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Studying the Qualitative Properties (physical and chemical) of Durum Wheat

Benyamin kourd

Graduated from M.Sc. in Agriculture and Plant Breeding, Azad University of Jiroft, jiroft Iran.

E-mail: mhmdyqwbkrd@gmail.com

ABSTRACT

This study aims to investigate the physical and chemical properties of durum wheat. The experiment took place on 1600 m² of land. Using a groove maker, the land was designed as a furrow pattern following initial land map preparation and implementation. To implement the experimental design, furrows 60 cm wide were created along the ground and perpendicular to the irrigation path. There were 20 plots in each replication equal to the number of treatments. Each 6 × 1.5 m plot consisted of six planting lines with a 30 cm distance. Data were analyzed by the one-way analysis of variance (ANOVA). MSTATC and SAS software were used to make calculations, and EXCEL was utilized to create graphics. According to the comparison test, the mean grain protein percentage of the tested cultivars differs significantly at the statistical level of one percent. There are statistically significant variances in the cultivars' average number of zeleni. The grain water absorption percent of the grains of the tested cultivars did not differ statistically. The grain hardness of the cultivars did not differ significantly. In any of the statistical levels, there is no statistical difference between the analyzed cultivars, and all twenty tested cultivars are in the same statistical class in terms of dry gluten content.

Keywords: *Durum wheat, Physical properties, Chemical properties, Grain hardness*

INTRODUCTION

Durum wheat is appropriate to semi-arid conditions, which the majority of its area, which is under cultivation, receiving less than 350 mm of rainfall. With 10-12 million tons produced, the Near East and Middle East are the main producers, followed by North America, the former Soviet Union, Europe, Africa, Australia, and South America. The global output ranges from 30 to 35 million tons, and the producing nations consumes more than 80% of the overall production. Durum wheat is an annual monocotyledonous plant. The root system of this wheat may penetrate to a depth of more than one meter in optimal conditions. The stem of durum wheat, like the stems of all dark cereals, is hollow, cylindrical and spongy at the ends. Sub-stems (paw) are found in durum wheat in addition to the main stem, although its tillering potential is limited.

Shepherd et al. (1996) used local Australian cultivars to repeat the electrophoretic investigation of durum wheat and bread wheat proteins and their influence on the qualitative attributes of pasta and bread undertaken by some prior investigators. Much research has been conducted to determine the function of prolamins in the baking quality of bread and durum wheat.

Cross (1991) attempted to detect two gamma gliadin bands caused by electrophoresis separation named regular taba undesirable pasta quality in a biochemical investigation and analysis utilizing high-performance liquid chromatography with reverse phase (related to good quality). Fabriani and Lintas (1992-1991) used the flake pasta production method to investigate the

technical features of durum wheat. According to Etran and Filet (1989 and 1987), heavy glutenin subunits had a considerable effect. In addition, they found a satisfactory relationship between pasta quality and the 6 + HMW band and the 16 + 13HM band in an electrophoretic investigation of high molecular weight glutenin subunits and their relationship with pasta quality in 1987. The strength of cooked pasta has also been demonstrated to be influenced by durum gluten strength. In their genetic investigations, Josephides et al. (1987) found that chromosome B1 of durum wheat is more essential than other chromosomes in regulating gluten potency.

Shewry and Mifin (1983) used chromatography to extract wheat or gluten proteins using a solvent. They used chromatography to extract wheat or gluten proteins using a solvent. Regarding wheat proteins, Bietz (1983) developed a reversed-phase high-performance liquid chromatography technique. The function of gliadin in pasta quality and the relationship between gamma gliadin 42 and 45 and gluten viscosity was investigated by Cross et al. (1982). All samples with low gluten strength had 42, whereas 90 percent of samples with high gluten strength had 45. Monen et al. (1983) extracted gluten using just an SDS solution. They presented a high molecular weight and quality of wheat flour (100 and 103), which was later validated and expanded by numerous groups of researchers. To remove gluten, Oxford et al. (1979) utilized SDS solution and lactic acid.

Durum wheat has a protein level ranging from 9 to 18 percent. Protein levels of 12 to 16 percent of grain protein at 14 percent moisture are adequate for excellent quality preparation. The physical qualities of the dough used in the pasta business should be sturdy. These qualities are studied using Farinograph. The goal of this research is to investigate the physical and chemical characteristics of durum wheat.

Materials and methods

The experiment occurred between the fall of 1987 and the spring of 1988 at the Baluchistan Agricultural Research Station, located in the Bampour section of Iranshahr city, at a latitude of 60 ° and 29 ′ east, a longitude of 27 ° and 11 ′ north, and a height of 525 meters above sea level.

According to climatic classifications, Iranshahr has a hot and dry climate. The mean annual rainfall in the region is 100 mm, with maximum and minimum temperatures of 38.7 and 12.2 °C, respectively.

Table 1. Rainfall in the months of 2008 per mm

March	April	May	June	July	August	September	October
15.9	9.2	0.4	0	0	0	0	9.2

Table 2. The average temperature in the months of 2008 in terms of degrees Celsius

March	April	May	June	July	August	September	October
17.13	21.18	27.27	29.24	25.13	22	20.27	12.48

Table 3 shows the findings of soil mechanical and chemical degradation. Loamy soil texture was evaluated using mechanical examination and percentages of each soil component.

Table 3. Decomposition of test soil samples

Absorbable nitrogen	Absorbable phosphorus	Absorbable potassium	Manganese	copper	Iron	Zinc	Percentage of organic carbon	Soil acidity (pH)	Electrical conductivity (EC) ds.m-2	Soil texture	Factors to be decomposed
Percentage	Mg/kg										
0.2	8.0	98	5	1	8	0.37	1.75	7.7	3.18	Loamy Sandy	Test result

The experiment occurred on a 1600 m^2 of land. The aid of a groove maker was used to change the land design into an atmosphere and a ridge following initial land preparation and implementation. The furrows were 60 cm wide and ran down the ground, perpendicular to the irrigation direction, before the experimental map was adopted. The number of plots in each replication was 20 and was equal to the number of treatments. It measured 1.5 m by 6 m. N2, P2O5, and K2O with formulas of 135, 90, and 46 kg per hectare are required. All fertilizers except nitrogen applied to the soil during soil preparation and nitrogen fertilizer applied at the beginning of stem development, spike emergence, and granulation spread evenly across the field. Duncan's multiple range test techniques was used to investigate the data using analysis of variance and mean of treatments. MSTATC and SAS software were used to make calculations, while EXCEL was used to create graphics.

Findings

Table 4. Summary of analysis of variance of qualitative properties in the first experiment

Summary of analysis of variance of qualitative properties in the first experiment								
Sediment height	**n weight**	**t of gluten**	**hardness**	**grain moisture**	**number**	**grain protein**	**freedom d.f**	**change s.o.v**
14.067 n.s	0.653 n.s	0.163 n.s	2.606 n.s	0.014 n.s	3.634 n.s	0.152 n.s	2	**Repetition**
28.225 n.s	1.530 *	10.302 *	16.047 n.s	0.088 n.s	11.574 **	2.646 **	19	**Figures**
22.435	1.198	6.298	9.744	0.087	3.244	0.263	38	**Test error**
12.10	9.32	7.03	7.30	13.54	5.12	13.68	-	**Percentage change**

								coefficient

n.s Thre is no acceptable statistical difference between the means of the studied parameters.
There is a significant difference between the mean of the studied parameters at the statistical level of 5%.
** There is a significant difference between the mean of the studied parameters at the statistical level of 1% •

1. Percentage of grain protein

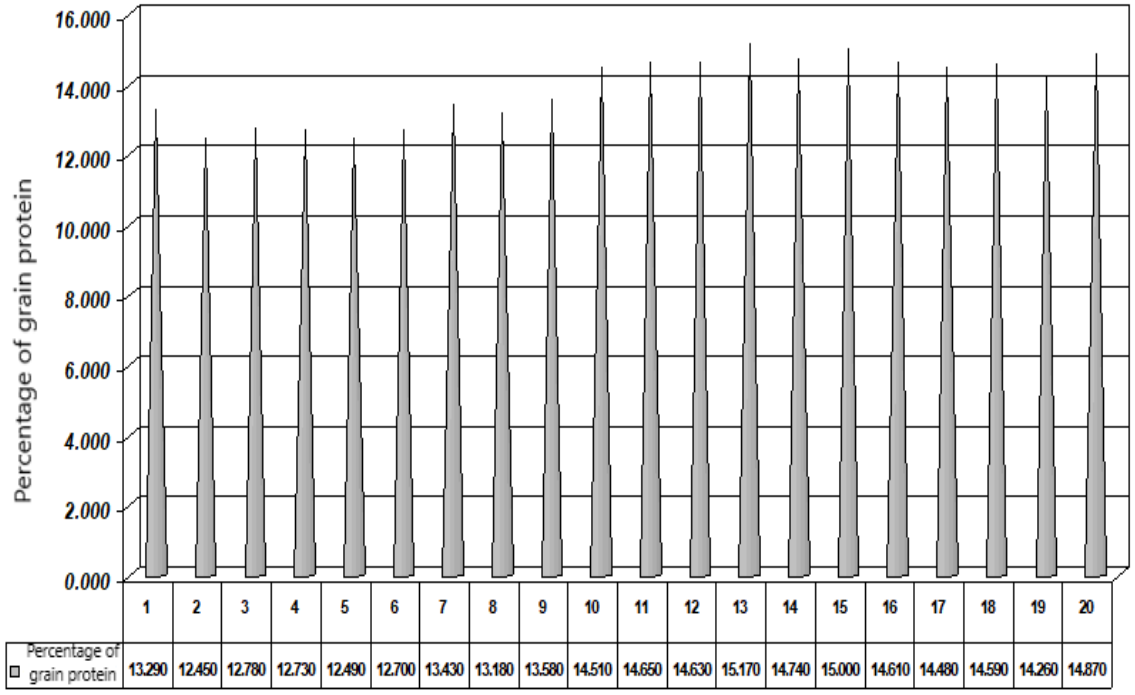

Figure 1. Comparing the average percentage of grain protein of different durum wheat cultivars compared to the first experiment

Table (4) shows that there is a significant difference at the statistical level of one percent between the mean value of grain protein of the examined cultivars, and Figures 10 to 20 have the maximum amount of grain protein with an average of approximately 14.5%. The second group includes cultivars 1 to 9, which are in various categories in terms of grain protein amount, which has an average of around 13.2 percent and the differences are not statistically significant.

In this study, the analyzed controls (cultivars 1 and 2), which were in the group with the highest grain yield, were examined in terms of grain protein percentage in the last ranks of cultivars. This suggests that there is an inverse relationship between the quantitative parameter of economic yield and the amount of grain protein, as evidenced by the studies mentioned below.

2. Zeleni number

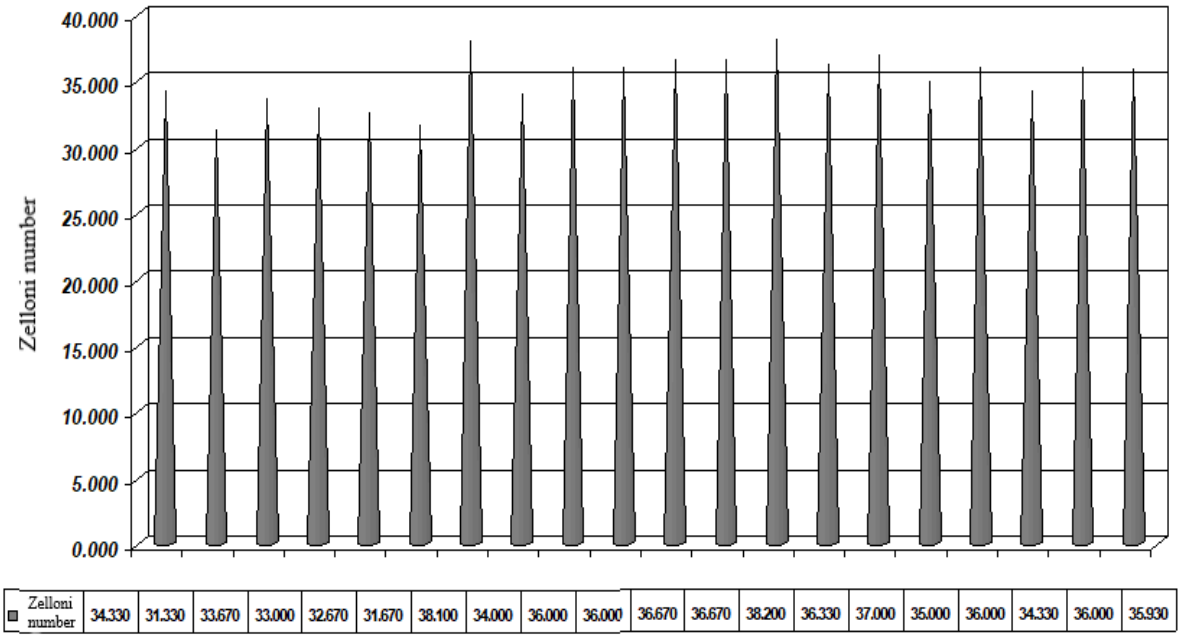

Figure 2. Comparing the mean changes of Zeleni number calculated by different durum wheat cultivars compared to the first experiment

The results in Table (4) and the comparison test of the mean on the Zeleni number indicate that there are statistically significant differences between the cultivars' mean Zeleni numbers, and except for cultivars 4, 5, 6, and 2, the other cultivars have the fewest Zeleni number.

3. Percentage of water absorption

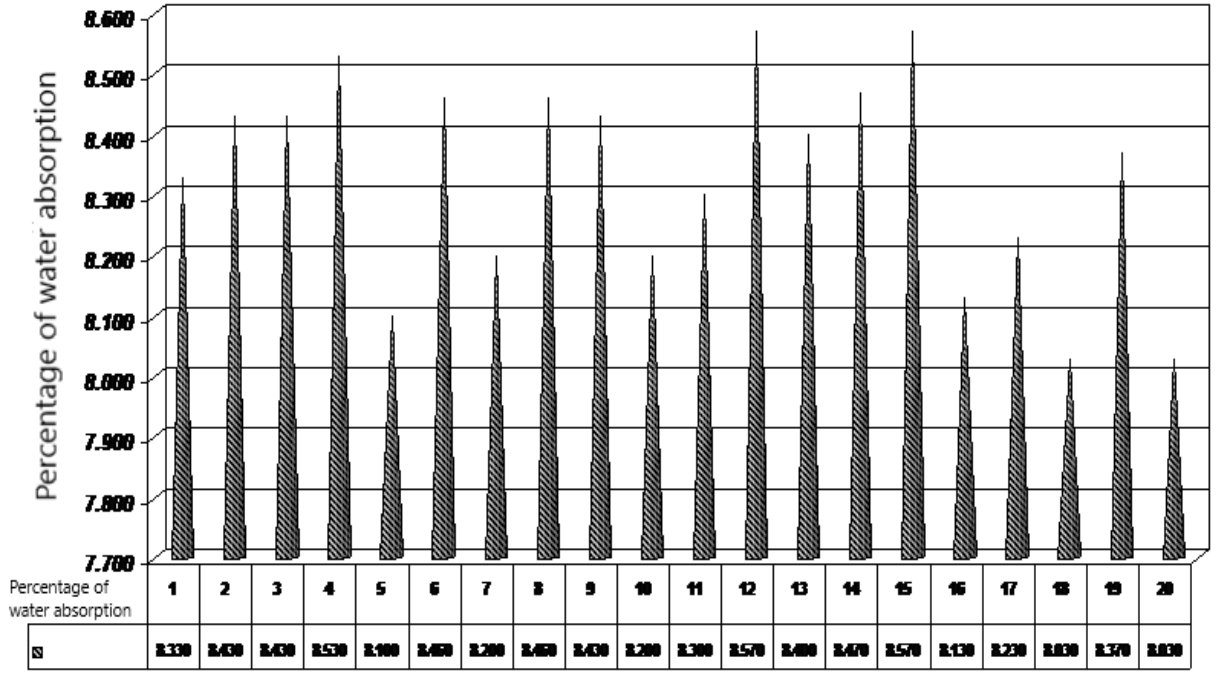

Figure 3. Comparing the mean value of water uptake of flour of different durum wheat cultivars compared to the first experiment

Based on the comparison of the means, there was no statistically significant difference in the grain water absorption value of the analyzed cultivars in this experiment. Considering the obtained mean, cultivar 15 with a water absorption percentage of 8.587 had the highest value, while cultivar 20 with a water absorption percentage of 8.033 had the lowest.

4. Grain hardness

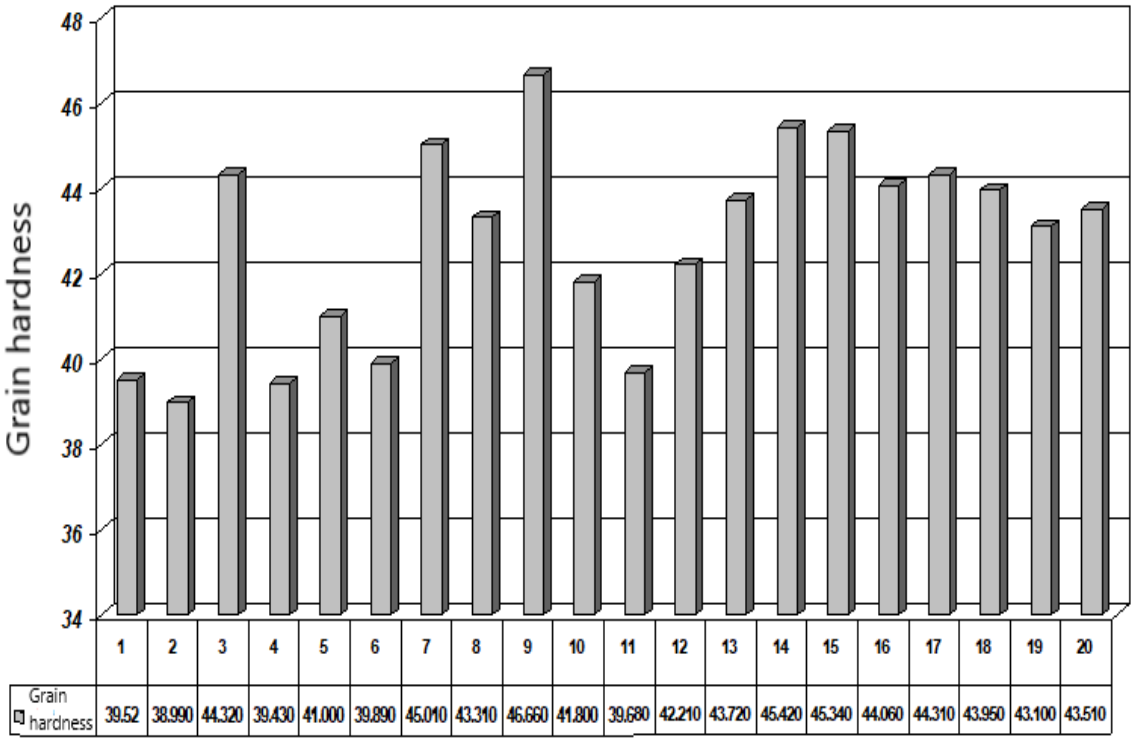

Figure 4. Comparing the mean grain hardness of different durum wheat cultivars compared to the first experiment

According to the statistical examination of this feature, there is no statistically significant difference in grain hardness amongst the investigated cultivars. Nevertheless, cultivar 9 had the maximum grain hardness of 46.66, whereas cultivar 2, which was used as a control in this experiment, had the lowest grain hardness of 38.99.

Betis et al. (36) found that grain hardness had a significant correlation with grain quality parameters such as number and size of the grain. In addition, grain hardness had a significant correlation with flour yield, in a study of single grain characteristics with final grain quality characteristics and planting 12 winter hard wheat cultivars in the Kansans region.

5. Percentage of wet gluten

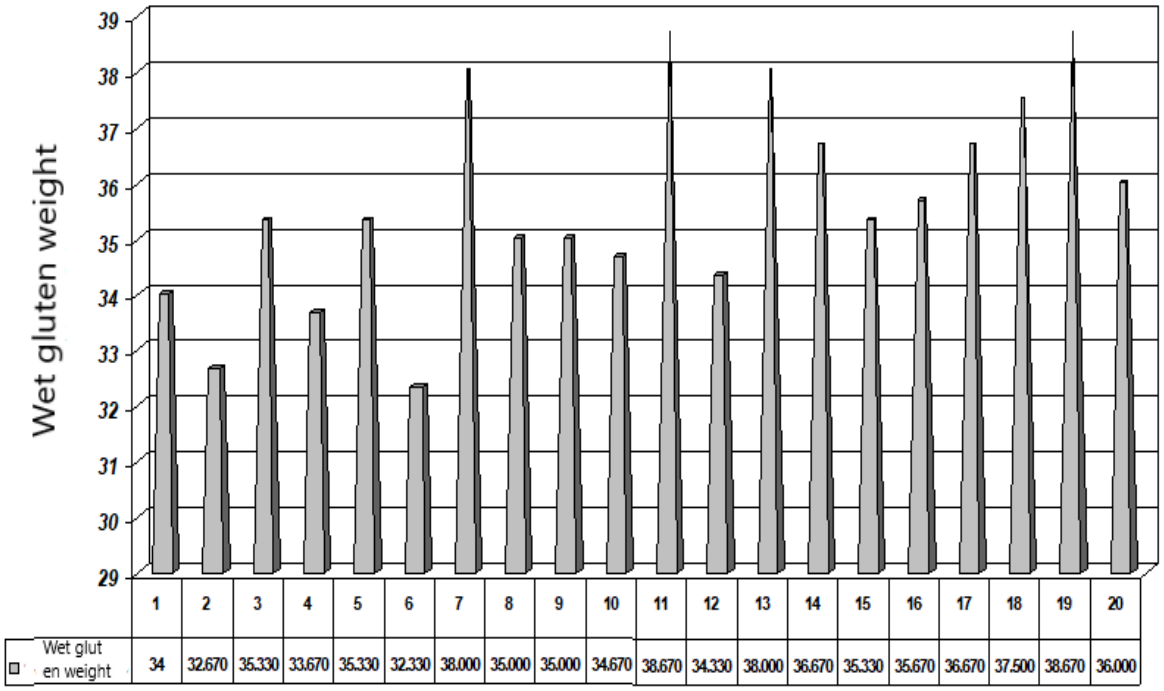

Figure 5. Comparing the mean wet weight gluten weight of different durum wheat cultivars compared to the first experiment

As found, there is no acceptable statistical difference. However, according to a study of the averages of this property in the examined cultivars, the cultivars 11-9-13 and 7 had the highest percentage of wet gluten, with a value of around 38. Conversely, cultivar 6 has the lowest amount of wet gluten (32.33). In contrast, the two control cultivars are in the same statistical group, and number 1 has a higher wet gluten content than number 2.

6. Percentage of dry gluten

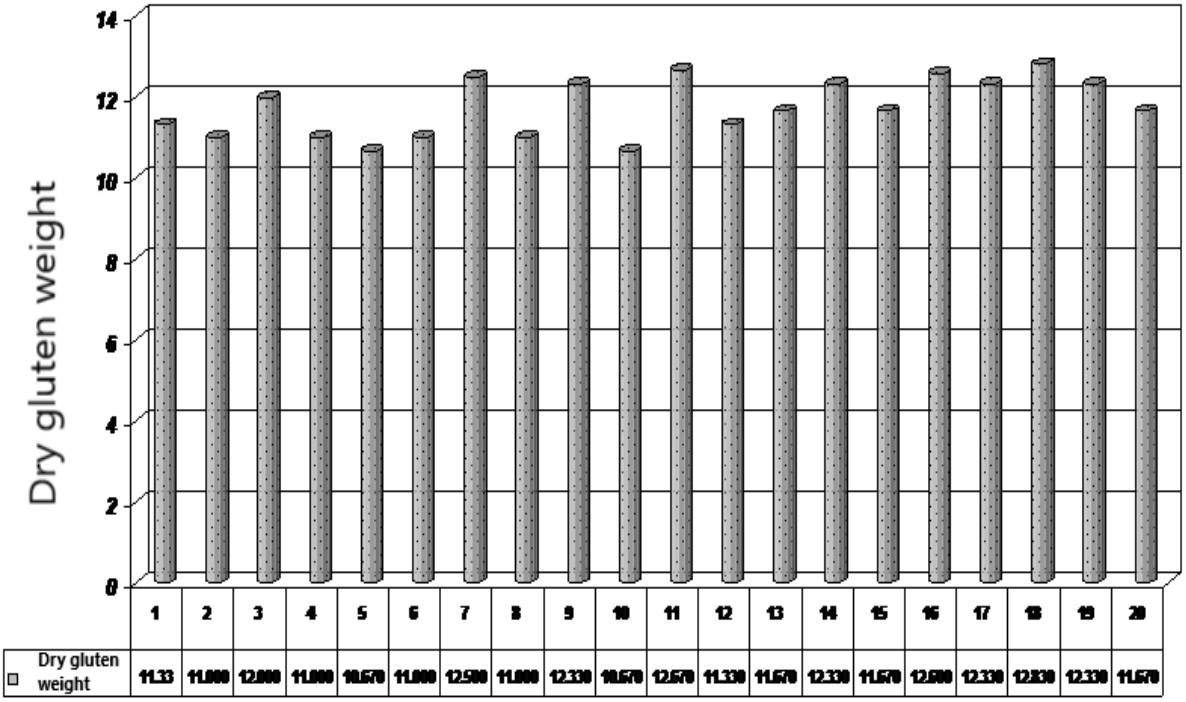

Figure 6. Comparing the average grain dry weight of different durum wheat cultivars compared to the first experiment

In any of the statistical levels determined, there is no statistical difference between the analyzed cultivars, and all twenty tested cultivars are in the same statistical class in terms of dry gluten content. The minor difference that they had in the research of wet gluten has vanished here, but according to this description, cultivar 18 has the highest value of dry gluten at 11.8 and the lowest percentage at 10.67.

7. Sediment height – SDS

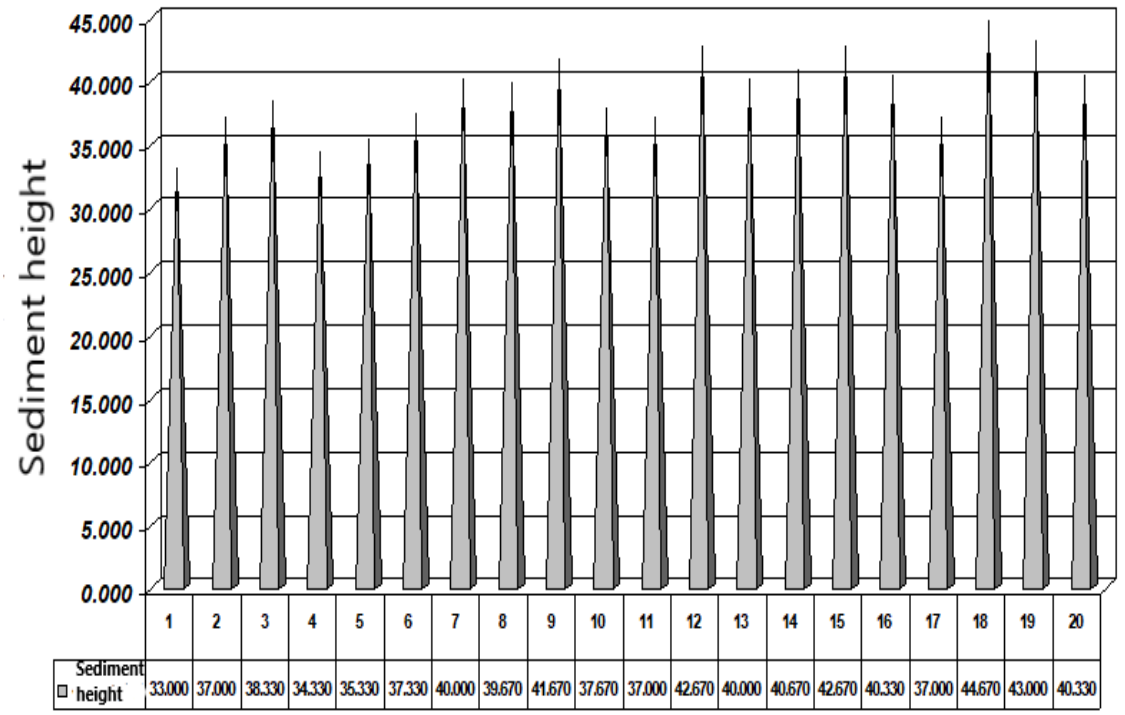

Figure 7. Comparing the mean grain deposition height of different durum wheat cultivars compared to the first experiment

It was found that there is no statistical difference between the mean sediment heights of the cultivars. Duncan's average comparison test, on the other hand, reveals the lowest difference. In terms of this feature, the examined cultivars can be statistically separated into two categories, with cultivars 1 and 4 being in the lowest category. The rest of the numbers are in a higher statistical category. Cultivar 18 has the highest sediment height determined, while cultivar 1 has the lowest at 33.

High thermal stress, according to Meflin et al. (32) lowers the deposition height during the grain filling stage. Low moisture stress during grain loading also increases sediment height, according to the researchers.

Table 5. Summary of analysis of variance of qualitative properties of the second experiment

Summary of analysis of variance of qualitative properties of the second experiment

Sediment height	More gluten	More gluten	Grain hardness	Percentage of water absorption	Zelloni number	Percentage of grain protein	Degrees of freedom d.f	Source of change s.o.v
18.117 *	0.052 n.s	2.279 n.s	2.778 n.s	0.559 n.s	19.125 n.s	0.871n.s	2	Repetition
58.895**	3.051**	20.520**	24.330**	0.197**	5.889*	0.389 *	19	Figures
7.503	0.882	5.871	6.848	0.493	6.569	1.241	38	Test error
7.05	8.04	6.80	6.17	8.55	7.21	8.01	-	Percentage change coefficient

n.s. There is no statistical difference between the mean of the analyzed parameters that is acceptable.

At a statistical level of 5%, there is a substantial difference between the mean of the analyzed parameters.

** At the 1% statistical level, there is a fairly substantial difference between the mean of the analyzed parameters.

1. Percentage of grain protein

According to the findings, there is no significant difference in the mean grain protein value of the tested cultivars at any of the acceptable statistical thresholds (5 percent or 1 percent). However, according to a mean comparison, cultivar 14 has the highest amount of grain protein, with an average of approximately 14.7%. While cultivar 6 had the lowest result (13.28% grain protein), the status of control cultivars did not differ from each other (13.96% and 13.57% grain protein, respectively).

2. Zeleni number

Considering wheat grain protein quality, the findings of this experiment show that there is no statistical difference between the investigated cultivars. Control cultivars had an average of 37.67 and 36 Zeleni numbers, respectively, putting them in the group with the best protein quality.

3. Percentage of water absorption

There was no significant statistical difference when the mean percentage of water uptake of flour of the grains of the examined cultivars was compared. According to the mean, cultivar 14 with a water absorption percentage of 8.733 had the highest value, while cultivar 2 with a water absorption value of 7.833 had the lowest.

4. Grain hardness

In this experiment, the range of variation for this characteristic is 36.80 to 46.66 percent, and the results of the statistical analysis done on this property reveal that there is a statistically significant difference between the cultivars' grain hardness. Cultivar 17 had the highest grain hardness of 46.66 and cultivar 6 had the lowest grain hardness of 31.33 among the evaluated cultivars. Betis et al. (36) found that grain hardness had a significant correlation with grain quality parameters such as number and size of the grain, as well as grain hardness had a

significant correlation with flour yield, in a study of single grain characteristics with final grain quality characteristics and planting 12 winter hard wheat cultivars in the Kansans region.

5. Percentage of wet gluten

Considering the summary table of analysis of variance of qualitative features, there is no significant difference in the percentage of wet gluten in the tested cultivars. According to a comparison of the mean on the averages of this feature in the examined cultivars, cultivars 11-9-13 and 7 had the highest percentage of wet gluten, with a value of around 38. Conversely, cultivar 6 has the lowest amount of wet gluten (32.33). In contrast to each other, the two control cultivars are in the same statistical group, and number 1 has a higher wet gluten content than number 2.

6. Percentage of dry gluten

In any of the statistical levels determined, there is no statistical difference between the analyzed cultivars, and all twenty cultivars tested are in the same statistical class in terms of dry gluten content. The tiny difference they had in the research of wet gluten has been eradicated here, but according to this description, cultivar 18 has the highest percentage of dry gluten at 11.8 and the lowest at 10.67.

7. Sediment height – SdS

The researchers discovered that there is no statistical difference in the mean sediment height of the cultivars evaluated. The analyzed cultivars may be statistically separated into two categories, according to Duncan's mean comparison test, which indicates the least difference, with cultivars 1 and 4 being in the lowest category in terms of this feature. The rest of the numbers are in a higher statistical category. Cultivar 18 has the highest sediment height determined, while cultivar 1 has the lowest at 33. High thermal stress, according to Meflin et al. (32) lowers the deposition height during the grain filling stage. Low moisture stress during grain loading also increases sediment height, according to the researchers.

Conclusion

The correlation coefficients between grain quality characteristics were studied. Protein concentration, SDS deposition height, and dry gluten content all had a positive and substantial connection with grain hardness index. Grain hardness and protein content have a direct and substantial relationship, showing that lowering the protein level in the grain increases the space between endosperm cells, lowering grain hardness. Wet gluten and dry gluten content had a positive and substantial connection with protein content. A positive relationship between protein content and gluten content appears plausible, given that gluten quantity reflects the amount of protein. This is in line with Golabadi and Arzani's findings, which demonstrated a strong and positive relationship between protein content and gluten content.

Only grain hardness exhibited a positive and significant connection with SDS sediment height in this investigation. When grain hardness increases, so do the protein components that impact grain quality. Arzani has also observed similar findings. Protein concentration and SDS sediment height were not substantially associated. Similarly, Kovacs et al. and Atran et al. showed a non-significant association between SDS deposition height and protein concentration in independent tests on durum wheat. There are conflicting studies on the relationship between SDS sediment and grain protein content in durum wheat, with some research indicating a positive relationship between the two features. Bogini found a substantial negative correlation of -0.41 between the two variables in a study of 20 durum wheat genotypes. The strongest ($r = 0.95$) positive and

significant connection was found between wet gluten and dry gluten content, as predicted. The low-cost study also underlines the significant relationship between these two characteristics. According to Kovacs et al., there is no relationship between the SDS level of durum wheat and the gluten concentration of durum wheat. While there was a 0.82 association between protein and gluten content.

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