Determining of Yield and Quality Characteristics of Some Wheat Cultivars Under Bingol Conditions

Bingöl Koşullarında Bazı Buğday Çeşitlerinin Verim ve Kalite Özelliklerinin Belirlenmesi

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Abstract – This study has been conducted to determine the yield and quality characteristics of some wheat varieties to be grown as the first product during the 2015-2016 growing season. In the research, 4 different bread wheat cultivars (Pehlivan, Krasunia odes'ka, Syrena odes'ka, Cham-6) and 5 durum wheat cultivars (Yelken-2000, Kunduru-1149, Dumlupınar, Eminbey, Simito) have been used as plant material. The research has been established as a randomized complete block design with three replications. In the study, plant height, biological yield, grain yield, hay yield, thousand grain weight, harvest index, hectolitre weight, grain humidity, protein ratio, protein yield, sedimentation and gluten characteristics have been investigated. The results of the research have indicated the plant height, biological yield, grain yield, hay yield, thousand grain weight, harvest index, hectolitre weight, grain humidity, protein ratio, protein yield, sedimentation and gluten content values to range from 69.6 to 101.3 cm, from 622.3 to 949.0 kg da^{-1}, from 185.7 to 438.7 kg da^{-1}, from 358.0 to 511.0 kg da^{-1}, from 39.7 to 49.6 kg da^{-1}, from 29.5 to 46.3%, from 78.0 to 82.5%, from 8.0 to 8.9%, from 12.0 to 15.8%, from 25.3 to 65.9 kg da^{-1}, from 28.0 to 38.0 ml and from 36.4 to 39.6%, respectively. In the trial, differences among cultivars were significant for all studied characters. Based on these results, it has been determined that Kunduru-1149, Eminbey and Yelken-2000 for durum wheat; Pehlivan and Cham-6 cultivars for bread wheat has come on the foreground under Bingol and similar ecological conditions.

Keywords – wheat; yield; quality; sedimentation; gluten

Özet-Bu çalışma, Bingöl ekolojik koşullarında kışlık olarak yetiştirilecek bazı buğday çeşitlerinin verim ve kalite özelliklerinin belirlenmesi amacıyla 2015-2016 yetiştirme sezonunda yürütülmüştür. Çalışmada bitki materyali olarak 4 adet ekmeklik (Pehlivan, Krasunia odes'ka, Syrena odes'ka, Cham-6) ve 5 adet makarnalık (Yelken 2000, Kunduru 1149, Dumlupınar, Eminbey, Simito) buğday çeşidi kullanılmıştır. Araştırma tesadüf blokları deneme desenine göre üç tekerrürlü olarak kurulmuştur. Araştırmada; bitki boyu, biyolojik verim, tane verimi, saman verimi, bin tane ağırlığı, hasat indeksi, hektolitre, rutubet, protein oranı, protein verimi, sedimantasyon ve glüten değerlerine ilişkin veriler ele alınmıştır.Araştırma sonucunda, çeşitlerin bitki boyları 69,6-101,3 cm, biyolojik verimleri 622,3- 949,0 kg/da, tane verimleri 185,7-438,7 kg da^{-1}, saman verimleri 358,0-511,0 kg da^{-1}, bin tane ağırlıkları 39,7-49,6 kg da^{-1}, hasat indeksleri %29,5-46,3, hektolitre oranları %78,0-82,5, rutubet oranları %8,0-8,9, protein oranları %12,0-15,8, protein verimleri 25,3-65,9 kg da^{-1}, sedimantasyon oranları %28,0-38,0 ve glüten oranları %36,4-36,9 arasında değişmiştir. Araştırmada incelenen tüm özellikler bakımından çeşitler arasında önemli farklılıklar belirlenmiştir. Elde edilen sonuçlara göre; Bingöl ve benzeri ekolojik koşullarda makarnalık buğday için Kunduru 1149, Eminbey ve Yelken 2000; ekmeklik buğday için ise Pehlivan ve Cham-6 çeşitlerinin ön plana çıktığı belirlenmiştir.

Anahtar Kelimeler- buğday, verim, kalite, sedimantasyon, glüten

INTRODUCTION

Cereals are members of the *Gramineae* family. The most common plants within this group are wheat, rice, maize, barley and sorghum. Cereals amount to approximately half of the world plant production areas, and more than half of world's plant production (approximately 1.8 billion tons). As well as wheat having the biggest share in world cereal production by 500 million tons, rice and maize have a

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great production share by 450 million tons each. Wheat is an important plant of cool climate zones. In terms of planting and production, wheat is ranked first among all cereals. In addition, wheat occupies a very important place in the world food trade. Most prominent wheat producing countries are USA, Canada, China, Russia, India, France and Turkey (Kurt 2012).

Being the most commonly used carbohydrate source, whether directly or indirectly, for human nutrition, wheat is the most cultivated cereal type in the world and in Turkey, but sometimes it is ranked in 2nd or 3rd behind rice and maize. Nowadays about half of the world is using wheat as the main source of nutrition. Wheat is the nutrient that dates back to the beginning of human existence and it has been identified with humanity in every sense. Wheat is the first choice because it is a balanced nutrient for human diet, it is easy to produce and it can be used to make bread with modern technology (Gecit and Ikincikarakaya 2011).

According to 2015 statistical data, there are 239.3 million decares of agricultural land in Turkey. Of this agricultural land, 65.9 million decares (27.5%) is used to cultivate bread wheat, and 12.7 million decares (5.3%) is used to cultivate durum wheat. These areas produce 18.5 million tons of bread wheat and 4.1 million tons of durum wheat. The yield per decare in Turkey is 281 kg da^{-1} for bread wheat and 322 kg da^{-1} for durum wheat (Anonymous 2016a).

Regarding the province of Bingol, located within the Eastern Anatolian Region, the total land area is 8253 km^2 and approximately 7% of it is agricultural land. Field crops are being cultivated in 66% of Bingol's agricultural land (Anonym 2016b). And in terms of field crops in Bingol, the biggest amount of cultivation land is allocated to cereals, as it is the case in most provinces in Turkey. Wheat is the most cultivated one among cereals.

Like in many other plants, wheat yield and quality is affected by many factors such as climate and soil characteristics, cultivation period and frequency, irrigation and harvesting period, altitude and genotype. A suitable wheat variety must be chosen for a productive and quality production. Varieties display different performances under different ecologies. Determining the suitable variety for a region is only possible through local trials.

Under the scope of this study, aiming to determine the yield and quality characteristics of some wheat cultivars, 4 bread wheat cultivars and 5 durum wheat cultivars have been tried for adaptation, yield and quality to determine the most suitable variety. The study is mainly aiming to contribute, even if it is to a certain extent, to identify and spread varieties with a high genetic potential, which can be an alternative for the varieties currently being cultivated.

MATERIAL AND METHOD

Material

This study has been conducted at the Bingol University Research and Practice Area during 2015-2016 growing season. The wheat cultivars used as study materials in the research and the institutions that have provided the cultivars are given in Table 1.

Climate and Soil Conditions of the Study Area

Climate data was obtained from General Directorate of Meteorology. The figures related to Bingol climate conditions are given in Table 2. We can say that in Bingol, 2015 and the first half of 2016 was warmer, with less precipitation and similar moisture levels when compared to long years'.

Table 1. The wheat cultivars used in the study and the providing institutions

No	Variety Name		Institutions and Organizations
1	Pehlivan	Bread	GAP International Agricultural Research and Training Centre
2	Krasunia odes'ka	Bread	GAP International Agricultural Research and Training Centre
3	Syrena odes'ka	Bread	GAP International Agricultural Research and Training Centre
4	Cham-6	Bread	Suleymaniye Agricultural Research Institute / Iraq
5	Simito	Durum	Suleymaniye Agricultural Research Institute / Iraq
6	Yelken 2000	Durum	Geçit Kuşağı Agricultural Research Institute
7	Kunduru 1149	Durum	Geçit Kuşağı Agricultural Research Institute
8	Dumlupınar	Durum	Geçit Kuşağı Agricultural Research Institute
9	Eminbey	Durum	Geçit Kuşağı Agricultural Research Institute

Soil samples have been taken from ten different points of the study area, from a depth of 0-30 cm, and then the samples were mixed. The analysis of the resulting sample took place at the Bingol University Faculty of Agriculture Department of Soil Science and Plant Nutrition Laboratories. Results of the analysis have been assessed by taking the limit values defined by Sezen (1995) and Karaman (2012) as a basis. Results of the analysis are given in Table 3.

Table 2. Monthly average climate figures of Bingol for long years (2000-2015) and first half of 2016

Months	Average Temperature (°C)			Total Precipitation (mm)			Relative Humidity (%)		
	Long Years	2015	2016	Long Years	2015	2016	Long Years	2015	2016
January	-2.5	1.8	-2.8	154.0	147.2	257.8	73.3	75.1	75.4
February	-0.9	1.9	2.5	137.7	119.8	95.3	72.2	74.4	73.3
March	4.9	5.5	7.0	124.1	155.3	131.0	64.2	66.9	60.2
April	10.9	10.7	14.0	103.8	66.7	46.8	61.2	60.1	43.4
May	16.2	16.4	16.3	66.8	21.2	66.2	55.8	53.9	57.4
June	22.6	22.6	22.3	18.4	8.1	34.4	42.5	38.4	43.5
July	27.0	27.4	26.9	7.3	0.1	7.0	36.7	28.1	43.3
August	26.8	27.1	-	5.4	0.6	-	36.8	30.8	-
September	21.3	23.6	-	16.4	0.4	-	42.2	30.0	-
October	14.2	14.4	-	70.3	18.9	-	58.9	68.6	-
November	6.5	14.4	-	91.8	46.2	-	64.7	56.4	-
December	0.2	1.3	-	121.8	219.1	-	70.7	58.6	-
Total/Ave.	12.3	13.9	12.3	917.8	803.6	638.5	56.6	53.4	56.6

Source: General Directorate of Meteorology (Bingol)

As seen in Table 3, the soil texture of the study area was "loamy", with "mildly acidic" pH, no "salinity", "low" levels of lime, organic matter ratio was "low", phosphor ratio was "average" and potassium ratio was "sufficient".

Table 3. Soil texture, saturation, pH, salinity, lime content, organic matter content, phosphor and potassium amounts of the study area

Texture	Saturation (%)	pH	Salinity (%)	$CaCO_3$ (%)	Organic Matter (%)	P_2O_5 (kg/da)	K (kg/da)
Loamy	43.31	6.37	0.0066	0.15	1.26	7.91	24.45

Method

The trial has been established on 13 October 2015 over a randomized complete block experimental design with 3 repetitions. Planting was made where parcels lengths were 5 m, row spacing was 20 cm and each parcel had 6 rows. 500 seeds have been used per square meter during planting. Right before planting, 4 kg nitrogen (N), 8 kg phosphor (P_2O_5) fertilizer was applied over pure matter per decare. Then during the bolting period of the plans, 4 kg nitrogen (N) fertilizer was applied over pure matter per decare to increase the nitrogen (N) quantity to 8 kg/da. The trial was conducted under dry conditions. Harvesting of the plants took place on 11 July 2016.
Plant height, randomly selected from each parcel, 10 plants have been measured from soil surface to the top, including the awn, in cm and the average has been taken. Biological yield, after removing the influence share, the remaining parts in each parcel (3 rows) have been harvested once the seeds matured. The obtained figure has been converted into decares to obtain the biologic yield. Grain yield, after blending the plants in the parcel, the resulting grain product has been cleaned, weighed and the obtained figures have been converted to kg da^{1-} to get the grain yield. Hay yield has been obtained by subtracting the grain yield from the biologic yield after blending. The outcome has been converted to decares.

100 samples taken from each parcel have been weighed for four times to get an average figure and then multiplied by 10 to get the thousand-grain yield. This is the weight of 1000 wheat grains in grams. Harvest index, grain yield of each parcel has been proportioned to the biologic yield of that particular parcel before being calculated in %.

Hectolitre, the product taken from each parcel after harvest and blending has been weighed with a 1 litre hectolitre tool. Hectolitre is the weight of 100 litre wheat in kg (kg 100^{1-} litre). It gives us an idea about flour yield. Grain humidity is an important quality factor. Products containing high grain humidity will have a reduced commercial value. Because over-grain humidity can lead to germination, insect and microorganism activities in the product while kept in storage.

Protein value is obtained by analysing the grinded grain samples with the help of a NIRS device. By multiplying the crude protein ratio in wheat grain with grain yield per decare, crude protein yields per decare have been found. Sedimentation informs us about the bread making value of wheat. It is a parameter that determines the gluten quantity and quality. In flours containing too much gluten or high quality gluten, sedimentation will be slow therefore sedimentation value will be high. An elastic matter is formed when gliadin and gluten proteins, found in the wheat composition, swell with water. Gluten can only be obtained from wheat among cereals. Gluten is an important criterion when making yeast cake. In short, it is an indication of bread mass. Hectolitre, grain humidity, protein, sedimentation and gluten values have been determined at the Diyarbakır Commodity Exchange.

Statistical Analyses

The data set has been analysed by the help of JUMP statistics package program (software of SAS program) in accordance with randomized complete block experimental was used. However, the results are given according to one way anova. The factor averages that were statistically significant according to the variance analysis results have been compared to LSD test (Kalayci, 2005).

STUDY FINDINGS AND DISCUSSION

The plant height, biological yield, grain yield, hay yield and harvest index averages observed in different wheat cultivars are given in Table 4. The thousand-grain yield, hectolitre, grain humidity, protein ratio and protein yield averages observed in different wheat cultivars are given in Table 5.

As seen in the Table 4, different wheat cultivars are statistically significant at a level of 1% in terms of plant height, biological yield, grain yield and harvest index. Wheat cultivars are statistically significant at a level of 5% in terms of hay yield.

As seen in the Table 5, different wheat cultivars are statistically significant at a level of 1% in terms of thousand grain weight, hectolitre, protein ratio and protein yield. Wheat cultivars are statistically significant at a level of 5% in terms of grain humidity.

Table 4. Plant height, biological yield, grain yield, hay yield and harvest index averages determined in different wheat cultivars

	Varieties	Plant Height (cm)	Biological yield (kg da^{-1})	Grain Yield (kg da^{-1})	Hay Yield (kg da^{-1})	Harvest Index (%)
1	Cham-6	77.1 e**	622.3 d**	264.3 c**	358.0 c*	42.6 ab**
2	Dumlupınar	91.5 b	850.0 b	370.0 b	480.0 ab	43.6 ab
3	Eminbey	78.4 de	949.0 a	438.7 a	510.3 a	46.3 a
4	Kunduru 1149	101.3 a	903.7 a	418.0 ab	485.7 ab	46.2 a
5	Krasunia odes'ka	77.9 de	638.7 d	234.0 cde	404.7 bc	36.9 bc
6	Pehlivan	84.3 c	746.7 c	246.7 cd	500.0 a	33.1 c
7	Simito	69.6 f	630.3 d	185.7 e	444.7 ab	29.5 c
8	Syrena odes'ka	81.3 cd	655.3 d	206.7 de	448.7 ab	31.6 c
9	Yelken 2000	79.5 de	927.7 a	416.7 ab	511.0 a	45.0 a
	Average	**82.3**	**769.3**	**309.0**	**460.3**	**39.4**

Averages indicated with the same name are statistically same according to LSD test **) within P≤0.01 error margins and *) within P≤0.05 error margins

Plant Height (cm)

The highest plant height has been obtained from Kunduru 1149 variety by 101.3 cm. The lowest plant height has been obtained from Simito by 69.6 cm and Cham-6 variety by 77.1 cm. The plant height average of the varieties has been defined as 82.3 cm.

In the wheat related studies conducted in different regions of Turkey, different plant height values have been obtained. Our findings are parallel to those obtained under; Ankara conditions 86.5 cm (Kaya 2004), Samsun-Amasya conditions 66.9-98.8 cm (Mut et al. 2005), Kahramanmaras conditions 82.1 cm (Cokkizgin and Colkesen 2006), again Samsun-Amasya conditions 84.8-99.4 cm (Mut et al. 2007) and Bingol conditions 79.4 cm (Gumustas 2014).

Biological Yield (kg da-1)

The highest biological yield has been obtained from Eminbey by 949.0 kg da^{-1}, Yelken-2000 by 927.7 kg da^{-1} and Kunduru-1149 by 903.7 kg da^{-1}. The lowest biological yield has been obtained from Cham-6 by 622.3 kg da^{-1}, Simito by 630.3 kg/ a^{-1}, Krasunia odes'ka by 638.7 kg da^{-1} and Syrena odes'ka cultivars by 655.3 kg da^{-1}. The biological yield average of the cultivars has been defined as 769.3 kg da^{-1}.

Our findings were lower than those obtained by Akram (2011) 1323-1246 kg da^{-1}, they were lower than those obtained by Refay (2011) 1460-1630 kg da^{-1} and by Ozen and Akman (2015) 1245-1910 kg

da^{-1}. The reason for the differences between our findings and these studies could be associated with the varieties used or the soil and climate conditions of the study area.

Grain Yield (kg da-1)

As the table suggests, the highest grain yield has been obtained from Eminbey by 438.7 kg da^{-1} and statistically followed Kunduru-1149 (418.0 kg da^{-1}) and Yelken-2000 (416.7 kg da^{-1}). The lowest grain yield has been obtained from Simito by 185.7 kg da^{-1} and Syrena odes'ka cultivar by 206.7 kg da^{-1}. Grain yield average of the cultivars has been observed as 309.0 kg da^{-1}.

While the grain yield values we have obtained were higher than those obtained by Gumustas (2014) 165.8 kg da^{-1}; they were lower than those obtained by Kaya (2004) 313 and 518 kg da^{-1}, Bilgin and Korkut (2005) 504.4 kg da^{-1}, Cokkizgin and Colkesen (2006) 525.6 kg da^{-1}, Dogan and Kendal (2012) first year 552.8 kg da^{-1} and second year 811.3 kg da^{-1}, again by Dogan and Kendal (2013) first year 576.8 kg da^{-1} and second year 765.5 kg da^{-1}, Kurt and Yagdi (2013) 358.4 kg da^{-1}, Tekdal et al. (2014) 381.5-830.8 kg da^{-1} and Ozen and Akman (2015) 427-639 kg da^{-1}.

On the other hand, the grain yield values we have obtained were similar to those by Mut et al. (2005) 284.4-490.6 kg da^{-1}, Mut et al. (2007) 302.2-495.7 kg da^{-1}.

Hay Yield (kg/da)

As the table suggests, the highest hay yield has been obtained from Yelken-2000 by 511.0 kg da^{-1}, Eminbey by 510.3 kg da^{-1} and Pehlivan cultivar by 500.0 kg da^{-1}, and they were followed by Dumlupınar, Kunduru-1149, Simito, Syrena odes'ka cultivars. The lowest hay yield has been obtained from Cham-6 cultivar by 358.0 kg da^{-1}. Hay yield average of the cultivars has been observed as 460.3 kg da^{-1}.

In wheat related studies conducted in different regions, different hay yield values have been observed. For example, under India conditions 568-602 kg da^{-1} (Tomar et al. 2014), Pakistan 637-578.9 kg da^{-1} (Qasim et al. 2008) have been obtained. The values we have obtained in the study were lower than those reported by the authors. On the other hand, the hay yield values we have obtained were higher to those by (Nizamuddin et al. 2014) 314-573 kg da^{-1}.

Harvest Index (%)

As the table suggests, the highest harvest index has been obtained from Eminbey by 46.3%, Kunduru-1149 by 46.2% and Yelken-2000 cultivar by 45.0%, and they were followed respectively by Dumlupınar (43.6%) and Cham-6 (%42.6) varieties, which are statistically in the same group. The lowest harvest index ratio has been obtained from Simito by 29.5%, Syrena odes'ka by 31.6% and Pehlivan cultivar by 33.1%. The harvest index ratio of the varieties has been defined as 39.4%.
For example; while the harvest index values we have obtained were higher than those by Gumustas (2014) 22%; they were similar to those obtained by Kaya (2004), in the second year, 40.3%.

Thousand Grain Yield (g)

As the Table 5 suggests, the highest thousand grain weight has been obtained from Simito cultivar by 49.6 g. Lowest thousand grain weight has been obtained from Krasunia odes'ka by 39.7 g, Pehlivan by 39.8 g and Eminbey cultivar by 40.1 g. The thousand grain weight average of the cultivars has been observed as 43.4 g.

The thousand grain weights we have obtained were similar to those reported by Budak and Karaaltin (1998) under Kahramanmaraş conditions 42.4 g, Kaya (2004) under Ankara conditions 42.2 g, Yagdi

(2004) under Bursa conditions 42.88-51.17 g, Cokkizgin and Colkesen (2006) under Kahramanmaraş conditions 43.74 g and Ozen and Akman (2015) under Yozgat conditions 33-44 g.

Hectolitre (kg/hl)

The highest hectolitre value has been obtained from Cham-6 cultivar by 82.5 kg hl^{-1}, and it was respectively followed by Pehlivan (81.4 kg hl^{-1}), Syrena odes'ka (80.9 kg hl^{-1}), Kunduru-1149 (80.8 kg hl^{-1}) and Yelken-2000 (80.7 kg hl^{-1}) cultivars, statistically in the same group. The lowest hectolitre value has been obtained from Simito cultivar by 78.0 kg hl^{-1}. The hectolitre value average of the cultivars has been observed as 80.2 kg hl^{-1}.

Studies conducted in different regions of Turkey have provided different hectolitre values. The hectolitre values we have obtained were higher than those reported by Mut et al. (2005) 68.4-74.9 kg hl^{-1}, Dogan and Kendal (2013) 78.72-78.70 kg hl^{-1} and Gumustas (2014) 70.6 kg hl^{-1}; but were similar to those reported by Budak and Karaaltin (1998) 81.3 kg hl^{-1}, Yagdi (2004) 77.93-81.26 kg hl^{-1}, Mut et al. (2007) 76.5-81.4 kg hl^{-1}, Dogan and Kendal (2012) 79.9-80.3 kg hl^{-1}, Tekdal et al. (2014) 76.3-85.3 kg hl^{-1}, Ozen and Akman (2015) 76-82 kg hl^{-1}.

Table 5. The thousand grain yield, hectolitre, grain humidity, protein ratio and protein yield averages determined in different wheat cultivars

	Varieties	Thousand Grain Weight (g)	Hectolitre (kg/hl)	Grain Humidity (%)	Protein Ratio (%)	Protein Yield (kg/da)
1	Cham-6	44.3 b**	82.5 a**	8.5 abc*	14.1 b**	37.2 c**
2	Dumlupınar	45.2 b	79.1 cde	8.0 c	14.2 b	52.6 b
3	Eminbey	40.1 c	80.1 bcd	8.0 c	12.0 c	52.3 b
4	Kunduru 1149	45.7 b	80.8 abc	8.4 bc	15.8 a	65.9 a
5	Krasunia odes'ka	39.7 c	78.2 de	8.9 a	13.7 a	32.0 cd
6	Pehlivan	39.8 c	81.4 ab	8.7 ab	13.5 b	33.3 cd
7	Simito	49.6 a	78.0 e	8.0 c	13.6 b	25.3 e
8	Syrena odes'ka	43.3 b	80.9 abc	8.6 ab	14.5 b	29.9 de
9	Yelken 2000	43.2 b	80.7 abc	8.4 abc	13.8 b	57.7 b
	Average	**43.4**	**80.2**	**8.4**	**13.9**	**42.9**

Averages indicated with the same name are statistically same according to LSD test **) within P≤0.01 error margins and *) within P≤0.05 error margins

Grain Humidity (%)

The highest grain humidity ratio has been obtained from Krasunia odes'ka cultivar by 8.9%, and it was followed by Pehlivan (8.7%), Syrena odes'ka (8.6%), Cham-6 (%8.5) and Yelken-2000 (8.4%) cultivars, found statistically in the same group. The lowest grain humidity ratio has been obtained from Simito, Dumlupınar and Eminbey cultivars by 8.0%. The grain humidity ratio average of the cultivars has been observed as 8.4%.

Ali et al. (2014) has reported it as 10%, Safdar et al. (2009) 9.11-9.79% and Tayyar (2005) %11.7-12.4%. The values we have obtained in the study were lower than those reported by the authors. While the grain humidity values we have obtained were similar to those by Khan and Zeb (2007) 8.38%.

Protein Ratio (%)

The highest protein ratio has been obtained from Kunduru-1149 cultivar by 15.8% and Krasunia odes'ka cultivar by 13.7%.. The lowest protein ratio has been obtained from Eminbey cultivar by 12.0%. Cultivars protein ratio average has been observed as 13.9%.

The wheat related studies conducted in different regions of Turkey have provided different protein ratio values. For example; Yagdi (2004) reported the protein ratio as 11.85-13.44%, Mut et al. (2005) reported the protein ratio as 10.4-13.6%, Mut et al. (2007) reported the protein ratio as 12.4-13.3%, Gumustas (2014) reported the protein ratio as 13.93%. The values we have obtained from the study are similar to those reported by the authors.

Protein Yield (kg da-1)

The highest protein yield has been obtained from Kunduru-1149 cultivar by 65.9 kg da^{-1}. The lowest protein yield has been obtained from Simito cultivar by 25.3 kg da^{-1} and Syrena odes'ka cultivar by 29.9 kg da^{-1}. The protein yield average of the cultivars has been observed as 42.9 kg da^{-1}.

Yagdi (2004) has reported the crude protein yield as 58.21-84.70 kg da^{-1}. The values we have obtained from the study were lower than those reported by the author. Aydogan et al. (2007) has reported the crude protein yield as 20.07-33.17 kg da^{-1}. The values we have obtained from the study were higher than those reported by the author.

The Sedimentation (ml) and Gluten Ratio (%)

The sedimentation and gluten ratio averages observed in different wheat cultivars are given in Table 6. As seen in the Table 6, bread wheat cultivars are statistically significant at a level of 1% in terms of sedimentation amount but the difference between bread wheat cultivars are statistically insignificant in terms of gluten ratio.

As the table suggests, the highest sedimentation amount has been obtained from Krasunia odes'ka cultivar by 38.0 ml, and it was followed by Cham-6 (36.0 ml) cultivar. The lowest sedimentation amount has been obtained from Pehlivan cultivar by 28.0 ml. The sedimentation value average of the cultivars has been observed as 33.7 ml.

Table 6. The sedimentation and gluten ratio averages determined in different wheat cultivars

	Varieties	**Sedimentation (ml)**	**Gluten Ratio (%)**
1	Cham-6	36.0 ab**	36.8
2	Krasunia odes'ka	38.0 a	36.4
3	Pehlivan	28.0 c	38.9
4	Syrena odes'ka	32.7 b	39.6
	Average	**33.7**	**37.9**

Averages indicated with the same name are statistically same according to LSD test **) within P≤0.01 error margins.

The sedimentation amount we have obtained from the study were similar those reported by Tayyar (2005) as 30.5-61.0 ml, Ozen and Akman (2015) as 7-35 ml, Aydin et al. (2005) 38.3 ml, Aydogan et al. (2013) 27.0-51.5 ml and Yazar et al. (2013) as 32.5 ml.

Cham-6 cultivar's gluten ratio has been observed as 36.8%, Krasunia odes'ka cultivar's gluten ratio has been observed as 36.4%, Pehlivan cultivar's gluten ratio has been observed as 38.9% and Syrena odes'ka cultivar's gluten ratio has been observed as 39.6%. The gluten ratio average of the cultivars has been observed as 37.9%.

The gluten ratio we have obtained from the study were higher than those reported by Sozen and Yagdi (2005) 15.12-27.42%, Altinbas et al. (2004) as 28.7%, Ozen and Akman (2015) 15-31%. The other hand the gluten content we have obtained from the study were similar those reported by Tayyar (2005) as 30.5-45.5%.

The reasons for these differences can be associated with the genotype characteristics of the varieties used and the different cultivation techniques and ambient factors of the trial zone.

RESULTS AND RECOMMENDATIONS

The highest values have been obtained; from Kunduru 1149 for plant height, from Eminbey, Kunduru 1149 and Yelken 2000 for biological yield; from Eminbey for grain yield; from Eminbey, Pehlivan and Yelken 2000 for hay yield; from Simito for thousand grain weight; from Eminbey, Kunduru 1149 and Yelken 2000 for harvest index; from Cham-6 for hectolitre weight; from Krasunia odes'ka for grain humidity and sedimentation; from Kunduru 1149 for protein content and protein yield. Based on these results, Kunduru 1149, Eminbey and Yelken 2000 can be recommended for durum wheat; Pehlivan and Cham-6 can be recommended for bread wheat under Bingol and similar ecological conditions.

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