.68	1.85	1.57
b 3	1.67	1.89	1.86	a 3	1.60	1.85	1.92	1.85	1.80
b 4	1.78	1.97	1.93	average cultivars	1.59	1.71	1.71	1.77	1.66
average Humic acid	1.55	1.70	1.80	LSD value for cultivars					0.09
L.S.D value for humic levels			0.07	L.S.D value for the interaction between humic and cultivars					0.16
L.S.D value for the interaction between humic and storage periods			0.15						

Cultivars	storage periods			
	b 1	b 2	b 3	b 4
c 1	1.38	1.42	1.75	1.81
c 2	1.39	1.70	1.83	1.91
c 3	1.56	1.69	1.74	1.85
c 4	1.57	1.70	1.84	1.96

c 5	**1.38**	**1.45**	**1.87**	**1.93**
Average of storage periods	**1.46**	**1.59**	**1.81**	**1.89**
L.S.D value for storage periods				**0.08**
L.S.D value for the interaction between storage periods and cultivars				**N.S**

Sedimentation value (ml)

The sedimentation test is one of the important and indirect methods in determining the quality of grains and their ability to make bread and estimating the quality and strength of flour. The method of sedimentation depends on the absorption of gluten into water, its swelling and its attachment to the aqueous solution in a dilute acidic medium. It is affected by many factors, including the quantity and quality of protein and the ability of gluten to absorb water, in addition to technical matters related to the number and time period of shaking, in addition to the quality of the chemicals used, where this trait is an indicator of Protein quality and evidence of gluten strength. The addition of humic acid levels (Table 7) showed a significant difference in the average sedimentation values, as the third level was significantly excelled (20.33 ml), while the first level recorded the lowest average (31.61 ml). As well as the presence of significant differences between the averages of storage periods, where the first period excelled with the highest average for this trait, which amounted to 35.32 ml, while the fourth period recorded the lowest average (30.13 ml). These results are consistent with the results of Al-Azzawi (2017), Popko et al. (2018) and Zangana (2019). The data in Table (7) showed that there is a significant difference in the sedimentation value of wheat cultivars, where the cultivar IPA 99 excelled in all cultivars with an average of 34.18 ml, at the same time, it did not differ from the Jihan cultivar, while Clark gave the lowest average for this trait (29.67 ml).The interaction (third level x first period) was significantly different on all averages except for the same level with the second period and the second level with the first period, while the sedimentation value decreased through (third level x fourth period) with an average of 29.80 ml,As the high values of the sedimentation volume indicate the good quality of gluten, its increased strength in air retention, and the increase in the elasticity of the dough, which improves the quality of baking and vice versa (Al-Daoudi, 2013).The interaction (third level x Jihan) was significantly excelled on all of the interactions, while the interaction (first level x Clark) gave the lowest Sedimentation average of 23. 28 ml, the high values of sedimentation volume, which indicate the good quality of gluten, and this may be due to the excelled of the cultivar IPA 99 in this trait in addition to its excelled in the gluten Coefficient, and the different cultivars in the sedimentation value can be due to their variation in the proportion of non-gluten proteins, These results were consistent with Siddiq et al. (2017) and Popko et al. (2018) and Zangana (2019) as they found a significant difference in the sedimentation value between different wheat cultivars. The interaction between the first period with the cultivar Jihan was significant (39.83 ml) on all interactions, but the interaction was delayed. Between the fourth period with Clark cultivar with the lowest mean of 28.00 ml, the addition of humic acid in the elongation stage had a good effect on a number of qualitative traits as well as the difference in the cultivars in the extent of their response to ground addition. The positive effect of humic acid led to an improvement in the quality of the gluten coefficient, which was reflected in an increase in the sedimentation value. Which indicates that the protein sedimentation values are directly proportional to the gluten coefficient, and these results are consistent with what was mentioned by Al-Daoudi (2013), Irena and Gvidas (2013) and Al-Namrawi (2014), who found significant differences between the sedimentation values by the influence of amino acids.

Table (7) Arithmetic averages of the effect of humic acid, storage periods and cultivars and their bi-interaction for sedimentation

storage periods	Humic acid			Humic acid	Cultivars				
	a 1	a 2	a 3		Rizkari(C1)	Jihan (C2)	IPA (C3)	Alaa (C4)	Clark(C5)
b 1	34.32	35.54	36.10	a 1	31.43	32.48	34.40	31.55	28.23
b 2	31.34	32.18	34.50	a 2	32.38	33.45	33.90	31.45	31.10
b 3	30.80	31.50	32.40	a 3	32.73	36.13	34.23	33.25	29.68
b 4	30.00	30.60	29.80	average cultivars	32.18	34.02	34.18	32.08	29.67
average Humic acid	31.61	32.45	33.20	LSD value for cultivars					0.75
L.S.D value for humic levels			0.58	L.S.D value for the interaction between humic and cultivars					1.30
L.S.D value for the interaction between humic and storage periods			1.16						

Cultivars	storage periods			
	b 1	b 2	b 3	b 4
c 1	34.67	32.03	32.33	29.67
c 2	39.83	34.23	31.67	30.33
c 3	36.00	34.87	33.83	32.00
c 4	34.33	32.00	31.33	30.67
c 5	31.77	30.23	28.67	28.00
Average of storage periods	35.32	32.67	31.57	30.13
L.S.D value for storage periods				0.67
L.S.D value for the interaction between storage periods and cultivars				1.50

Specific weight ($kg.hL^{-1}$)

Specific weight is one of the important indicators of the quality of grain, and one of the physical measurements used in classifying and grading grain, as it is affected by many factors, including environmental and genetics. The data in Table (8) showed that the first level prevailed in this trait with a mean of 75.157 $kg.hL^{-1}$, but the third level recorded the lowest average (74.57 $kg.hL^{-1}$), and the first period made significant progress

(75.81 kg.hL^{-1}), followed by the second period (75.33 kg.hL^{-1}). While the fourth period recorded the lowest average of 73.35 kg.hL^{-1}, as well as a significant effect of the cultivars in this trait, where the Rizgary cultivar significantly excelled it by giving the highest average specific weight of 78.44 kg.hL^{-1}, while the Alaa cultivar gave the lowest average of 71.74 kg.hL^{-1},The reason for the variation of cultivation in this trait may be due to a difference in the proportions of the grain content of the chemical composition, and these results are in line with previous research reached by Al-Azzawi et al. (2018) and Abu Al-Nadr (2019), who indicated that wheat cultivars differ significantly in this trait. The interaction (first-period x Rezgary) was distinguished by the highest mean of 79.81 kg.hL^{-1}, followed by the same cultivars with the second and third storage periods (78.7 and 78.30 kg.hL^{-1}), with a significant difference from all interactions, but the interactions(fourth period x A) decreased with the lowest average of 71. 27 kg.hL^{-1},Non-significant difference occurred between the first level of humic acid with the first period (76.34 kg.hL^{-1}), as well as between the first level (humic) with the cultivar Rizgary 79.41 kg.hL^{-1} and for the rest of the interactions, and these results are in line with Al-Mohammadi (2018) and Zangana (2019).) who indicated a significant effect of this trait on this crop.

Table (8) Arithmetic averages of the effect of humic acid, storage periods and cultivars and their bi-interaction for specific weight

storage periods	Humic acid			Humic acid	Cultivars				
	a 1	a 2	a 3		Rizkari(C1)	Jihan (C2)	IPA (C3)	Alaa (C4)	Clark(C5)
b 1	76.34	75.81	75.29	a 1	79.41	75.09	75.07	72.05	74.17
b 2	75.81	75.22	74.95	a 2	78.07	74.47	74.90	71.79	74.39
b 3	75.04	74.74	74.59	a 3	77.85	74.33	75.08	71.38	74.25
b 4	73.44	73.12	73.48	average cultivars	78.44	74.63	75.02	71.74	74.27
average Humic acid	75.157	74.722	74.57	LSD value for cultivars					0.45
L.S.D value for humic levels			0.35	L.S.D value for the interaction between humic and cultivars					N.S
L.S.D value for the interaction between humic and storage periods			N.S						

Cultivars	storage periods			
	b 1	b 2	b 3	b 4
c 1	34.67	32.03	32.33	29.67

c 2	**39.83**	**34.23**	**31.67**	**30.33**
c 3	**36.00**	**34.87**	**33.83**	**32.00**
c 4	**34.33**	**32.00**	**31.33**	**30.67**
c 5	**31.77**	**30.23**	**28.67**	**28.00**
Average of storage periods	**35.32**	**32.67**	**31.57**	**30.13**
L.S.D value for storage periods				**0.41**
L.S.D value for the interaction between storage periods and cultivars				**0.91**

Extraction percentage (%)

Extraction means the percentage of flour produced by grinding a known weight of wheat grains, and it can be taken as an indicator of the quality of the wheat, and it is affected by many factors such as the hydration process before milling, the efficiency of the milling process, the nature of the grains, their degree of hardness, and their physical and chemical composition. The results in Table (9) indicated that there were significant differences between the levels of humic acid, where the first level was significantly excelled by giving it the highest average of the extraction percentage amounted to 73.3%, but the lowest average amounted to 72.5% for the third level. As well as the presence of significant differences between the averages of storage periods, as the first period recorded a significant excelled and amounted to 74.13%, but the fourth period declined (72.00%). It was also noted that there was a significant excelled in the Rizgari cultivar by giving it the highest average of the phenotype (75.50%), while cultivar Alaa gave the lowest average for this trait (70.83%). Perhaps the reason for the varietal differences in this trait is due to the nature of the growth of genotypes. Also, Rizgary cultivar, in its interaction with the levels of humic acid (first and second), was significantly excelled on all interactions with an average of 75.75% for both, but the interaction between the third level with Clark cultivar decreased with a lower average (70.50%), as well as the differences of storage periods with cultivars significantly through the success of the interaction between the first period with the cultivar Rizgari by recording the highest mean of 77.33%, followed by the same variety with the second period (76.00%).While the fourth period and its interaction with the two cultivars Alaa and Clark filled both of them had the lowest average for this trait amounting to 70.00% for both. When amino acids were sprayed at different times, the efficiency of the photosynthesis process and the accumulation of dry matter increased, especially in the stage of filling the grain, which was reflected in its superiority in the number of grains and weight of 1000 grains, which achieved A good conclusion, these results are in agreement with the results of Al-Azzawi (2017) and Al-Zangana 2019).As they found significant differences between wheat cultivars in the percentage of extraction, there was no significant difference for the interaction between humic acid and storage periods, where the arithmetic averages ranged between 74.40% to 71.40% for the interaction between the first level with the first period and the third level with the fourth period, respectively, and this shows the existence of a relationship There is a direct correlation between the percentage of extraction and the weight of one thousand grains. These results are consistent with both Al-Namrawi (2014) and Abu Al-Nadr (2019).

Table (9) Arithmetic averages of the effect of humic acid, storage periods and cultivars and their bi-interaction for the extraction percentage

storage periods	Humic acid			Humic acid	Cultivars				
	a 1	a 2	a 3		Rizkari(C1)	Jihan (C2)	IPA (C3)	Alaa (C4)	Clark(C5)
b 1	74.40	74.00	74.00	a 1	75.75	74.25	73.75	70.50	72.25
b 2	73.00	73.20	72.40	a 2	75.75	73.25	73.00	71.00	71.25
b 3	73.00	72.40	72.20	a 3	75.00	71.50	74.50	71.00	70.50
b 4	72.80	71.80	71.40	average cultivars	75.50	73.00	73.75	70.83	71.33
average Humic acid	73.3	72.85	72.5	LSD value for cultivars					0.53
L.S.D value for humic levels			0.41	L.S.D value for the interaction between humic and cultivars					0.92
L.S.D value for the interaction between humic and storage periods			N.S						

Cultivars	storage periods			
	b 1	b 2	b 3	b 4
c 1	77.33	76.00	74.67	74.00
c 2	73.00	73.00	72.67	73.33
c 3	75.33	73.67	73.33	72.67
c 4	72.00	70.33	71.00	70.00
c 5	73.00	71.33	71.00	70.00
Average of storage periods	74.13	72.87	72.53	72.00
L.S.D value for storage periods				0.48
L.S.D value for the interaction between storage periods and cultivars				1.06

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