



### Determining the Diversity of Bread Wheat Varieties on Yield and Quality Traits at Rainfed and Irrigated Conditions

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#### ABSTRACT

This study was conducted with 7 bread wheat varieties in rainfed and irrigated conditions at Bahri Dagdas International Agricultural Research Institute as a randomized complete block design with three replications. Grain yield, thousand kernel weight, protein ratio, Zeleny sedimentation value, bread weight, bread volume and farinograph traits were investigated. Significant differences between the varieties were determined in terms of investigated traits in rainfed and irrigated conditions. Bread volume, farinograph development time, protein ratio and Zeleny sedimentation values in rainfed conditions were higher than values in irrigated conditions. Bread volume, farinograph development time, protein ratio and Zeleny sedimentation were determined as 507 cm<sup>3</sup>, 9.2 min, 13.6% and 46.8 ml in rainfed conditions and 495 cm<sup>3</sup>, 6.7 min., 12.3% and 44.0 ml in irrigated conditions respectively. According to the results; the effect of the growing conditions were found statistically significant on wheat quality.

#### 1. Introduction

Production of cereals in Turkey is the basis of the general economy as well as the agricultural sector. Cereals have an important place as a basic foodstuff in human nutrition.

Wheat is basic material of bakery products which has an important place in food industry and nutrition. Quality traits of wheat are usually influenced by genotypes, environmental factors and the interaction between genotype and environment. Genetic and environmental factors effect on quality together. A qualified end materials requires qualified raw materials. Developing technology is preparing a major competition on an international scale.

This and similar reasons require continuous, standard and qualified products in cereal-based industries as all kinds of industrial products. Determination of the quality is necessary for both economy and product qualification. The quality of wheat varies genetically depending on the variety, but it has undergone significant changes in the same year depending on the climatic conditions such as precipitation, precipitation distribution and temperature. Many tests have been developed

to determine the quality of bread wheat. Effects of rainfed and irrigated conditions can be determined with these tests on quality of varieties.

Protein ratio is the most commonly used criteria for determining the quality of wheat. The rheological properties of the dough are important in terms of processing the dough and influencing the final product quality obtained (Indrani and Rao 2007). In this study, the effects of rainfed and irrigated conditions on yield and some quality traits of bread wheat varieties have been determined. Yield and some quality traits (Thous and kernel weight, protein ratio, Zeleny sedimentation, bread weight, bread volume, farinograph development time, water absorption, stability, softening degree 10.min.) were examined.

#### 2. Materials and Methods

In this research 7 different bread wheat varieties were used as material (Bağcı-2002 Bezostaya-1, Demir-2000, Gün-91, Kate A-1, Sönmez-2001 and Tosunbey) in Konya location at rainfed and irrigated conditions in 2011-2012. Quality analyzes were conducted according to randomized block design with two replication. Grain yield, thousand kernel weight, protein ratio, Zeleny sedimentation, farinograph parame-

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ters were determined and bread trials were done. Wheat samples were tempered according to AACC method 26-95 (to be 14.5% moisture) and milled according to AACC method 26-50 with Brabender Quadrumat Junior mill. Protein ratio was measured with Leco FP 528 analyzer (Leco Inc, St Joseph, MI) according to AOAC 992.23 (Anonymous, 2009). Zeleny sedimentation were determined according to AACC 56-61A (Anonymous, 2000). Farinograph properties were determined according to AACC approved methods 54-21 (Anonymous 2000). In bread making trials; 100 g flour according to 14.5% moisture, 2% yeast, 1.5% salt were kneaded with water according to farinograph water absorption and were cooked at 220 °C, 25 minutes after fermentation (Anonymous 2000). Bread volume and weight were measured according to Elgün et al. (2001). Variance analyzes were done with Anonymous (2014) JMP 11 statistical program.

### 3. Results and Discussion

It was found that there are significant differences between examined characteristics of varieties in different experimental conditions. Grain yield of bread wheat varieties ranged between 284.80-346.50 kg/da and mean of grain yield was 317.34 kg/da in rainfed conditions. Aydoğan et al. (2013a) determined that grain yield ranged between 331.85-749.05 kg/da, protein ratio ranged between 12.62-15.23% in rainfed conditions. Grain yield of bread wheat varieties ranged

between 357.80-591.50 kg/da and mean of grain yield was 519.94 kg/da in irrigated conditions. Grain yield and quality of wheat are opposite traits and are affected by the environmental conditions as well as by the variety. Thousand kernel weight ranged between 23.80-35.60 and mean of thousand kernel weight was 30.00 g in rainfed conditions. Thousand kernel weight ranged between 27.60- 44.90 and mean of thousand kernel weight was 37.87 g in irrigated conditions. Protein ratio ranged between 12.6-14.50% and mean of protein ratio was 13.64% in rainfed conditions. Protein ratio ranged between 11.30-14.00% and mean of protein ratio was 12.28% in irrigated conditions (Table 1). Aydoğan et al. (2006), found that mean value of protein ratio of bread wheat geotypes was 11.80% in irrigated conditions. Aktaş et al. (2011) reported that in a two-year study conducted in rainfed conditions, the protein ratios of the genotypes ranged from 12.7% and 14.4% in the first year; in the second year it ranged from 11.4% to 14.7% reported. Saleem et al.(2015) reported that genetic and environmental factors affected the wheat protein ratio and that the protein ratio of wheat grown in dry areas varied between 11-15% and the protein ratio of wheat grown in humid areas varied between 8-10%.

Table 1  
Mean values of grain yield, thousand kernel weight and protein ratio

Varieties	Grain yield (kg/da)			Thousand kernel weight (g)			Protein ratio (%)		
	Rainfed	Irrigated	Mean	Rainfed	Irrigated	Mean	Rainfed	Irrigated	Mean
Bağcı-2002	313.80	357.80	335.80	23.80	27.60	25.70	12.60	11.40	12.00
Bezostaya-1	311.60	447.60	379.60	32.70	43.60	38.10	14.50	14.00	14.20
Demir-2000	320.70	591.50	456.10	35.60	37.60	36.60	13.50	12.00	12.50
Gün-91	346.50	553.50	450.00	30.90	36.70	33.80	13.90	12.20	13.00
KateA-1	327.50	572.80	450.15	25.80	44.90	35.30	13.60	14.00	13.80
Sönmez-2001	316.50	570.60	443.55	29.60	39.80	34.70	13.80	12.10	12.90
Tosunbey	284.80	545.80	415.30	31.60	34.90	33.20	14.10	11.30	12.20
Mean	317.34	519.94	445.64	30.00	37.87	30.93	13.64	12.28	12.90
CV <sub>(%)</sub>			11.45			7.41			1.54
LSD <sub>(0.05)</sub>			80.63			6.32			6.14

Table 2  
Mean values of Zeleny sedimentation, bread weight and bread volume

Varieties	Zeleny sedimentation (ml)			Bread weight (g)			Bread volume (cm <sup>3</sup> )		
	Rainfed	Irrigated	Mean	Rainfed	Irrigated	Mean	Rainfed	Irrigated	Mean
Bağcı-2002	62.50	51.00	56.75	147.10	137.00	142.05	500.00	455.00	477.50
Bezostaya-1	37.00	42.50	39.75	151.00	142.50	146.75	515.00	520.50	517.75
Demir-2000	32.50	42.50	37.50	148.70	139.00	143.85	485.00	480.00	482.50
Gün-91	60.50	43.50	52.00	144.70	146.70	145.70	525.00	515.00	520.00
KateA-1	49.00	42.00	45.50	147.30	137.40	142.35	515.00	505.00	510.00
Sönmez	57.50	46.50	52.00	140.10	147.30	143.70	495.00	525.00	510.00
Tosunbey	39.00	40.00	34.50	144.50	138.60	141.55	515.00	466.50	490.75
Mean	46.85	44.00	45.43	146.20	141.21	143.71	507.14	495.28	501.21
CV <sub>(%)</sub>			4.56			8.52			8.47
LSD <sub>(0.05)</sub>			3.15			1.10			15.21

Zeleny sedimentation value ranged between 32.50-62.50 ml and mean of Zeleny sedimentation value was 46.85 ml in rainfed conditions. Zeleny sedimentation value ranged between 40.00-51.00 ml and mean of Zeleny sedimentation value was 44.00 ml in irrigated conditions. Bağcı-2002 variety has the highest Zeleny sedimentation value in rainfed and irrigated conditions. In a similar study, the mean value of Zeleny sedimentation was found 41.7 ml in rainfed conditions and 36.0 ml in irrigated conditions (Sakin et al. 2017). Şahin et al. (2016) determined that the mean value of Zeleny sedimentation was 39.4 ml in irrigated conditions. Bread weight ranged between 140.10-151.0 g and mean value of bread weight was 146.0 g in rainfed conditions. Bread weight ranged between 137.0-147.3 g and mean value of bread weight was 141.21 g in irrigated conditions. Şahin et al. (2013) studied quality traits of bread wheat in rainfed and irrigated conditions. They found that mean of bread weight was 146.2 g in rainfed conditions and mean of bread weight was 140.51 g in irrigated conditions. Bread volume ranged between 485-525 cm<sup>3</sup> and mean value of bread volume was 507.14 cm<sup>3</sup> in rainfed conditions. Bread volume

ranged between 455-525 cm<sup>3</sup> and mean value of bread volume was 495.28 cm<sup>3</sup> in irrigated conditions (Table 2).

Farinograph development time ranged between 5.0-15.1 min. and averaged 9.2 min in rainfed conditions. Farinograph development time ranged between 4.0-11.1 min. and mean value of farinograph development time was 6.98 min. in irrigated conditions. Bezostaya-1 variety has the highest farinograph development time value in rainfed and irrigated conditions. Farinograph water absorption ranged between 60.50-64.10% and mean value of farinograph water absorption was 62.38% in rainfed conditions. Gün-91 variety has the highest farinograph water absorption in rainfed conditions. Farinograph water absorption ranged between 60.80-66.80% and mean value of farinograph water absorption was 62.87% in irrigated conditions. Kate A-1 variety has the highest farinograph water absorption in irrigated conditions. Aydoğan et al. (2013b) studied on 21 bread wheat variety in rainfed conditions. Farinograph water absorption ranged between 52.60-65.90% and mean of farinograph water absorption was determined 61.20% in their study (Table 3).

Table 3  
Mean values of farinograph parameters

Varieties	Development time (min.)			Water absorption (%)			Stability (min.)			Softening degree 10.(BU)		
	Rainfed	Irrigated	Mean	Rainfed	Irrigated	Mean	Rainfed	Irrigated	Mean	Rainfed	Irrigated	Mean
Bağcı-2002	10.00	10.10	10.05	60.70	60.80	60.80	20.10	20.50	20.30	12.00	12.00	12.00
Bezostaya-1	15.10	11.10	13.10	63.50	65.80	64.65	20.50	15.20	17.85	10.50	2.50	6.50
Demir-2000	5.00	7.10	6.05	62.40	61.10	61.75	15.70	16.20	11.70	16.10	6.50	11.30
Gün-91	14.20	7.30	10.75	64.12	61.60	62.85	20.20	14.40	15.80	37.50	5.50	21.50
KateA-1	5.40	5.30	5.35	61.30	66.80	64.05	16.10	15.40	12.25	12.10	14.50	13.30
Sönmez	7.30	4.00	5.65	64.10	62.30	63.20	19.50	15.50	12.50	3.00	25.50	14.25
Tosunbey	7.40	4.00	5.70	61.50	61.70	61.10	16.10	15.10	12.10	6.00	23.50	14.75
Mean	9.20	6.98	8.09	62.38	62.87	62.63	18.31	16.04	14.64	13.88	12.85	13.37
CV <sub>(%)</sub>			7.14			8.47			7.12			9.42
LSD <sub>(0.05)</sub>			2.55			1.78			3.14			3.25

#### 4. Results

The results showed that the quality traits and yield varied according to growing conditions. Differences

were determined between varieties in terms of yield, protein ratio, Zeleny sedimentation, farinograph parameters, bread weight and bread volume. According to the mean values in rainfed and irrigated conditions; Demir-2000 has the highest grain yield, Bezostaya-1 has the highest thousand kernel weight, protein ratio, farinograph development time, water absorption and bread weight, Bağcı-2002 has the highest Zeleny sedimentation value Gün-91 has the highest bread volume. More comprehensive studies in rainfed and irrigated conditions will contribute to determine suitable varieties for the region and quality studies

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