STUDY BAKING QUALITY OF SOME BREAD WHEAT GENOTYPES UNDER WATER STRESS

L. A. Hussain[1] M. S. Hamdalla[2] S. A. Yousif[1]
Researcher Prof. senior Researchers
[1] Direct. Agric. Res. /Min., Higher Edu., Sci. & Tech, Baghdad- Iraq
[2]Dept. Crop Science, Coll. Agric. Engin. Sci., University of Baghdad
lina.Ali1006@coagri.uobaghdad.edu.iq

ABSTRACT

This study was aimed to investigate baking quality of some bread wheat and water stress. A field experiment was carried out at the fields of the College of Agricultural Engineering Sciences - University of Baghdad during the seasons 2018-2019 and 2019-2020. Five local cultivars and 20 entrance genotypes were planted, during first season and the best 9 genotypes for baking ability were selected and tested in the second season, under moisture depletion levels of 50, 70, and 90% of field capacity, RCBD was used for the first season, with a split-plot design for the second season, with three replications for both seasons. The levels of moisture depletion occupied the main plots and the genotypes of the sub plots. In the second season, the results showed that reducing the moisture depletion to the level of 50% of the available water produced the highest grain yield, while the 90% moisture depletion level exceeded 90% produced the highest means of the protein%. It could be concluded that the availability of the appropriate quantities of irrigation water reflected positively on grain yield and that the decrease in the quantities of irrigation water improved protein%.

Key words: gluten, falling number, gliadin, protein% and moisture depletion

دراسة صفات جودة الخبيز لبعض من التراكيب الوراثية من حنطة الخبز تحت تأثير الاجهاد المائي

لينا علي حسين[1] ماجد شايع حمدالله[2] شذى عايد يوسف[1]
باحث استاذ رئيس باحثين
دائرة البحوث الزراعية/ وزارة التعليم العالي والعلوم والتكنولوجيا[1]
قسم المحاصيل الحقيلة/ كلية علوم الهندسة الزراعية/ جامعة بغداد[2]

المستخلص

لدراسة قابلية بعض التراكيب الوراثية من الحنطة لجودة الخبيز تحت تأثير الاجهاد المائي. نفذت تجربة حقلية في حقول كلية علوم الهندسة الزراعية _جامعة بغداد للموسمين 2018-2019 و2019- 2020. زرعت في الموسم الاول 5 اصناف محلية و 20 تركيب وراثي مدخل, و اختيرت افضل 9 تراكيب وراثية في قابلية الخبيز والحاصل، واختبارها في الموسم الثاني تحت مستويات الاستنفاذ الرطوبي 50 و70 و 90% من الماء الجاهز, استعمل تصميم القطاعات الكاملة المعشاة RCBD للموسم الاول وبترتيب الالواح المنشقة للموسم الثاني و بثلاث مكررات للموسمين. احتلت مستويات الاستنفاذ الرطوبي الالواح الرئيسة والتراكيب الوراثية الالواح الثانوية. في الموسم الثاني فقد بينت النتائج ان تقليل الاستنفاذ الرطوبي الى المستوى 50% من الماء الجاهز اعطى اعلى حاصل حبوب، وتفوق مستوى الاستنفاذ الرطوبي 90% من الماء الجاهز في اعطاء اعلى متوسطات لنسبة البروتين ورقم السقوط. يستنتج ان توفر الكميات المناسبة من مياه الري انعكس ايجاباً على حاصل, وان انخفاض كميات مياه الري ادى الى تحسن النسبة المئوية للبروتين.

الكلمات المفتاحية: الكلوتين، رقم السقوط، كليادين، البروتين، الاستنفاذ الرطوبي

Received:25/8/2021, Accepted:5/12/2021

INTRODUCTION

Wheat is the first food crop in the world since it is the raw materials for the production of flour used in the manufacture of bread, which is the main food for more than three-quarters of the population of the world (14). Bread is the most important component of the diet on which the people of Iraq depend for their food since ancient times. Today, providing sufficient bread has become a goal that most countries seek to achieve for their people. It is also considered a mainstay for the stability and security of these countries. Wheat is distinguished the first crop of the cultivated area globally, amounting to 220 million hectares and producing 744 million tons of wheat grains (15). With a production rate of 2910.4 kg h^{-1} (13), which is a low production compared to the production rate to other the world, and despite the multiplicity of local varieties with high productivity, they are exposed to water and thermal stresses, which cause a change in their chemical composition and limit of its agricultural capacity and negatively affect the quality of these varieties (28). The production compared to the production rate in other the world, and despite the multiplicity of local varieties with high productivity, they are exposed to water and thermal stresses, which cause a change in their chemical composition and limit their agricultural capacity and negatively affect the quality of these varieties (27). Therefore, plant breeders combined efforts to rely on modern technologies in agriculture, management, and production, to adevise to introduce new varieties that are superior in their productivity and adapted to different conditions of stress (10). For this reason, obtaining bread that meets the consumer's desire depends on mixing the flour of local varieties with imported flour, and this matter made the state import large quantities of wheat flour suitable for the bread industry, which causes a deficit in the general trade balance and constitutes a heavy burden on the state's balance of payments, and for the purpose of securing food Achieving self-sufficiency, which has become one of the most important priorities of agricultural research programs. Therefore, great efforts must be made by plant breeders to find agricultural means that improve the quality of some wheat varieties to be suitable for bread production. Therefore, drought was chosen as being one of the most important factors that lead to morphological and physiological changes in the various components of the plant and cause a change in its chemical composition, affecting the quality of these varieties exposed to it (3, 14 and 18). This study was aimed to introduce new genotypes with good yield, and quality, under drought tolerance, while evaluating their performance and comparing them with local varieties.

MATERIALS AND METHODS

This study was carried out at the fields of the College of Agricultural Engineering Sciences - University of Baghdad - Jadriya during the seasons 2018-2019 and 2019-2020. Added to the soil was 100 kg h^{-1} dab (48%P) from P_2O_5 was added to the soil at once when preparing. Urea was added at an amount of 200 kg h^{-1} (46%N) in two equal batches (30). Soil samples were taken during preparation at a depth of 30 cm to conduct physical and chemical analyzes of the soil and estimate its water retention capacity by estimating the relationship between the structural tension of the soil sample and the moisture content at the tension (33, 100, 500, 1000 and 1500) kPa in the Agricultural Research Department / Ministry of Sciences and Technology (Table 1). The difference between the volumetric moisture content at the field capacity of 33 kPa and the permanent wilting point of 1500 kPa, the available water content of the soil was estimated. The experiment were included cultivation of 20 genotypes, which were obtained from the Latifiya Research Station of the Agricultural Research Department / Ministry of Sciences and Technology and five local cultivars obtained from the Agricultural Research Department/ Ministry of Agriculture to evaluate the performance of these genotypes with local varieties (Table 2). After harvesting, the best of these genotypes were selected in terms of baking ability based on the gluten% index with the falling number and with a good yield. The eight genotypes selected with the best local variety (Rasheedia) were evaluated under depletion levels of 50, 70, and 90% of available water. The planting date was 17-12-2018 and 24-11-2019 for the first and second seasons, respectively. The randomized complete block design (RCBD) was used for the first and second seasons, with the arrangement of the split plots for the second season, only the depletion levels of 50, 70, and 90% of the available water occupied the main plots, and the genotypes occupied the secondary plots with three replications for both seasons. Irrigation at the first season on which basis whenever needed, while the second season was from a sub-waterwheel equipped with a pump and by means of plastic tubes that end with a meter to measure the quantities of water added to each experimental unit in liters. Equal amounts of water were added to all plots when planting and to the limits of the field capacity to ensure field emergence and after emergence, irrigation began under the specified depletion levels at a depth of (30 and 50) cm. It was 30 cm deep from cultivation to end-stage and 50 cm deep from end-stage to full maturity stage. The depth of water added for each experimental unit was calculated by explain the soil moisture before irrigation and its completion of the field capacity. The duration of irrigation for the moisture depletion level of 50% of the available water ranged from 9 to 12 days, while the depletion level of 70% of the available water ranged from 19 to 25 days, and the percentage of 90% of the available water ranged from 24 to 35 days, according to the stage of plant growth and changing climatic conditions during the agricultural season. The equation mentioned by Allen et al. (4) was used to calculate the depth of water to be added to compensate for the depleted moisture.

$$d = (\theta_{fc} - \theta_w) \times D$$

d = depth of water added (cm)

θ_{fc}= volumetric water content at field capacity (cm^3-cm)

θ_w =Volumetric water content before irrigation (cm^3-cm^3)

D = effective rootstock depth (cm)

Table 1. Soil physical and chemical properties and moisture content for the agricultural seasons 2018-2019 and 2019-2020

Analysis type	measruing unit	Season 2018-2019	Season 2019-2020
PH	-	7.2	7.2
EC	dsm m^{-1}	2.2	2.0
N	mg kg^{-1}	78.3	52.30
P	mg kg^{-1}	12.25	8.05
K	mg kg^{-1}	120.7	123.00
Sand	%	36.20	36.20
Silt	%	47.10	46.60
Clay	%	16.70	17.20
bulk density	Mega gm m^{-3}	1.2	1.2
Volumetric moisture content at field capacity	cm^3	0.33	0.33
Volumetric moisture content at permanent wilting point	cm^3	0.14	0.14
available water	cm^3	0.19	0.19

The gravimetric method was used to measure the moisture content of the soil, as samples were taken from the soil by the ogare a day before irrigation and the soil was placed in a metal box with a known weight. The drying time is 12 minutes until reaching the stage of stability in weight after drying (5, 17and 29). After recording the dry weight, the moisture content of the soil was estimated according to equation of Hillel's (19) and Zein (29).

$$Pw=\left(\frac{Msw-Ms}{Ms}\right) 100 \qquad (21)$$

=Since:

Pw = weight percentage of moisture

Msw = mass of wet soil (g).

Ms = dry soil mass (g)

The experiment was covered using transparent polyethylene (agricultural nylon with a thickness of 2 mm) to prevent the arrival of raining during the period of rain. It was fixed on iron structures made for this purpose at a height of 1.5 m above the surface of the soil, and it was covered from the top while leaving the sides open for the purpose of allowing the entry of air and allowing steam water from evaporation - transpiration out into the atmosphere. The coverage process was based on the information of meteorological sites that expected rain during the season.

Table 2. Symbols of the studied genotypes in the first season

symbols	genotypes	Source
V1	baghdad	The Agricultural Research Department/ Ministry of Agriculture
V2	rashidiya	
V3	bohooth	
V4	tamoz	
V5	rashid	
V6	3194	The Latifiya Research Station of the Agricultural Research Department / Ministry of Science and Technology
V7	3083	
V8	3075	
V9	3230	
V10	3184	
V11	3001	
V12	3151	
V13	3166	
V14	3223	
V15	3195	
V16	3152	
V17	3096	
V18	3285	
V19	3055	
V20	3189	
V21	3104	
V22	3211	
V23	3202	
V24	3241	
V25	3206	

Studied traits

Grain yield: The grain yield was estimated for an area of one square meter from each experimental unit and converted to ton h^{-1} after excluding the guard lines**.**

Protein content in grains (%): The protein percentage in the grains was squolied according to the equation:

Protein percentage = N x 5.70, as stated in AOAC (11).

The fall number: is estimated as AACC (1).

Gluten content: of wheat flour(%). Wet and dry gluten and gliadin were estimated as per AACC (1). The results were analyzed using analysis of variance, and the differences amoing means were analyzed statistically by L.S.D. at 5% level Genstat-Version 7 Pragram (25).

RESULTS AND DISCUSSION

Grain yield ton ha^{-1}: Table (3) shows a significant difference in highest mean grain yield of (12.91 and 12.88 tons ha^{-1}) for the two genotypes V6 and V21 , respectively. While, V17 and V24, genotypes produced the lowest mean grain yield of (3.43 and 4.76 tonnes ha^{-1}) and these are consistent with the results of Muhammad (21) and **Al-ziady, Hussain.** (12). as a result of the different susceptibility of genotypes. After testing the superior compositions in baking ability in the levels of moisture depletion. The results of, Table (4) reveal a significant decreases in grain yield with increasing levels of moisture depletion. The highest mean grain yield was at the level of 50% depletion of the available water and reached (5.71 tons ha^{-1}) when was outperformed by an increases of (64.55%) than the level of depletion of 90% of the available water that gave the lowest mean grain yield (3.47 tons ha^{-1}) because the availability of the appropriate moisture. The genotypes differed significantly in the grain yield production. The two genotypes V11 and V24 were superior in producing the highest mean grain yield (5.06 and 5.08 tons ha^{-1}) , respectively compared to the other genotypes there grain yield ranged (4.05- 4.98 tons ha^{-1}). These results are in line with the findings of Al-Baldawi (6) and **Hassan** et al. (17), which clarified the variation in the response of the genotypes with the appropriate environmental factors that are reflected in the increase in the efficiency of metabolic processes and all growth characteristics of wheat. The interaction was significant between the genotypes and the levels of moisture depletion, the grain yield of most of the genotypes decreased with the increase in the levels of depletion, as the genotypes V11 and V25 excelled with the level of depletion of 50% of the available water in giving the highest mean grain yield of (6.33 and 6.16 tons ha^{-1}). Thus, they outperformed the genotypes V7 and V13 with a 90% depletion level of the available water, which gave the lowest mean grain yield (2.82 and 3.05 tons ha^{-1}).

Protein percentage: Table (3) indicates a significant differences in the level of protein in wheat grains with different genotypes. Genotypes V19, V13, and V20 excelled in giving the highest mean protein percentage of (11.32, 11.40, and 11.09%) respectively, and thus they outperformed two genotypes of V5 and V18, which gave the lowest mean protein percentage of (8.79 and 8.54%) for the two genotypes, respectively, due to the different susceptibility of the genotypes. Genetic influence on absorption, assimilation efficiency, re-transfer of nitrogen to grains, and the extent to which they are affected by the environmental factor (22). After testing the best compositions under different levels of depletion in the second season, The results in Table (5) show a significant increases in the level of wheat grain protein with an increases in moisture depletion levels, as the depletion level of 90% of the available water gave the highest mean protein percentage (14.63%) outperformed by (33.85%) compared to the level of depletion of 50% of the available water, which gave the lowest mean protein content of 10.93% because water stress increases the accumulation of dissolved sugars and amino and organic acids, which is positively reflected on the protein (2). The percentage of protein in the wheat kernel differed with the different genotypes. Genotypes V25 and V9 gave the highest mean protein percentage of (14.22 and 14.11%), superior to V2, which gave the lowest mean protein percentage (10.22%). The interaction of depletion levels with different genotypes was significant, as formulas V11 and V25 with the depletion level of 90% of the available water gave the highest mean protein percentage of (16.33 and 16.00%) respectively, outperforming formulas V2 and 3160 in the level of depletion of 50% of the water. The available -made product that gave the lowest mean protein content was (8.67 and 8.67%), because soil moisture is one of the influencing factors, especially during the stage extending from flowering to physiological maturity, and that the lack of water caused the short period of filling the grain, which helped to increase the accumulation of nitrogenous substances in the grains, which was reflected On the high content of protein (16).

Table 3. The grain yield and protein% of some genotypes introduced from bread wheat for the first season

N	genotypes	Grain yield ton h^{-1}	protein%
1	V1	6.54	10.23
2	V2	8.43	10.04
3	V3	11.63	9.12
4	V4	11.38	10.33
5	V5	9.80	8.79
6	V6	12.88	10.33
7	V7	10.39	10.29
8	V8	6.93	10.39
9	V9	11.13	10.35
10	V10	6.71	10.00
11	V11	10.50	9.18
12	V12	12.23	10.48
13	V13	11.66	11.40
14	V14	10.23	10.54
15	V15	9.64	9.32
16	V16	11.78	10.22
17	V17	3.43	10.93
18	V18	7.79	8.54
19	V19	7.28	11.32
20	V20	7.10	11.09
21	V21	12.91	10.12
22	V22	5.44	9.26
23	V23	8.03	10.09
24	V24	4.76	10.34
25	V25	7.02	10.13
L.S.D		1.26	1.08

Table 4. Effect of moisture depletion levels on grain yield of some genotypes introduced from bread wheat.

genotypes	grain yield ton ha^{-1} for the second season moisture depletion %50	%70	%90	mean
V2	6.02	4.31	3.71	4.68
V7	5.31	4.03	2.82	4.05
V9	5.47	5.62	3.84	4.98
V11	6.33	5.04	3.81	5.06
V13	5.75	3.73	3.05	4.17
V14	5.24	4.48	3.08	4.27
V21	5.50	4.48	3.16	4.38
V24	5.56	3.84	3.85	5.08
V25	6.16	5.14	3.95	4.42
mean	5.71	4.52	3.47	
L.S.D. 0.05	Genotypes	moisture depletion	genotypes * moisture depletion	
	0.25	0.21	0.44	

Table 5. Effect of moisture depletion levels on protein% of some genotypes introduced from bread wheat

genotypes	protein% for the second season moisture depletion %50	%70	%90	mean
V2	8.67	10.00	12.00	10.22
V7	10.66	12.00	13.00	11.89
V9	12.67	14.00	15.67	14.11
V11	11.33	13.67	16.33	13.78
V13	8.67	12.33	14.67	11.89
V14	9.66	13.33	13.00	12.00
V21	12.00	14.00	15.66	13.89
V24	12.00	13.67	15.33	13.67
V25	12.67	14.00	16.00	14.22
mean	14.63	13.00	10.93	
L.S.D. 0.05	genotypes	moisture depletion	genotypes * moisture depletion	
	0.89	0.88	1.60	

Falling number (second)

The availability of amylase enzymes effectively is of great importance, especially alpha-amylase, because the substances resulting from the action of this enzyme are simple sugars that are food for yeast, thus increasing the production of carbon dioxide gas necessary for the expansion of the dough and increase its size, so it is one of the important enzymes in the process of making bread as the It provides the reason for increasing the number of loaves of bread in a given volume of flour. Figure (1) indicates the superiority of genotype V22 in giving the highest mean falling number (421 seconds) compared to other the genotypes whose falling number ranged (254-418 seconds). After selecting the superior compositions and planting them with different moisture depletion levels. Table (6) shows a significant superiority of the falling number with increasing levels of moisture depletion. The level of depletion of 90% of the available water exceeded in giving the highest mean of the falling number reached (385.51 seconds) with an increase of (19.85%) over the level of depletion of 50% of the available water that was given. The lowest mean falling number was (321.66 seconds) due to the role of soil moisture content to influence different degrees the levels of enzymes inside plant cells, and the occurrence of moisture tension, especially in the last stages of bean growth, helped reduce the activity of decomposition enzymes. The genotypes differed were significantly in the mean of the fall number, the genotype V14 was superior in giving the highest mean of the falling number (381.00 seconds) compared to the other genotypes there falling number ranged (322.67-368.89 seconds) due to the different response of the genotypes and their impact on climatic conditions and field management. The genotypes significantly overlapped with the levels of moisture depletion, the response of all genotypes was towards an increase in the number of falls with an increases in the levels of moisture depletion. The formulation V14 with the level of depletion of 90% of the available water gave the highest mean drop number of (426.00 seconds), and thus surpassed the formulation V9 with the level of depletion of 50% of the available water, which gave the lowest mean falling number of (270.33 seconds) for the role of dehydration in reducing the activity of enzymes amylase, so that the values of the falling number for all the compounds within the study were within the acceptable and good limits for the bread industry mentioned by Zine el-abidin (30), which ranged between (213-446 seconds) and this agrees with the results of Al-Obaidi (9) and Tatar et al. (25).

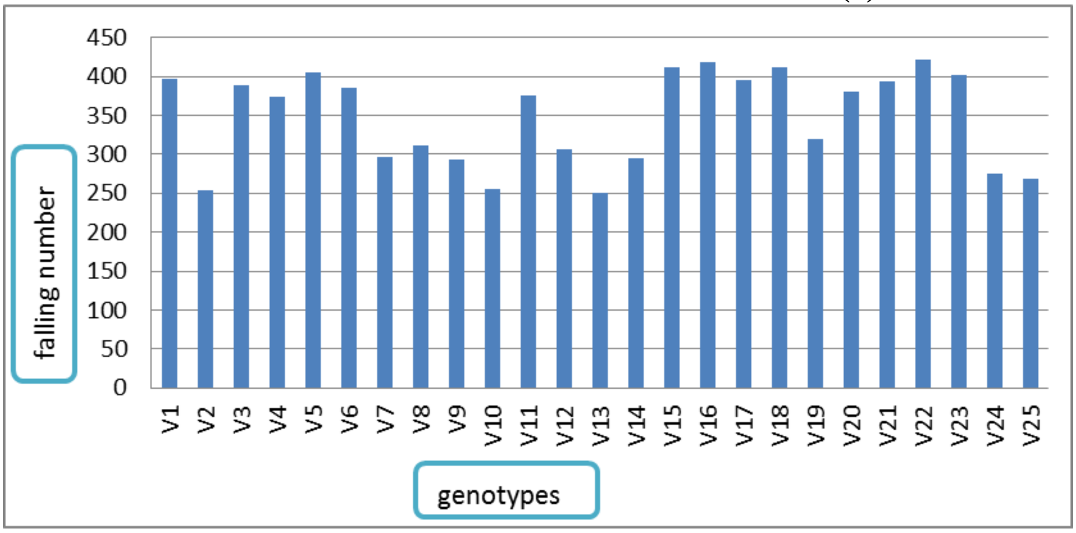

Figure 1. Falling number for genotypes into the first season

Table 6. Effect of moisture depletion levels on the falling number of some genotypes introduced from bread wheat

genotypes	Falling Number for the second season, moisture depletion %50	%70	%90	mean
V2	323.00	326.00	405.00	351.33
V7	322.67	385.00	399.00	368.89
V9	270.33	320.00	377.67	322.67
V11	351.00	366.00	373.00	363.33
V13	324.00	354.00	368.00	348.67
V14	323.00	394.00	426.00	381.00
V21	329.00	338.00	384.00	350.33
V24	327.00	328.00	353.00	336.00
V25	325.00	326.00	384.00	345.00
Mean	321.66	348.55	385.51	
L.S.D. 0.05	Genotypes	moisture depletion	genotypes * moisture depletion	
	1.53	0.42	2.51	

Gluten%: It is an indicator of wheat quality, as the high gluten% gives a best indicator of the good rheological properties and directly affects the functional properties. The gluten consists of (wet and dry quality gluten with high molecular weight and cladding with low molecular weight). Figures (2, 3, and 4) show significant differences in the gluten% with all its proteins in the genotypes. The composition V25 was superior in giving the highest mean of the wet and dry gluten (38.8% for wet gluten and 12.5% for dry gluten) outperformed by the V15 compositions, which gave the lowest mean for the wet and dry gluten amounted to (19.4% for wet and 6.6% for dry gluten). The gluten% in quality of the compositions depends on the different genetic factors and their response to environmental conditions, soil service processes, and the crop, and that gluten is a colloidal fiber similar to threads and it gives cohesion to the dough produced from flour (strength). As for clonidine, its presence gives elasticity to the dough. Figure (4) shows significant differences in the gliadin% with the different genotypes. genotype V9 outperformed in giving the highest mean of the percentage of gliadin amounted to (26%), and thus it surpassed the formulation V10, which gave the lowest mean of the percentage of gliadin amounted to (1%). After cultivating the superior compositions in baking quality characteristics and testing them at different moisture depletion levels. The results in Tables (7, 8, and 9) indicate significant differences in the percentage of gluten of all kinds with different levels of moisture depletion. Tables (7 and 9) show that the level of depletion of 90% of the available water exceeded in giving the highest mean of the percentage of wet and dry gluten, which amounted to (40.59% for wet gluten and 11.99% for dry gluten, with an increases of (64.93% for wet and 48.30% for dry) compared to the level of depletion of 50 % of the available water that had the lowest mean of dry and wet gluten was (24.61% for wet gluten and 8.08% for dry gluten) The gliadin did not differed from the behavior of the gluten. Table (9) shows that the levels of gliadin increased with the increase of moisture depletion levels. The level of depletion of 90% of the available water gave the highest mean of the percentage of gliadin amounted to (1.96%) with an increases of (263%) over the level of depletion of 50% of the available water which gave the lowest mean of the percentage of gliadin amounted to (0.54%). most of the ingredients except for protein, which is reflected in the gluten% and represents the largest part of wheat proteins. Moisture stress increased protein accumulation in wheat grains (Table 5), which played a major role in increasing the levels of gluten of all kinds. The genotypes were significantly affected in the gluten% of all kinds. The combination of V9 and V25 was superior in giving the highest mean percentage of wet and dry gluten (35.00% for wet and 11.08% for dry) and (35.61% for wet and 10.11% for dry) for the two genotypes respectively, thus surpassing genotype V7, which gave the lowest mean of wet and dry gluten reached (27.00% for wet and 9.23% for dry) and these differences were due to genetic variation between the genotypes when the same irrigation conditions were available. The good compositions were characterized by a high gluten% and good gluten was characterized by water absorption and good baking ability, unlike weak gluten (23). The gliadins differed in the genotypes significantly, the synthesis V14 was superior in giving the highest mean of the percentage of gliadins which reached (2.57%), superior to other genotypes for which the mean of the gliadins ranged (0.54-1.50%). The interaction of genotypes with moisture depletion levels was significant. The gluten components of (wet and dry gluten and gliadin) increased in all genotypes with increased levels of moisture depletion. The genotypes V11 and V25 were superiored in the level of depletion of 90% of the available water in producing the highest mean of the gluten% which reached (45.00 and 45.17%) for the two genotypes respectively, superior to the two genotypes V2 and V11 in the level of depletion of 50% of the available water, which gave the lowest mean of the percentage of wet gluten it reached (22.50 and 22.00%) for the two installations, respectively. As for the results of dry gluten. It was found that the two genotypes V9 and V13 at the level of depletion of 90% of the available water in the highest mean of the gluten% reached (13.47 and 13.93%) for the two genotypes respectively. The lowest mean of dry gluten was (7.33 and 7.07%) for the two genotypes, respectively. The results of the gliadin showed, that genotype V14 was superior in the level of depletion of 90% of the available water in giving the highest mean of the percentage of gliadin (3.41%) and it outperformed the genotypes V11 and V13 in the level of depletion of 50% of the available water, which gave the lowest mean of the percentage of gliadin amounted to (0.11 and 0). 11%) for the two installations, respectively. This agrees with the results of Hashem (16) and Mohammed (21), due to the role of dehydration in increasing the proportion of gluten in wheat grains because the presence of dehydration enhances the disulfide bonds that are formed from gluten proteins and thus there is an increases in the accumulation of proteins. Al-obaidy et al. (8), that bonds disulfides play an important role in maintaining the gluten network, as dehydration oxidizes the amino acid cysteine in the protein to form cysteine disulfide bonds, and this causes larger gatherings of gluten proteins and an increase in their molecular Weight.

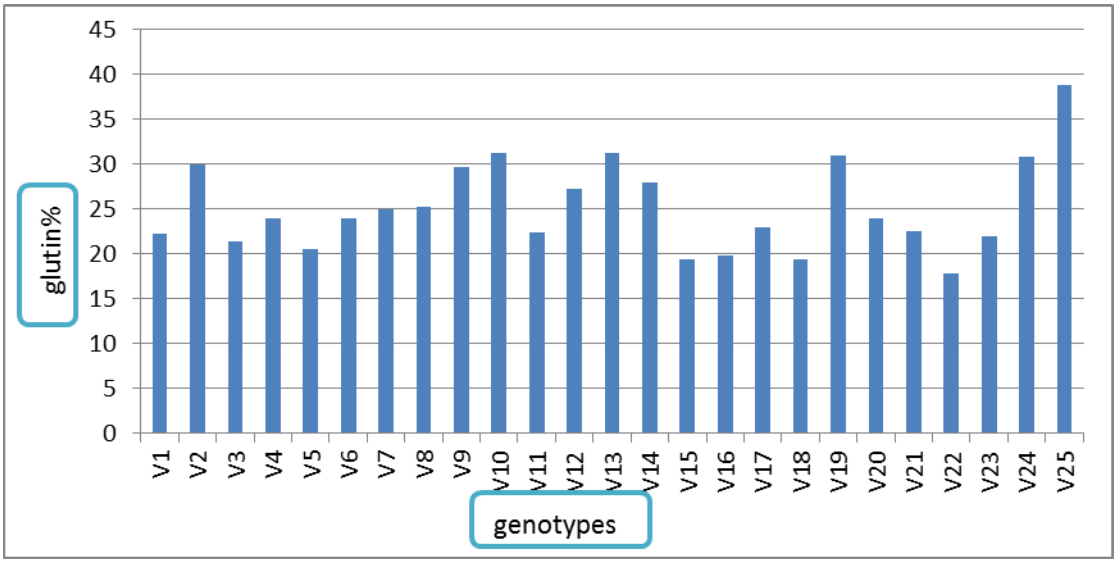

Figure 2. the Gluten% for the genotypes into the first season

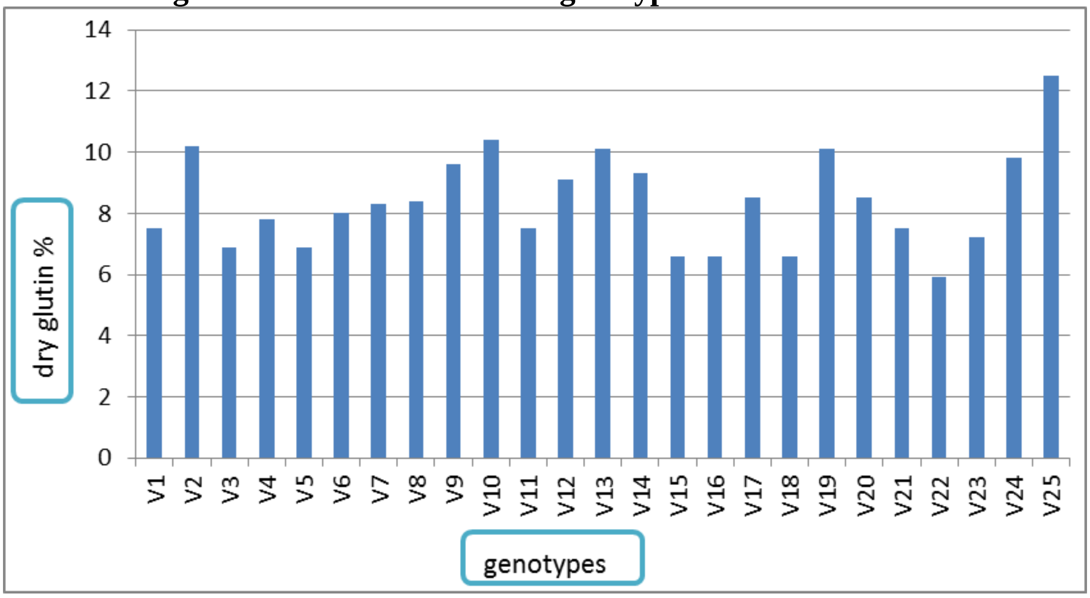

Figure 3. Dry gluten% to genotypes into the first season

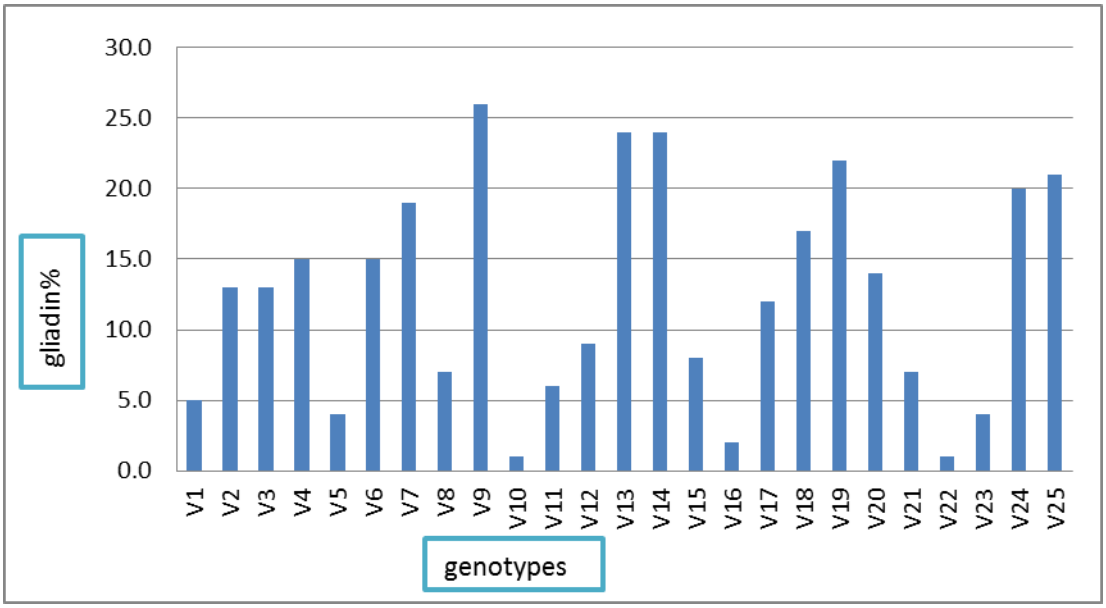

Figure 4. Weak gluten% (gliadin%) for the genotypes into the first season

Table 7. Effect of moisture depletion levels on wet gluten% of some genotypes from bread wheat

genotypes	wet gluten% (gliadin%) for second season moisture depletion %50	%70	%90	mean
V2	22.50	33.00	41.17	32.22
V7	23.00	24.00	34.00	27.00
V9	26.00	35.00	44.00	35.00
V11	22.00	34.00	45.00	33.67
V13	23.50	26.00	41.00	30.17
V14	24.00	30.17	39.00	31.06
V21	25.00	26.00	33.00	28.00
V24	27.00	32.00	43.00	34.00
V25	28.50	33.17	45.17	35.61
Mean	24.61	30.37	40.59	
L.S.D. 0.05	genotypes 0.46	moisture depletion 0.39	genotypes* moisture depletion 0.80	

Table 8. Effect of moisture depletion levels on the dry gluten% for some genotypes introduced from bread wheat

genotypes	Dry gluten% for second season moisture depletion %50	%70	%90	mean
V2	7.33	7.90	9.90	8.38
V7	7.60	8.60	11.50	9.23
V9	8.50	11.27	13.47	11.08
V11	8.60	8.50	11.30	9.47
V13	7.70	8.00	13.93	9.88
V14	7.07	7.80	13.00	9.29
V21	8.50	12.80	13.30	11.53
V24	8.30	9.90	10.33	9.51
V25	9.13	10.00	11.20	10.11
Mean	8.08	9.42	11.99	
L.S.D. 0.05	genotypes 0.47	moisture depletion 0.54	genotypes * moisture depletion 0.87	

Table 9. Effect of moisture depletion levels on the weak gluten% for some genotypes from bread wheat

genotypes	Weak gluten% (gliadin%) second for season moisture depletion			mean
	%50	%70	%90	
V2	0.20	1.80	2.50	1.50
V7	0.20	1.00	1.70	0.97
V9	0.66	1.20	2.60	1.49
V11	0.11	0.60	0.90	0.54
V13	0.11	1.10	2.50	1.24
V14	2.10	2.21	3.41	2.57
V21	0.20	0.70	1.20	0.70
V24	0.60	0.70	1.40	0.90
V25	0.68	1.20	1.40	1.09
Mean	0.54	1.17	1.96	
L.S.D. 0.05	Genotypes	moisture depletion	genotypes * moisture depletion	
	0.07	0.04	0.12	

Conclusion

That The depletion level of 50% of the available water increased the grain yield, while the high moisture depletion levels 90% of the available water led to an increased the percentage of protein and its positive reflection on the specific trails of the quality of the crop. We recommend the use of moisture tension in intensive research experiments on local varieties that have been known to have low baking quality values to improve the quality of these varieties, and conducting studies to determine the stage of growth in the wheat in which irrigation is cut and has an effect on the quality of the crop. Use of genotypes V25, V9, V11, and V13 in future plant breeding research and include them in cross-breeding programs with local varieties to improve the ability of these varieties to bake by taking advantage of the good baking ability of these genotypes. Using of moisture depletion levels of 70% of the available water to improve the chemical characteristics of the quality of baking and the different rheological characteristics of the crop in addition to obtaining a satisfactory yield.

REFERENCES

1-AACC . 2010. Approved Methods of the American Association of Cereal Chemists. St. Paul, Minnesota, U.S.A

2- Abadi, T., A. Alemzadeh, and S. A. Kazemeini. 2011. Wheat yield and grain protein response to nitrogen amount and timing. Australian J. Crop Sci. 5(3):330-336

3- Abdullah, A. A. and Z. R. Kadhim. 2023. Minimization of water needs in Iraq agricultural in light of the prevailing of the cropping combination during. Iraqi Journal of Agricultural Sciences. 54(1): 189- 204. https://doi.org/10.36103/ijas.v54i1.1690

4- Abdul Rahman, T. F., K. J. Osamah and N. J. Bilal. 2023. Impact of improved seeds and some modern technologies on increasing the supply Of wheat crop in Iraq for the agriculture season 2019-2020. Iraqi Journal of Agricultural Sciences. 54(1): 176- 188. https://doi.org/10.36103/ijas.v54i1.1689

5- Al-aridhee, A. H. A. and N. T. Mahdi. 2022. Influence of irrigation systems and cover crop on water productivity, and mize growth. Iraqi Journal of Agricultural Sciences. Sci. 53(6): 1465- 1475. https://doi.org/10.36103/ijas.v53i6.1663

6- Al-Baldawi, M. H. K. 2006. Effect of Planting Dates on The Duration of Seed Filling, Growth Rate, Yield and Its Components in Some Varieties of Bread Wheat (*Triticuma aestivum* L.) Ph.D Dissertation. College of Agric. – Univ. of Baghdad. pp: 147

7- Allen, R. G., L. S. Priera, D. Raes and M. Smith. 1998. Crop Evapotranspiration. Guid Lines for Computing Crop Water Requirement. FAO Irrigation and Drainge paper No. 56. FAO, Rome. Italy. pp: 300

8- Al-Obaidy, B. S. H and K. A. Jaddoa. 2017, Wheat seeds priming (*triticum aestivum* L.) for tolerance drought. 22(10): 209-220

9- Al-Obaidi, N. F. 2019. Factors Affecting the Percentage of Damaged Starch in the Wheat Flour Used in the Bread Industry. Master's thesis. Dep. of Food Sci. College of Agric. Eng. Sci. Univ. of Baghdad. pp: 146

10- Al-Younis, A. A. 1993. Production and Improvement of Field Crops (Part One) Ministry of Higher Education and Scientific Res. - College of Agric. Univ. of Baghdad. pp: 469

11- AOAC. 2005. Official Methods of Analysis Association of official Analytical chemists Washington, U.S.A. Chapter 32, pp: 27

12- Al-ziady, S. H. A. and L. A. Hussain. 2023. Effect of palm pollen, pumpkin extract, nano fertilizer and their interactions with wheat herbicides. Iraqi Journal of Agricultural Sciences. 54(2):553- 562. https://doi.org/10.36103/ijas.v54i2.1731

13- Central Statistical Organization . 2020. The Annual Report for the Production of Wheat. Ministry of Planning. Iraq. pp 17

14- Fadl, J. A., M. S. Shaiban and M. Ibadi. 2010. Comparison of physical, chemical, rheological and baking characteristics of some local and imported wheat cultivars. Ass. Univ. Bull. Environ. Rer. 13(2): 37-52

15- FAW. 2020. Crop Rospects and Food Situation. pp: 45

16- Hashem, I. K. and H. K. Haidari. 2012. Response of some growth characteristics of bread wheat to planting dates and irrigation periods. Iraqi Journal of Agricultural Sciences. 43 (5): 42-51

17- Hassan, D. F., A. S. Ati and A. S. Naima. 2023. Evaluation of the performance of the aquacrop model under different irrigation and cultivation methods and their effect on water on consumption. Iraqi Journal of Agricultural Sciences. 54(2): 478- 490. https://doi.org/10.36103/ijas.v54i2.1724

18- Hussain, M. A., M. A. B. Sadeeq and S. Y. Hassan. 2022. Stability analysis and estimation some genetic parameters for grain yield and its components for some durum wheat genotypes. Iraqi Journal of Agricultural Sciences. 53(1):84-90. https://doi.org/10.36103/ijas.v53i1.1511

19- Hillel, D.1980. Application of Soil Physics. Academic press. Inc. New York. pp: 116-126

20- Issa, T. A. 1990. Crop Plant Physiology, Translated by Roger, L., Ministry of Higher Edu. and Sci. Res, Univ. of Baghdad, pp: 449

21- Muhammad, E. I. 2020. Effect of a number of irrigations on some qualitative characteristics of three cultivars of soft bread wheat *Triticum aestivum* L. Proceedings of the Eighth and Second International Scientific Conference. College of Agric., Tikrit Univ. 1-12

22- Omran, B. and G. A. Alloush. 2020. The effect of potassium fertilization on the tolerance of soft wheat (*Triticum aestivum* var.Sham 6) to water stress. Syrian J. of Agric. Res. 7(2): 291-310

23- Popko. M. et al. 2018. Effect of the new plant growth bio stimulant based on amino acid on yield and grain quality of winter wheat. Dep. of Advanced Material Techn. Faculty of chemistry. Wroclaw Univ. of Sci. and Techn. Smoluchowskiego 25: 350-372

24-Regulatory Guide to the Work of Laboratories of the General Company for Grain Trade. 1980. Ministry of Commerce / Quality Control Laboratories in Taji. pp: 130

25-Steel, R. G., and J. H. Torrie. 1980. Principles and Procedures of Statistics. Mc Graw Hill Book Company. Inc. USA. pp: 485

26-Tatar, O., U. Cakalogullari, F., Aykuttonk, D. Istipliler, and R. Karakoc. 2020. Effect of drought stress on yield and quality traits of common wheat during grain fillng stage. Field Crops . 25(1): 236-24

27-Youssef, D. B, K. K. al-Janabi, A. R. Abbas, S. M. Wasmi, K. M. Wasmi, A. A. Nafal and A. M. Haidar. 2017. Breeding and development of a new variety of durum wheat (*Triticum turgidum* var. durum) suitable for the irrigated area of Iraq. The Arab J. of Dry Envi. 10 (1and 2): 85-104

28-Zadoks, J. C., T. T. Chang and C. F. Konzak.1974. A decimal for the growth stages of cereals . Weed Res., 14: 415-421

29-Zein, A. K. 2002. Rapid determination of soil moisture content by the microwave oven drying method. Sudan engineering society J. 48(40): 43-54

30-Zine el abidine, M. W. 1979. A study of fixing the standard specifications of flour suitable for the production of Iraqi bread and Samon. M. Sc Thesis, College of Agric. Univ. of Baghdad, pp: 104.