DETERMINING OF YIELD AND QUALITY CHARACTERISTICS OF SOME WHEAT VARIETIES UNDER BİNGOL CONDITIONS

Areevan Jalil SHARIF

Master Thesis

Department of Field Crops
Adviser: Assistant Prof. Dr. Erdal ÇAÇAN

2016

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This thesis has been accepted on the date of 26.12.2016 by a unanimous vote by the below jury.

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FOREWORD

I would like to acknowledge the contributions of Assistant Prof. Dr. Erdal ÇAÇAN who did not refrain his support during my works to complete the thesis by providing assistance and sharing his knowledge without holding anything back. My gratitudes to Prof. Dr. Mehmet AYÇİÇEK, Associate Prof. Dr. Kağan KÖKTEN and Associate Prof. Dr. Hasan KILIÇ for the high quality education, intimate care and high tolerance they have provided during the my postgraduate studies.

Finally, I owe a debt of gratitude to my parents in particular, for all their efforts, sacrifices and prayers.

Areevan Jalil SHARIF

Bingöl 2016

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LIST OF SYMBOLS AND ABBREVIATIONS

g	: Gram
kg	: Kilogram
da	: Decare
ha	: Hectare
km	: Kilometer
mm	: Millimeter
cm	: Centimeter
t	: Ton
N	: Nitrogen
P	: Phosphor
K	: Potassium
CV	: Variation coefficient
CP	: Crude protein

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BİNGÖL KOŞULLARINDA BAZI BUĞDAY ÇEŞİTLERİNİN VERİM VE KALİTE ÖZELLİKLERİNİN BELİRLENMESİ

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, 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, saman verimleri 358,0-511,0 kg/da, bin tane ağırlıkları 39,7-49,6 kg/da, 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, sedimantasyon oranları %28,0-38,0 ve glüten oranları %36,4-36,9 arasında değişmiştir. Araştırmada incelenen tüm özellikler bakımından çeşitler arasında önemli farklar belirlenmiştir.

Bitki boyu Kunduru, biyolojik verim Eminbey, Kunduru 1149 ve Yelken 2000, tane verimi Eminbey, saman verimi Eminbey, Pehlivan ve Yelken, bin tane ağırlığı Simito, hasat indeksi Eminbey, Kunduru 1149 ve Yelken 2000, hektolitre Cham-6, rutubet ve sedimantasyon Krasunia odes'ka, protein oranı ve verimi ise Kunduru 1149 çeşitlerinde en yüksek bulunmuştur. Bu sonuçlara göre Bingöl ve benzeri ekolojik koşullarda makarnalık buğday için Kunduru 1149, Eminbey ve Yelken 2000; ekmeklik buğday için ise Pehlivan ve Cham-6 yetiştirilmesi tavsiye edilmektedir.

Anahtar Kelimeler: Buğday, verim, kalite, sedimantasyon, glüten.

DETERMINING OF YIELD AND QUALITY CHARACTERISTICS OF SOME WHEAT VARIETIES UNDER BİNGOL CONDITIONS

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 under Bingöl province ecological conditions.

In the research, 4 different bread wheat varieties (Pehlivan, Krasunia odes'ka, Syrena odes'ka, Cham-6) and 5 durum wheat varieties (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, from 185.7 to 438.7 kg/da, from 358.0 to 511.0 kg/da, from 39.7 to 49.6 kg/da, 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, 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.

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 Bingöl and similar ecological conditions.

Keywords: Wheat, yield, quality, sedimentation, gluten.

1. 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 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).

The most commonly sown and produced cool climate cereal type in Turkey, as in the rest of the world, is wheat. According to agricultural statistics data of Turkey, wheat is planted in an area of 8 490 000 hectares and 20 010 000 tons of wheat is produced. Among the cool climate cereals, wheat's share of cultivation area is 68.5%, and in terms of production and has a 66.4% share. In Turkey, wheat has a share of 33% of the total cultivated areas, on its own, while its share among total field areas is 36% (Geçit and İkincikarakaya 2011).

Occupying 56% of the field areas in Turkey, wheat has the biggest share in our field production. In fact, even though the wheat yield cultivated in I, II and III. Class soils is above 300 kg, yield is lower in soils with higher classes, which leads to a reduction of this yield average. In terms of feeding the increasing population of our country, this is an indication that it is not sufficient to increase the amount of agricultural areas, but rather there is a need to increase the yield gained per unit area (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 (Geçit and İkincikarakaya 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 for bread wheat and 322 kg/da for durum wheat (Anonym 2016a).

Regarding the province of Bingöl, 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 Bingöl's agricultural land (Anonym 2016b). And in terms of field crops in Bingöl, 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 varieties, 4 bread wheat varieties and 5 durum wheat varieties have been tried for adaptation, yield and quality under Bingöl ecologic conditions 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.

2. SUMMARY OF RESOURCES

In a study determining the yield and quality characteristics of 13 durum wheat genotypes under Kahramanmaraş condition, the average figures were as follows; 42.4 g for thousand grain weight, 440.6 kg/da for grain yield, 81.3 kg for hectolitre weight and 12.4% for protein ratio (Budak and Karaaltın 1998).

In a study to determine the yield and quality characteristics of some bread wheat varieties under İzmir conditions, the average figures were as follows; 628.6 kg/da for grain yield, 39.2 g for thousand grain weight, 25.8 ml for sedimentation value and 28.7% for wet gluten content (Altınbaş et al. 2004).

In a study to determine the yield characteristics of some bread wheat varieties under Ankara conditions; plant height average for the first year has been reported as 86.5 cm, and 108.0 cm second year, thousand grain weight average for the first year has been reported as 42.2 g, and 32.9 g for the second year, unit area grain yield average has been reported as for the first year 313.0 kg/da, and 518.6 kg/da for the second year, while harvest index average for the first year was 23.6%, and 40.3% for the second year (Kaya 2004).

In a two year study determining the yield and quality characteristics of 13 bread wheat genotypes under Bursa conditions; it has been observed that hectolitre weights ranged between 77.93 and 81.26 kg, thousand grain weights ranged between 42.88 and 51.17 g, protein ratio ranged between 11.85 and 13.44% and protein yield ranged between 58.21 and 84.70 kg/da (Yağdı 2004).

In a study determining the yield and quality characteristics of 25 bread wheat genotypes under middle Black Sea conditions, the average figures ranged as follows: the grain yield were 345.0 kg/da in Samsun and 486,3 kg/da in Amasya, thousand grain weight ranged

between 25.9 and 38.3 g in Samsun and 27.8 and 36.9 g in Amasya, hectolitre weight ranged between 63.8 and 71.8 kg in Samsun and 73.1 and 80.2 kg in Amasya, sedimentation amount were 38.3 ml and protein content was 11.2% (Aydın et al. 2005)

In a study analysing the yield and quality characteristics of 20 bread wheat genotype under Tekirdağ conditions; grain yield average was reported as 504.46 kg/da and plant height average was reported as 94.83 cm (Bilgin and Korkut 2005).

In a study analysing the yield and quality characteristics of 25 bread wheat genotype under Samsun and Amasya conditions; the average figures for the two locations for the genotypes ranged as follows: grain yields 284.4-490.6 kg/da, plant heights 66.9-98.8 cm, thousand grain weights 28.4-38.9 g, hectolitre weights 68.4-74.9 kg and protein ratios 10.4-13.6% (Mut et al. 2005).

In a two year study to determine the quality characteristics of 11 durum wheat genotypes under Bursa conditions; the average hectolitre weights ranged between 80.30 and 82.00 kg, average fresh gluten value ranged between 15.12 and 27.42%, average sedimentation ranged between 19.51 and 31.34 ml and average protein ratio ranged between 10.90 and 12.27% (Sözen and Yağdı 2005).

In a study determining the yield and quality characteristics of 34 bread wheat genotypes under Biga conditions; the yield of the genotypes have been reported to range between 645 and 352.5 kg/da and the average figure was 494.1 kg/da, grain humidity ranged between 12.4 and 11.7%, gluten ranged between 45.5 and 30.5 g, sedimentation value ranged between 30.5 and 61.0 ml (Tayyar 2005).

In a three year study examining the effects of nitrogen fertilizer durum wheat on yield under Kahramanmaraş conditions; the average plant height has been observed as 82.1 cm, average thousand grain weight was 43.74 g and average grain yield was 525.6 kg/da (Çokkızgın and Çölkesen 2006).

In a study determining the yield and some quality characteristics of 36 bread wheat genotypes under Konya conditions; the grain yield ranged between 154.58 and 258.43

kg/da, thousand grain weight ranged between 24.13 and 36.60 g, protein content ranged between 11.88 and 15.43% and protein yield ranged between 20.07 and 33.17 kg/da (Aydoğan et al. 2007).

In the year 2005 in Pakistan, biochemical and physiochemical characteristics of twelve wheat cultivars were studied. Protein content ranged from 9.15 to 10.27% and moisture content ranged from 8.38 to 9.67% (Khan and Zeb 2007).

In a study analysing the yield and quality characteristics of 25 bread wheat genotype under Samsun and Amasya conditions, the average figures for the two locations for the genotypes ranged as follows; grain yields 302.2-495.7 kg/da, plant heights 84.8-99.4 cm, thousand grain weights 32.4 – 43.2 g, hectolitre weights 76.5-81.4 kg and protein ratios 12.4-13.3% (Mut et al. 2007).

In a study conducted in Faisalabad, Pakistan during season of 2005-2006 70 wheat cultivars from different National Yield Trials at different locations and CIMMYT were evaluated for variability parameters. It has been observed variation among cultivars; plant height was 64.57-120.17 cm, number of productive tillers was 5.33-24 and 1000 grain weight 32.3-56.92 g (Ali et al. 2008).

In the growing season of 2003-2004 a field experiment was conducted in Pakistan, three wheat cultivars (Inqalab 91, Suliman 96 and Chakwal 97) were compared. The straw yield were 637.3 kg/da for Inqalab 91, 605,7 kg/da Chakwal 97, and 578.9 kg/da Suliman 96 (Qasim et al. 2008).

At the end of a three year study on determining the yield and quality characteristics of 13 durum wheat under wet and dry conditions in Konya; it has been observed that the figures ranges as follows: grain yield 325.2-445.5 kg/da, protein ratio 13.7-14.8%, thousand grain weight 34.5-42.2 g and hectolitre weight 72.7-78.3 kg/l, while under dry conditions, grain yield ranged between 187.0 and 236.5 kg/da, protein ratio 13.8-14.7%, thousand grain weight 28.0-39.5 g and hectolitre weight 75.6-77.2 kg/l (Şahin et al. 2008).

In a three year study in Pakistan, seven wheat cultivars (Bhakhar2002, Inqulab91, Shafaq2006, AS2002, Sehar2006, Auqab2000 and GA2002) were studied for their quality characters. The result for the parameters was; test weight 77-81 kg/hl, 1000 kernel weight 37-41 g, moisture content 9.11-9.79% (Safdar et al. 2009).

In 2002, three winter wheat varieties from Colorado USA (Haltm, Yuma and Akron) and an accession of *Triticum dicocodies* from Izmir, Turkey were used for studying some agronomic traits. The cultivars showed variation in those traits; protein content (%) ranged from 15.4 to 21.42 and sedimentation (cl) 5.27-9.45 (Tonk et al. 2010).

A field study conducted in Faisalabad, Pakistan during the year 2005. Two wheat cultivars; Inqlab-9l and Uqab-2000 were compared in some yield component under different water regime; 1000 grain weight 40.78 g, biological yield 13233 kg/h, grain yield 3985 kg/h and harvest index 0.302 for Inqlab-9l. 1000 grain weight 43.83 g, biological yield 12460 kg/h, grain yield 3314 kg/h, harvest index 0.267 for Uqab-2000 (Akram 2011).

During two growing seasons 2008/2009 and 2009/2010, an experiment was conducted in the Agricultural Research Station near Riyadh, Saudi Arabia for comparing three wheat cultivars; KSU 105, KSU 106 and Yecora Rojo. The average figures ranged as follows: biological yield 14.60-16.31 ton/h, grain yield 5.49-6.11 ton/h, harvest index 0.375-0.381, 1000 kernel weight 37.48-40.95 gm (Refay 2011).

In 2011, five bread wheat cultivars and five durum wheat cultivars developed at the Maize Research Institute Zemun Polje, Serbia were compared based on their agronomic characters. The total protein content ranged from 9.26-12.64% and gluten (soluble + insoluble) 29-43.8 for bread wheat varieties, for durum wheat 11.04-12.40% protein and gluten (soluble + insoluble) 27.35-39.45. (Zilic et al. 2011).

In a two year study to determine the grain yield and some quality characteristics of some bread wheat genotypes under Diyarbakır conditions, the average figures ranged as follows: plant height first year 93.5 cm, second year 104.5 cm, parcel grain yield first year 552.8 kg/da, second year 811.3 kg/da, thousand grain weight first year 35.9 g,

second year 37.9 g, hectolitre weight first year 79.9 kg, second year 80.3 kg, protein ratio first year 11.1%, second year 11.0% (Doğan and Kendal 2012).

In 2004 and 2005 ten winter wheat varieties (Žitarka, Demetra, Srpanjka, Super Žitarka, Golubica, Panonka, Ševa, Zrnka, Janica and Alka) were evaluated through multi location trials. The average figures ranged as follows: grain protein 13.9 % and sedimentation 51.1 cm^3 (Horvat et al. 2012).

In a three years study in Western Australia, five spring wheat and one winter wheat cultivar were compared to determine variation in some agronomic traits. The average of the traits ranged from; grain yield first year 342-573 gm^2, second year 253-359 gm^2, and third year 425-585 gm^2, first year 1000 grain weight 34.9-41.3 gm, second year 33.8-42.4 gm, third year 29.2-45.4 gm, harvest index first year 0.23-0.37, second year 0.36-0.45, third year 0.38-0.43 (Zhang et al., 2012).

In a study to determine the yield and quality characteristics of some bread wheat genotypes under Konya conditions, the average figures ranged as follows; grain yields ranged between 331 and 749 kg/da, protein content ranged between 12.6 and 15.2% and sedimentation value ranged between 27.0 and 51.5 (Aydoğan et al. 2013).

In a two year study to determine the grain yield and some quality characteristics of some bread wheat genotypes under Diyarbakır conditions, the average figures ranged as follows; plant height first year 96.3 cm, second year 105.4 cm, parcel grain yield first year 576.8 days second year 765.5 days, thousand grain weights first year 35.9 g, second year 36.8 g, hectolitre weight first year 78.72 kg, second year 78.70 kg, protein ratio first year 11.1%, second year 10.9% (Doğan and Kendal 2013).

In a study, fourteen wheat cultivars (Kiran-95, Amber, Sindh-90, Sarsabz, Khirman, Jauher-18, Mehran-89, Anmol-91, TJ-83, GP-256, GP-205, Marvi, and Soghat) collected from Nuclear Institute of Agriculture (NIA) and one unknown from local market. These cultivars were compared in their total protein, crude protein and gluten in order to indicate the best wheat cultivar in baking quality and with good nutrition status. The cultivars varied in these quantitative properties; total protein 15.42-8.28%, crude protein

8-15% and gluten 43-50.43% (Khan et al. 2013).

In a two year study to determine the yield characteristics of some bread wheat lines under Bursa conditions; the average plant height was reported as 88.5 cm, thousand grain weight was 39.8 g and grain yield was 358,4 kg/da (Kurt and Yağdı 2013).

In a study conducted in 2008-2009 in Sudan, three wheat varieties grown at, Sudan (Elnelainm Nepta and Argeen) and one Australian variety as control were sowing for comparison in this study. The test weight (kg/hl) ranged from 80.6 to 83.6, 1000 kernel weight (g) 31.7-34.8, protein 9.5-12.9%, wet gluten (g) 24.2-33.5 and sedimentation value (ml) 15-30 were tested (Makawi et al. 2013).

In a study to determine the agricultural characters of some bread wheat lines under Middle Anatolia Region conditions; the average grain yield was 440 kg/da, thousand grain weight was 34.4 g, protein content was 11.9% and sedimentation value was 32.5 ml (Yazar et al. 2013).

In a study conducted under Pakistan conditions, six wheat cultivars; Siran-010, Atta Habib, Pirasabak-2008 Pirasabak-2005, Pirasabak-2004 and Saleem-2000, were studied to determine their biochemical characteristics. The average figures that have been observed for these cultivars were; moisture content 10% and protein content 19% (Ali et al. 2014).

In a study conducted under Bingöl Province, Genç district conditions during 2012–2013 to determine the bread wheat varieties suitable to Bingöl province ecologic conditions; 24 wheat varieties (Flamura-85, Demir-2000, Bayraktar-2000, Konya-2002, Tosunbey, Karahan-99, Gelibolu, Selimiye, Tekirdağ, Aldane, Kate-A-1, Bezostaja-1, Sönmez-2001, Kenanbey, Bereket, Gün-91, Kıraç-66, Seval, Dağdaş-94, Kırgız-95, Pehlivan, Alpaslan, Kirik, Gerek-79) have been used. In the study, the average figures have been observed as 79.4 cm for plant height, 165.8 kg/da for grain yield, 0.22% for harvest index, 13.93% for protein ratio, 34.1 g for thousand grain weight and 70.6 kg/100 l for hectolitre weight (Gümüştaş 2014).

In a one year stud 2009-2010, an experiment was conducted at Agriculture Farm Chilas, Pakistan. Four cultivars (Uqaab 2000, AS-2002, Bhakkar 2002 and Inqlab-91) were cultivated. The average figures have been observed as 52-75 cm for plant height, 502-581 kg/da for grain yield, straw yield 314-573 kg/da (Nizamuddin et al. 2014).

In a study examining the yield and quality characteristics of advanced level 80 durum wheat lines under Diyarbakır conditions; grain yield ranged between 381.5 and 830.8 kg/da, hectolitre weight ranged between 76.3 and 85.3 kg/l, thousand grain weight ranged between 20.2 and 40.2 g and protein ratio ranged between 14.3 and 17.2% (Tekdal et al., 2014).

In a two year study 2009-10 and 2010-11 at agricultural research farm of College of Agriculture, Gwalior, MP, India. Four wheat varieties; HI 1544, HI 8498, GW 322 and Lok 1) were compared. The studied parameter range were; plant height 89.94-91.78 cm, test weight 0.32-0.37 kg/hl, and straw yield 568-602 kg/da (Tomar et al. 2014).

A comparison study was conducted in the 2010–2011 crop season at the wheat breeding station of the Institute of Crop Science, Beijing. 330 wheat varieties with diverse origins including top commercial varieties and elite lines were compared. The mean protein of the Chines cultivars (12.9%) were higher than the Australian wheat (12.5%) (Yanga et al. 2014).

In a three season experiment at CIMMYT Norman E. Borlaug Experimental Station Mexico, 12 cultivars were examined. The detected differences ranged from 89.4-109.6 cm in plant height, grain yield 742.1-588.4 g m^2, harvest index 0.412-0.468 and 1000 seed weight 34.1-44.9 g (Aisawi et al. 2015).

In a study examining the yield and quality characteristics of some bread wheat under Yozgat conditions; plant height ranged between 86 and 112 cm, grain yield ranged between 427 and 639 kg/da, thousand grain weight ranged between 33 and 44 g, hectolitre weight ranged between 76 and 82 kg/l, biological yield ranged between 1215 and 1910 kg/da, protein content ranged between 8 and 13%, gluten amount ranged

between 15 and 31%, sedimentation amount ranged between 7 and 35 ml (Özen and Akman 2015).

In two constitutive seasons 2003/2004 and 2004/2005 at three locations (Wad Medani, Hudeiba, and Dongola) with different environment of Sudan, 20 wheat genotypes were studied. The findings obtained ranged from test weight 76.6–85.25 kg/hL, protein 9.96–14.06%, sedimentation 19–40 mL, thousand kernel weight 28.70–48.48 gm, wet gluten 28.63–46.53% (Mutwali et al. 2016).

3. MATERIAL AND METHOD

3.1. Material

The wheat varieties used as study materials in the research and the institutions that have provided the varieties are given in Table 3.1.

Table 3.1. The wheat varieties 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

3.1.1. Study Location and Year

This study has been conducted at the Bingöl University Research and Practice Area during 2015-2016 growing season.

3.1.1.1. Climate Conditions of the Study Area

The figures related to Bingöl climate conditions are given in Table 3.2. As seen in the table, the long year's temperature average of Bingöl is 12.3 ^{o}C. According to the long year's temperature averages, the coldest month is January and the warmest month is July. Accordingly in 2015, when the study was conducted, the annual average temperature was 13.9 ^{o}C, coldest month being January, and warmest month being July. During the study in 2015, the average temperatures never fell below 0^{o}C in any month and average

temperatures in January, February, March, May, July, August, September, October, November and December were higher than the long year's averages. Hence, we can say that 2015 was a warm year for Bingöl compared to previous years. Until the month of July, when the harvest took place, 2016 average temperature was 12.3 ^{o}C. During the first half of 2016 the figures were similar to those of long years' averages.

Table 3.2. Some monthly average climate figures of Bingöl for long years (2000-2015) and first half of 2016

Months	Average Temperature (^{o}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 (Bingöl)

During January, February, April, May, June, July, August, September, October and November 2015 the precipitation levels were lower than those of previous years' averages. It has been determined that 2015 total precipitation level is lower than the total precipitation level of previous years. But during the first half of 2016, the amount of precipitation was higher than the previous years.

In terms of relative humidity values, the average figure for the long years was 56. 6% but in 2015 this figure became 53.4%, and during the first half of 2016 it was 56.6%. It has

been observed that the figures acquired for relative humidity were close to the previous year's average.

In conclusion, we can say that in Bingöl, 2015 and the first half of 2016 was warmer, with less precipitation and similar moisture levels when compared to long years'.

3.1.1.2. Soil Conditions of the Study Area

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 Bingöl 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 3.3.

Table 3.3. 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

As seen in Table 3.3, 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".

3.2. Method

3.2.1. Trial 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.

3.2.2. Analysed Features

3.2.2.1. Plant Height (cm)

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.

3.2.2.2. Biological Yield (kg/da)

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.

3.2.2.3. Grain Yield (kg/da)

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 to get the grain yield.

3.2.2.4. Hay Yield (kg/da)

Hay yield has been obtained by subtracting the grain yield from the biologic yield after blending. The outcome has been converted to decares.

3.2.2.5. Thousand Grain Yield (g)

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. In bread wheat this figure should be 35 grams and higher.

25-35 : Average - severe
>35 : Mild (Anonym 2016c)

3.2.2.6. Harvest Index (%)

Grain yield of each parcel has been proportioned to the biologic yield of that particular parcel before being calculated in %.

3.2.2.7. Hectolitre (kg/hl)

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 litre). It gives us an idea about flour yield. Hectolitre has been determined at the Diyarbakır Commodity Exchange. In bread wheat 77 kg/hectolitre and higher is deemed to be good.

50-70 : Abnormal
70-73 : Mild
73-77 : Intermediate
77-80 : Severe (good)
>80 : Very severe (very good) (Anonym 2016c)

3.2.2.8. Grain humidity (%)

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. Grain humidity in wheat is supposed to be around 11-14% (Anonym 2016c). Grain humidity value has been determined at the Diyarbakır Commodity Exchange.

3.2.2.9. Protein Ratio (%)

Protein value is obtained by analysing the grinded grain samples with the help of a NIRS device. Having a protein ratio of over 12% in wheat grain is deemed to be good (Anonym 2016c). Grain protein value has been determined at the Diyarbakır Commodity Exchange.

3.2.2.10. Protein Yield (kg/da)

By multiplying the crude protein ratio in wheat grain with grain yield per decare, crude protein yields per decare have been found.

3.2.2.11. Sedimentation (ml)

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. Sedimentation value has been determined at the Diyarbakır Commodity Exchange.

<20 ml : Weak
20-40 ml : Intermediate
>40 ml : Strong (good) (Anonym 2016c).

3.2.2.12. Gluten (%)

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. Gluten value has been determined at the Diyarbakır Commodity Exchange. In flour, the following figures are accepted;

>35 : High
28-35 : Good
20-27 : Average
<20 : Low (Anonym 2016c)

3.2.3. Statistical Model and Assessment Method

The gathered data has been analysed by the help of JUMP statistics package program (software of SAS program) in accordance with randomized complete bock experimental design with three repetitions. The factor averages that were statistically significant according to the variance analysis results have been compared to LSD test (Kalayci, 2005).

4. STUDY FINDINGS AND DISCUSSION

4.1. Plant Height (cm)

The variance analysis results of the plant heights of different wheat varieties are given in Table 4.1.

Table 4.1. Plant height variance analysis results of different wheat varieties

Variance Source	**Degree of Freedom**	**Squares Total**	**Squares Average**	**F Value**
Repetition	2	5.36	2.68	
Variety	8	2049.653	256.206	<0.0001**
Error	16	89.9467	5.622	
General	26	2144.96		
CV%	2.88			

**significant at a level of P≤0.01

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of plant height. The plant height averages observed in different wheat varieties are given in Table 4.2.

As the table suggests, 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.

Table 4.2. Plant height (cm) averages determined in different wheat varieties

No	Varieties	Plant Height (cm)	Groups
1	Cham-6	77.1	E[+]
2	Dumlupınar	91.5	B
3	Eminbey	78.4	DE
4	Kunduru 1149	101.3	A
5	Krasunia odes'ka	77.9	DE
6	Pehlivan	84.3	C
7	Simito	69.6	F
8	Syrena odes'ka	81.3	CD
9	Yelken 2000	79.5	DE
	Average	**82.3**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.01 error margins.

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), Kahramanmaraş conditions 82.1 cm (Çokkızgın and Çölkesen 2006), again Samsun-Amasya conditions 84.8-99.4 cm (Mut et al. 2007) and Bingöl conditions 79.4 cm (Gümüştaş 2014).

Our findings were a bit lower than those obtained under Tekirdağ conditions 94.83 cm (Bilgin and Korkut 2005), Diyarbakır conditions first year 93.5 cm second year 104.5 cm (Doğan and Kendal 2012), again Diyarbakır conditions first year 96.3 cm second year 105.4 cm (Doğan and Kendal 2013), Bursa conditions 88.5 cm (Kurt and Yağdı 2013) and Yozgat conditions 86-112 cm (Özen and Akman 2015).

Plant height is an important goal in wheat breeding as it affects crop performance and thus yield and quality. Plant height positively and directly influenced grain yield, in irrigated and dryland conditions (Mohammadi et al. 2012).

4.2. Biological Yield (kg/da)

The variance analysis results of the biological yield of different wheat varieties are given in Table 4.3.

Table 4.3. Biological yield variance analysis results of different wheat varieties

Variance Source	Degree of Freedom	Squares Total	Squares Average	F Value
Repetition	2	793.85	396.925	
Variety	8	460246.96	57530.87	<0.0001**
Error	16	14728.81	920.6	
General	26	475769.63		
CV%	3,94			

**significant at a level of P≤0.01

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of biological yield. The biological yield averages detected in different wheat are provided in Table 4.4.

Table 4.4. Biological yield (kg/da) averages observed in different wheat varieties

No	Varieties	Biological yield (kg/da)	Groups
1	Cham-6	622.3	D[+]
2	Dumlupınar	850.0	B
3	Eminbey	949.0	A
4	Kunduru 1149	903.7	A
5	Krasunia odes'ka	638.7	D
6	Pehlivan	746.7	C
7	Simito	630.3	D
8	Syrena odes'ka	655.3	D
9	Yelken 2000	927.7	A
	Average	**769.3**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.01error margins.

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

There is positive and significant genetic correlation between biomass and yields under the conditions of drought and irrigation. Thus any increase in biomass causes increase in yield (Kandic et al. 2009).

Our findings were lower than those obtained by Akram (2011) 1323-1246 kg/da, they were lower than those obtained by Refay (2011) 1460-1630 kg/da and by Özen and Akman (2015) 1245-1910 kg/da. 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.

4.3. Grain Yield (kg/da)

The variance analysis results of the grain yield of different wheat varieties are given in Table 4.5.

Table 4.5. Grain yield variance analysis results of different wheat varieties

Variance Source	**Degree of Freedom**	**Squares Total**	**Squares Average**	**F Value**
Repetition	2	12.74	6.37	
Variety	8	243588.96	30448.62	<0.0001**
Error	16	13175.26	823.45	
General	26	256776.96	9876.04	
CV%	9,29			

**significant at a level of P≤0.01

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of grain yield. The grain yield averages observed in different wheat varieties are given in Table 4.6

Table 4.6. Grain yield (kg/da) and averages observed in different wheat varieties

No	Varieties	Grain Yield (kg/da)	Groups
1	Cham-6	264.3	C[+]
2	Dumlupınar	370.0	B
3	Eminbey	438.7	A
4	Kunduru 1149	418.0	AB
5	Krasunia odes'ka	234.0	CDE
6	Pehlivan	246.7	CD
7	Simito	185.7	E
8	Syrena odes'ka	206.7	DE
9	Yelken 2000	416.7	AB
	Average	**309.0**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.01 error margins.

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

The past century saw a great increase in wheat grain yield and it was the most-produced crop in the world as it reached 651 mt by the year 2010. However, agriculture faces serious challenges as the demand on wheat is rapidly rising in the coming decades. Therefore, boosting wheat grain yield is the most important goal for most experiments made on wheat (Curtis and Halford, 2014).

While the grain yield values we have obtained were higher than those obtained by Gümüştaş (2014) 165.8 kg/da; they were lower than those obtained by Budak and Karaaltın (1998) 440,6 kg/da, Kaya (2004) 313 and 518 kg/da, Bilgin and Korkut (2005) 504,4 kg/da, Tayyar (2005) 352.5-645.0 kg/da, Çokkızgın and Çölkesen (2006) 525.6 kg/da, Şahin et al. (2008) 187.0-236.5 kg/da, Doğan and Kendal (2012) first year 552.8 kg/da and second year 811.3 kg/da, again by Doğan and Kendal (2013) first year 576.8

kg/da and second year 765.5 kg/da, Kurt and Yağdı (2013) 358.4 kg/da, Tekdal et al. (2014) 381.5-830.8 kg/da and Özen and Akman (2015) 427-639 kg/da.

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, Mut et al., (2007), 302.2-495.7 kg/da.

4.4. Hay Yield (kg/da)

The variance analysis results of the hay yields of different wheat varieties are given in Table 4.7.

Table 4.7. Hay yield variance analysis results of different wheat varieties

Variance Source	**Degree of Freedom**	**Squares Total**	**Squares Average**	**F Value**
Repetition	2	644.67	322.34	
Variety	8	64864.67	8108.08	0.0195*
Error	16	39038.67	2439.92	
General	26	104548.00	4021.08	
CV%	10,73			

*significant at a level of P≤0.05

As seen in the table, different wheat varieties are statistically significant at a level of 5% in terms of hay yield. The hay yield averages observed in different wheat varieties are given in Table 4.8

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

Table 4.8. Hay yield (kg/da) and averages observed in different wheat varieties

No	Varieties	Hay Yield (kg/da)	Groups
1	Cham-6	358.0	C[+]
2	Dumlupınar	480.0	AB
3	Eminbey	510.3	A
4	Kunduru 1149	485.7	AB
5	Krasunia odes'ka	404.7	BC
6	Pehlivan	500.0	A
7	Simito	444.7	AB
8	Syrena odes'ka	448.7	AB
9	Yelken 2000	511.0	A
	Average	**460.3**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.05 error margins.

Wheat hay is the agricultural by-product obtained from different parts of the wheat plant like stem, leaves etc. after the grain and chaff have been removed. It is primarily composed of cellulose, hemicellulose and lignin. It is usually gathered and stored in a straw bale and has many uses; animal feed, soil fertility and biofuel (Khan and Mubeen 2012).

In wheat related studies conducted in different regions, different hay yield values have been observed. For example, under India conditions 568-602 kg/da (Tomar et al. 2014), Pakistan 637- 578.9 kg/da (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.

4.5. Thousand Grain Weight (g)

The variance analysis results of the thousand grain weight of different wheat varieties are given in Table 4.9.

Table 4.9. Thousand grain weight variance analysis results of different wheat varieties

Variance Source	Degree of Freedom	Squares Total	Squares Average	F Value
Repetition	2	2.85	1.43	
Variety	8	257.90	32.24	<0.0001**
Error	16	34.31	2.14	
General	26	295.07	11.35	
CV%	3,37			

**significant at a level of P≤0.01

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of thousand grain weight. The thousand grain weight and averages observed in different wheat varieties are given in Table 4.10.

Table 4.10. Thousand grain weights (g) and averages observed in different wheat varieties

No	Varieties	Thousand Grain Weight (g)	Groups
1	Cham-6	44.3	B^{+}
2	Dumlupınar	45.2	B
3	Eminbey	40.1	C
4	Kunduru 1149	45.7	B
5	Krasunia odes'ka	39.7	C
6	Pehlivan	39.8	C
7	Simito	49.6	A
8	Syrena odes'ka	43.3	B
9	Yelken 2000	43.2	B
	Average	**43.4**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.01 error margins.

As the table suggests, the highest thousand grain weight has been obtained from Simito variety 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 variety by 40.1 g. The thousand grain weight average of the varieties has been observed as 43.4 g.

The mass of thousand grain or kernels weight (g) is the weight of air-dried and not damaged grains. It is one of the parameters for evaluating grain quality. Grains with high thousand weights have better milling quality and ensure better emergence than those with low thousand grain weights. Different varieties, soil, agricultural practises and un favourable conditions during growth stages, all these factors have influence on thousand grain weight (Protic et al. 2007).

The thousand grain weights we have obtained were higher than those obtained by Mut et al. (2005) under Samsun and Amasya conditions 28.4-38.9 g, Mut et al. (2007) under Samsun and Amasya conditions 32.4-43.2 g, Şahin et al., (2008) under Konya conditions 34.5-42.2 g, Doğan and Kendal (2012) under Diyarbakır conditions first year 35.9 g second year 37.9 g, again Doğan and Kendal (2013) under Diyarbakır conditions first year 35.9 g second year 36.8 g, Kurt and Yağdı (2013) under Bursa conditions 41.7 g, Gümüştaş (2014) under Bingöl conditions 34.1 g and Tekdal et al. (2014) under Diyarbakır conditions 20.2-40.2 g; while they were similar to those reported by Budak and Karaaltın (1998) under Kahramanmaraş conditions 42.4 g, Kaya (2004) under Ankara conditions 42.2 g, Yağdı (2004) under Bursa conditions 42.88-51.17 g, Çokkızgın and Çölkesen (2006) under Kahramanmaraş conditions 43.74 g and Özen and Akman (2015) under Yozgat conditions 33-44 g.

4.6. Harvest Index (%)

The variance analysis results of the harvest indexes of different wheat varieties are given in Table 4.11.

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of harvest index ratios. The harvest index ratios and averages observed in different wheat varieties are given in Table 4.12.

Table 4.11. Harvest index variance analysis results of different wheat varieties

Variance Source	Degree of Freedom	Squares Total	Squares Average	F Value
Repetition	2	0.23	0.12	
Variety	8	1075.29	134.41	0.0010**
Error	16	347.39	21.71	
General	26	1422.90	54.73	
CV%	11,82			

**significant at a level of P≤0.01

As the table suggests, the highest harvest index has been obtained from Eminbey by 46.3%, Kunduru 1149 by 46.2% and Yelken 2000 variety 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 variety by 33.1%. The harvest index ratio of the varieties has been defined as 39.4%.

Table 4.12. Harvest index (%) and averages observed in different wheat varieties

No	Varieties	Harvest Index (%)	Groups
1	Cham-6	42.6	AB[+]
2	Dumlupınar	43.6	AB
3	Eminbey	46.3	A
4	Kunduru 1149	46.2	A
5	Krasunia odes'ka	36.9	BC
6	Pehlivan	33.1	C
7	Simito	29.5	C
8	Syrena odes'ka	31.6	C
9	Yelken 2000	45.0	A
	Average	**39.4**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.01error margins.

Harvest index is the improve in plant capacity to allocate biomass into the formed reproductive parts. In several crops, such as wheat, the considerable progress in breeding

for higher yields is achieved mainly through man-made selection forces for the harvest index (Foulkes et al. 2007).

For example; while the harvest index values we have obtained were higher than those by Gümüştaş (2014) 22%; they were similar to those obtained by Kaya (2004), in the second year, 40.3%.

4.7. Hectolitre (kg/hl)

The variance analysis results of the hectolitre value of different wheat varieties are given in Table 4.13.

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of hectolitre. The hectolitre value and averages observed in different wheat varieties are given in Table 4.14.

Table 4.13. Hectolitre value variance analysis results of different wheat varieties

Variance Source	**Degree of Freedom**	**Squares Total**	**Squares Average**	**F Value**
Repetition	2	2.97	1.49	
Variety	8	53.14	6.64	0.0032**
Error	16	21.40	1.34	
General	26	77.50	2.98	
CV%	1,44			

**significant at a level of P≤0.01

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

Test weight- hectolitre (kg/hl) is a measure of the density of a grain and it's a good way to measure how well the endosperm has filled out. Higher test weight are often indicative of better wheat quality, thus easier processing and higher flour yield than lower test weight. The value of hectolitre is affected by several factors such as moisture content, seed shape, internal air space and the condition of barn coat (Posner, 2009).

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, Şahin et al. (2008) 72.7-78.3 kg/hl, Doğan and Kendal (2013) 78.72-78.70 kg/hl and Gümüştaş (2014) 70.6 kg/hl; but were similar to those reported by Budak and Karaaltın (1998) 81.3 kg/hl, Yağdı (2004) 77.93-81.26 kg/hl, Sözen and Yağdı (2005) 80.30-82.00 kg/hl, Mut et al. (2007) 76.5-81.4 kg/hl, Doğan and Kendal (2012) 79.9-80.3 kg/hl, Tekdal et al. (2014) 76.3-85.3 kg/hl, Özen and Akman (2015) 76-82 kg/hl, Aydın et al. (2005) in Samsun 73.1-80.2 kg/hl.

Table 4.14. Hectolitre value (kg/hl) and averages observed in different wheat varieties

No	Varieties	Hectolitre (kg/hl)	Groups
1	Cham-6	82.5	A^{+}
2	Dumlupınar	79.1	CDE
3	Eminbey	80.1	BCD
4	Kunduru 1149	80.8	ABC
5	Krasunia odes'ka	78.2	DE
6	Pehlivan	81.4	AB
7	Simito	78.0	E
8	Syrena odes'ka	80.9	ABC
9	Yelken 2000	80.7	ABC
	Average	**80.2**	

$^{+}$ Averages indicated with the same name are statistically same according to LSD test, within P≤0.01 error margins.

4.8. Grain Humidity (%)

The variance analysis results of the grain humidity ratio of different wheat varieties are given in Table 4.15.

As seen in the table, different wheat varieties are statistically significant at a level of 5% in terms of grain humidity ratio. The grain humidity ratio averages observed in different wheat varieties are given in Table 4.16.

Table 4.15. Grain humidity ratio variance analysis results of different wheat varieties

Variance Source	**Degree of Freedom**	**Squares Total**	**Squares Average**	**F Value**
Repetition	2	0.11	0.06	
Variety	8	2.85	0.36	0.0155*
Error	16	1.62	0.10	
General	26	4.58	0.18	
CV%	3,79			

*significant at a level of P≤0.05

As the table suggests, the highest grain humidity ratio has been obtained from Krasunia odes'ka variety 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%) varieties, found statistically in the same group. The lowest grain humidity ratio has been obtained from Simito, Dumlupınar and Eminbey varieties by 8.0%. The grain humidity ratio average of the varieties has been observed as 8.4%.

Table 4.16. Grain humidity ratio (%) and averages observed in different wheat varieties

No	**Varieties**	**Grain Humidity (%)**	**Groups**
1	Cham-6	8.5	ABC[+]
2	Dumlupınar	8.0	C
3	Eminbey	8.0	C
4	Kunduru 1149	8.4	BC
5	Krasunia odes'ka	8.9	A
6	Pehlivan	8.7	AB
7	Simito	8.0	C
8	Syrena odes'ka	8.6	AB
9	Yelken 2000	8.4	ABC
	Average	**8.4**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.05 error margins.

An important element in management of harvesting, storage and post-harvest processing is grain humidity content. Determining grain humidity content is an essential first step in analyzing wheat or flour quality that millers adjust the moisture in wheat to a standard level before milling. It is also an indicator of grain storability, high grain humidity content attracts diseases and insects which cause damages during storage. Wheat or flour with low grain humidity content is more stable during storage (Amoodeh, 2006).

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%.

4.9. Protein Ratio (%)

The variance analysis results of the protein ratio of different wheat varieties are given in Table 4.17.

Table 4.17. Protein ratio variance analysis results of different wheat varieties

Variance Source	**Degree of Freedom**	**Squares Total**	**Squares Average**	**F Value**
Repetition	2	3.18	1.59	
Variety	8	24.23	3.03	0.0002**
Error	16	5.92	0.37	
General	26	33.33	1.28	
CV%	4,37			

**significant at a level of P≤0.01

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of protein ratio. The protein ratios and averages observed in different wheat varieties are given in Table 4.18.

As the table suggests, the highest protein ratio has been obtained from Kunduru 1149 variety by 15.8%. The lowest protein ratio has been obtained from Eminbey variety by 12.0%. Varieties protein ratio average has been observed as 13.9%.

Table 4.18. Protein ratio (%) and averages observed in different wheat varieties

No	Varieties	Protein Ratio (%)	Groups
1	Cham-6	14.1	B[+]
2	Dumlupınar	14.2	B
3	Eminbey	12.0	C
4	Kunduru 1149	15.8	A
5	Krasunia odes'ka	13.7	B
6	Pehlivan	13.5	B
7	Simito	13.6	B
8	Syrena odes'ka	14.5	B
9	Yelken 2000	13.8	B
	Average	**13.9**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.01 error margins.

Wheat is a major source for energy and it's largely consumed by humans after processing into bread and other foods. The protein in wheat grains exists in the aleurone and the embryo and these two parts account only for about 10% of the grain dry weight which are usually removed by milling. The unique bread making properties of wheat are generally are due to the visco-elastic properties of the gluten. While gliadin show viscous behavior, glutenin are elastic (Shewry and Halford, 2002).

The wheat related studies conducted in different regions of Turkey have provided different protein ratio values. For example; Yağdı (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%, Şahin et al. (2008) reported the protein ratio as 13.8-14.7%, Gümüştaş (2014) reported the protein ratio as 13.93%, Aydoğan et al. (2007) reported the protein ratio as 11.8-15.4%, Aydoğan et al. (2013) reported the protein ratio as 12.6-15.2%. The values we have obtained from the study are similar to those reported by the authors.

The findings we have obtained from the study were lower than those reported by Tekdal et al. (2014) as 14.3-17.2%.

On the other hand, the protein ratio we have obtained from the study has been higher than those reported by Budak and Karaaltın (1998) as 12.4%, Sözen and Yağdı (2005) as 10.90-12.27%, Doğan and Kendal (2012) first year 11.1% second year 11.0%, Doğan and Kendal (2013) first year 11,1% second year 10.9%, Özen and Akman (2015) 8-13%, Aydın et al. (2005) 11.2%.

4.10. Protein Yield (kg/da)

The variance analysis results of the protein yield of different wheat varieties are given in Table 4.19.

Table 4.19. Protein yield variance analysis results of different wheat varieties

Variance Source	**Degree of Freedom**	**Squares Total**	**Squares Average**	**F Value**
Repetition	2	32.53	16.27	
Variety	8	4966.34	620.79	<0.0001**
Error	16	205.41	12.84	
General	26	5204.23	200.16	
CV%	8.35			

**significant at a level of P≤0.01

As seen in the table, different wheat varieties are statistically significant at a level of 1% in terms of protein yield. The protein yield averages observed in different wheat varieties are given in Table 4.20.

As the table suggests the highest protein yield has been obtained from Kunduru 1149 variety by 65.9 kg/da. The lowest protein yield has been obtained from Simito variety by 25.3 kg/da and Syrena odes'ka variety by 29.9 kg/da. The protein yield average of the varieties has been observed as 42.9 kg/da.

Yağdı (2004) has reported the crude protein yield as 58.21-84.70 kg/da. The values we have obtained from the study were lower than those reported by the author. Aydoğan et al. (2007) has reported the crude protein yield as 20.07-33.17 kg/da. The values we have obtained from the study were higher than those reported by the author.

Table 4.20. Protein yield (kg/da) and averages observed in different wheat

No	Varieties	Protein Yield (kg/da)	Groups
1	Cham-6	37.2	C[+]
2	Dumlupınar	52.6	B
3	Eminbey	52.3	B
4	Kunduru 1149	65.9	A
5	Krasunia odes'ka	32.0	CD
6	Pehlivan	33.3	CD
7	Simito	25.3	E
8	Syrena odes'ka	29.9	DE
9	Yelken 2000	57.7	B
	Average	**42.9**	

[+] Averages indicated with the same name are statistically same according to LSD test, within P≤0.01 error margins.

4.11. Sedimentation (ml)

The variance analysis results of the sedimentation amount of different wheat varieties are given in Table 4.21.

Table 4.21. Sedimentation amount variance analysis results of bread wheat varieties

Variance Source	Degree of Freedom	Squares Total	Squares Average	F Value
Repetition	2	1.17	0.59	
Variety	3	172.00	57.33	0.0017**
Error	6	17.50	2.92	
General	11	190.67	17.33	
CV%	5,07			

**significant at a level of P≤0.01

As seen in the table, bread wheat varieties are statistically significant at a level of 1% in terms of sedimentation amount. The sedimentation averages observed in bread wheat varieties are given in Table 4.22.

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

Table 4.22. Sedimentation amount (ml) and averages observed in bread wheat varieties

No	Varieties	Sedimentation (ml)	Groups
1	Cham-6	36.0	AB
2	Krasunia odes'ka	38.0	A
3	Pehlivan	28.0	C
4	Syrena odes'ka	32.7	B
	Average	**33.7**	

[+] 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 higher than those reported by Sözen and Yağdı (2005) 19.51-31.34 ml, Altınbaş et al. (2004) as 25.8 ml.

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

4.12. Gluten (%)

The variance analysis results of the gluten ratio of different wheat varieties are given in Table 4.23.

As seen in the table, the difference between bread wheat varieties are statistically insignificant in terms of gluten ratio. The gluten ratio averages observed in bread wheat varieties are given in Table 4.24.

Table 4.23. Gluten ratio variance analysis results of bread wheat varieties

Variance Source	Degree of Freedom	Squares Total	Squares Average	F Value
Repetition	2	1.52	0.76	
Variety	3	0.86	0.29	0.5100 ^{NS}
Error	6	52.37	8.73	
General	11	101.49	9.23	
CV%	7,79			

^{NS} insignificant at a level of P≥0.05

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

Table 4.24. Gluten ratio (%) and averages observed in bread wheat varieties

No	Varieties	Gluten Ratio (%)
1	Cham-6	36.8
2	Krasunia odes'ka	36.4
3	Pehlivan	38.9
4	Syrena odes'ka	39.6
	Average	**37.9**

The gluten ratio we have obtained from the study were higher than those reported by Sözen and Yağdı (2005) 15.12-27.42%, Altınbaş et al. (2004) as 28.7%, Özen 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.

5. RESULTS AND RECOMMENDATIONS

This study has been conducted with the purpose of determining the yield and quality characteristics of some wheat varieties grown under the ecologic conditions of Bingöl province.

The plant materials of the study were 4 bread and 5 durum wheat varieties. The study has been established as randomized complete block experimental design with three repetitions. The data obtained in the study were related to plant height, biologic yield, grain yield, hay yield, thousand grain weight, harvest index, hectolitre, grain humidity, protein ratio, protein yield, sedimentation and gluten values.

The findings of the study have been listed below.

1. It has been observed that wheat varieties are statistically significant at a level of 1% in terms of plant height, highest plant height has been obtained from Kunduru 1149 variety (101.3 cm), while the lowest value has been obtained from Cham-6 variety (77.1 cm). The general plant height averages observed in the varieties has been reported as 82.3 cm.

2. It has been observed that wheat varieties are statistically significant at a level of 1% in terms of biological yield. The highest biological yield has been obtained from Eminbey variety (949.0 kg/da) and it has been followed by Kunduru 1149 and Yelken 2000 varieties from the same statistical group. The lowest biological yield has been obtained from Cham-6 (622.3 kg/da) and Krasunia odes'ka, Simito and Syrena odes'ka varieties from the same statistical group. The general biological yield average of the varieties has been defined as 769.3 kg/da.

3. The wheat varieties are statistically significant at a level of 1% in terms of grain yield, the highest grain yield has been obtained from Eminbey variety (438.7 kg) and it was followed by Kunduru 1149 and Yelken 2000 varieties from the same statistical group. The lowest grain yield has been obtained from Simito variety (185.7). General grain yield average of the varieties has been observed as 309.0 kg/da.

4. Wheat varieties are statistically very significant at a level of 5% in terms of hay yield, the highest hay yield has been obtained from Yelken 2000 by 511.0 kg/da, and it was followed by Eminbey, Pehlivan, Dumlupınar, Kunduru 1149, Simito and Syrena odes'ka varieties from the same statistical group. The lowest hay yield has been obtained from Cham-6 variety by 358.0 kg/da. Hay yield average of the varieties has been observed as 460.3 kg/da.

5. Wheat varieties are statistically very significant at a level of 1% in terms of thousand grain weight, the highest thousand grain weight has been obtained from Simito variety by 49.6 g. Lowest thousand grain weight has been obtained from Krasunia odes'ka by 39.7 g and Pehlivan and Eminbey varieties from the same statistical group. The thousand grain weight average of the varieties has been observed as 43.4 g.

6. Wheat varieties are statistically very significant at a level of 1% in terms of harvest index ratios. The highest harvest index has been obtained from Eminbey by 46.3%, and it was respectfully followed by Kunduru 1149, Yelken 2000, Dumlupınar and Cham-6 varieties from the same statistical group. The lowest harvest index ratio has been obtained from Simito by 29.5% and from Pehlivan and Syrena odes'ka varieties from the same statistical group. The harvest index ratio of the varieties has been defined as 39.4%.

7. Wheat varieties are statistically very significant at a level of 1% in terms of hectolitre. The highest hectolitre ratio has been obtained from Cham-6 variety by 82.5 kg/hl, and it was respectively followed by Pehlivan, Syrena odes'ka, Kunduru 1149 and Yelken 2000 varieties, statistically in the same group. The lowest hectolitre ratio has been obtained from Simito variety by 78.0 kg/hl. The hectolitre ratio average of the varieties has been observed as 80.2 kg/hl.

8. Wheat varieties are statistically significant at a level of 5% in terms of grain humidity ratio. The highest grain humidity ratio has been obtained from Krasunia odes'ka variety by 8.9%, and it was respectively followed by Pehlivan, Syrena odes'ka, Yelken 2000 and Cham-6 varieties, found statistically in the same group, while the lowest grain humidity ratio has been obtained from Simito, Dumlupınar and Eminbey varieties by 8.0%. The grain humidity ratio average of the varieties has been observed as 8.4%.

9. Wheat varieties are statistically very significant at a level of 1% in terms of protein ratio. The highest protein ratio has been obtained from Kunduru 1149 variety by 15.8%, while lowest protein ratio has been obtained from Eminbey variety by 12.0%. The protein ratio average of the varieties has been observed as 13.9%.

10. Wheat varieties are statistically very significant at a level of 1% in terms of protein yield. The highest protein yield has been obtained from Kunduru 1149 variety by 65.9 kg/da, and the lowest protein yield has been obtained from Simito variety by 25.3 kg/da. The protein yield average of the varieties has been observed as 42.9 kg/da.

11. It has been observed that in terms of sedimentation value, the statistical difference between wheat varieties has been very significant at 1%. The highest sedimentation value has been obtained from Krasunia odes'ka variety by 38.0 ml and Cham-6 variety by 36.0 ml, while the lowest sedimentation value has been obtained from Pehlivan variety by 28.0 ml. The sedimentation value average of the varieties has been observed as 33.7 ml.

12. The difference between wheat varieties are statistically insignificant in terms of gluten ratio. Cham-6 variety's gluten ratio has been observed as 36.8%, Krasunia odes'ka variety's gluten ratio has been observed as 36.4%, Pehlivan variety's gluten ratio has been observed as 38,9% and Syrena odes'ka variety's gluten ratio has been observed as 39.6%. The gluten ratio average of the varieties has been observed as 37.9%.

Based on these results, Kunduru 1149, Eminbey ve Yelken 2000 can be recommended for durum wheat; Pehlivan and Cham-6 can be recommended for bread wheat under Bingöl and similar ecological conditions.

REFERENCES

Aisawi, KAB., Reynolds, MP., Singh, RP. and Foulkes, MJ. "The physiological basis of the genetic progress in yield potential of cimmyt spring wheat cultivars from 1966 to 2009". Crop science, 55: 1749-1764, 2015.

Akram, M. "Growth And Yield Components of wheat under water stress of different growth stages". Bangladesh Journal of Agricultural Research. 36(3): 455-468, 2011.

Ali, Y., Atta, MB., Akhteer, J., Monneveux, P. and Lateef, Z. "Genetic variability, association and diversity studies in wheat (*Triticum aestivum* L.) germplasm". Pakistan Journal of Botany, 40(5): 2087-2097, 2008.

Ali, N., Shah, HU. and Khan, FU. "Biochemical variability among wheat cultivars grown in Khyber Pakhtunkwa". Pakistan Journal of Food Science. 24(1): 7-12, 2014.

Altınbaş, M., Tosun, M., Yüce, S., Konak, C., Köse, E., Can, RA., "Effects of genotype and location on the grain yield and some quality traits in bread wheats (*T. aestivum* L.)", Ege University Faculty of Agriculture Journal, 41(1): 65-74, 2004.

Amoodeh, MT., Khoshtaghaza, MH. and Minaei, S. "Acoustic on-line grain moisture meter". Computers and Electronics in Agriculture. 52 (1–2): 71–78, 2006.

Anonym, "Turkish Statistical Institute", Plant production statistics, www.tuik.gov.tr, Access Date: 22.09.2016, 2016a.

Anonym, "Bingöl Governorate, Bingöl Provincial Directorate of Food, Agriculture and Stockbreeding", bingol.tarim.gov.tr, Access Date: 22/09/2016, 2016b.

Anonym, "Başer food industry and trade AŞ", http://baserun.com.tr/index.php?option= com_content & view=article&id=57&Itemid=73, Access Date:15.11.2016, 2016c.

Aydın, N., Bayramoğlu, HO, Mut, Z., Özcan, H., "Determination of yield and quality characters of bread wheat (*Triticum aestivum* L.) cultivars and lines under Black Sea region conditions of Turkey", Agricultural sciences journal 11(3): 257-262, 2005.

Aydoğan, S., Akçacık, AG., Şahin, M., Kaya, Y. "Relationships among yield and some quality traits in bread wheat (*T. aestivum* L.) genotypes", Journal of Field Crops Central Research Institute, 16(1-2): 21-30, 2007.

Aydoğan, S., Şahin, M., Akçacık, AG., Taner, S., "Evaluation of yield and quality traits of wheat varieties", Central Anatolia Region, 1st Agriculture and Food Congress, 2013.

Bilgin, O., Korkut, KZ., "Determining the grain yield and some phenological characteristics of some milling wheat (*Triticum aestivum* L.) varieties and lines", Tekirdağ Faculty of Agriculture Magazine, 2(1): 2005.

Budak, H., Karaaltın, S., "Determining the quality characteristics of some durum (*Triticum durum* Desf.) wheat varieties through physical and chemical methods", Anadolu, J. of AARI 8(2): 66-79, 1998.

Curtis, T. and Halford, N.G. "Food security: the challenge of increasing wheat yield and the importance of not compromising food safety". Annals of Applied Biology 164(2014): 354–372, 2014.

Çokkızgın, A., Çölkesen, M., "The effect of nitrogenous manure on yield and yield factors in durum wheat (*Triticum durum* Desf.) under Kahramanmaraş conditions", KSÜ Science and Engineering Magazine, 9(1): 2006.

Doğan, Y., Kendal, E., "Determining the grain yield and some quality characteristics of milling wheat (*Triticum aestivum* L.) genotypes", GOÜ Faculty of Agriculture Magazine, 29(1): 113-121, 2012.

Doğan, Y., Kendal, E., "Determining the grain yield and some quality characteristics of some milling wheat (*Triticum aestivum* L.) genotypes under Diyarbakır conditions", YYÜ Agronomy Magazine, 23(3): 199-208, 2013.

Foulkes, MJ., Snape, JW., Shearman, VJ., Reynolds, MP., Gaju, O. and Sylvester-Bradley, R. "Genetic progress in yield potential in wheat: recent advances and future prospects". Journal of Agricultural Science, 145, 17–29, 2007.

Geçit, HH., İkincikarakaya, SÜ., "Field Crops", Ankara University Faculty of Agriculture Publishing, No: 1588, 2011.

Gümüştaş, R., "Analysing the yield and yield factors of some milling wheat varieties under Bingöl conditions", Bingöl University Institute of Science Department of Field Crops, Doctorate Thesis, 2014.

Horvat, D., Drezner, G., Dvojković, K., Šimić, C., Magdić, D. and Španić, V. "End-use quality of wheat cultivars in different environments". Sjemenarstvo 29(1/2): 5-13, 2012.

Kalayci, M. "Use JUMP with Examples and Anova Models for Agricultural Research" Anatolia Agricultural Research Institute Directorate Publications No:21, 2005.

Kandıć, V., Dodıg, D., Jovıć, M., Nıkolıć, B. and Prodanovıć, S. "The importance of physiological traits in wheat breeding under irrigation and drought stress". Genetika, 41(1): 11-20, 2009.

Karaman, MR. "Plant Nutrition" Gübretaş Guide Books Series: 2. Editor: Zengin, M., Basic Principles in Interpreting Soil and Plant Analysis Results (Section 12), Page: 874, 2012.

Kaya, M., "A study on the yield and yield elements of some milling wheat (*Triticum aestivum* L.) varieties", Anadolu, J. of A ARI, 14(1): 41-61, 2004.

Khan, I. and Zeb, A. "Nutritional composition of Pakistani wheat varieties". Journal of Zhejiang University Science B. 8(8): 555-559, 2007.

Khan, TS and Mubeen, U. "Wheat straw: a pragmatic overview". Current Research Journal of Biological Sciences, 4(6): 673-675, 2012.

Khan, S., Ghanghro, A., Memon, AN., Tahir, A., Shah, AM., Sahito, AL., Talpur FL. and Qureshi, S. "Quantitative analysis of wheat proteins in different varieties grown in Sindh, Pakistan". International Journal of Agriculture and Crop Sciences. 5 (16), 1836-1839, 2013.

Kurt, O., "Cultivation techniques of field crops", Ondokuz Mayıs University Faculty of Agriculture workbook no:44, 2012.

Kurt, Ö., Yağdı, K., "Studying the yield characteristic performance of some advanced milling wheat (*Triticum aestivum* L.) lines under Bursa conditions", UÜ. Faculty of Agriculture Magazine, Volume 27, Edition 2, 19-31, 2013.

Makawi, AB., Mahmood, MH., Hassan, HA. and Ahmed, IM. "Grains quality characteristics of local wheat (*Triticum aestivum*) cultivars grown at Khartoum State, Sudan". International Journal of Life Science. 7(1): 12-16, 2013.

Mohammadi, M., Sharifi, P., Karimizadeh, R. and Shefazadeh, M. "Relationships between grain yield and yield components in bread wheat under different water availability (Dryland and supplemental irrigation conditions)". Notulae Botanicae Horti Agrobotanici, 40(1): 195-200, 2012.

Mut, Z., Aydın, N., Özcan, H., Bayramoğlu, HO., "Determining the yield and some quality characteristics of milling wheat (*Triticum aestivum* L.) genotypes in Central Black Sea Region", GOÜ Faculty of Agriculture Magazine, 22(2): 85-93, 2005.

Mut, Z., Aydın, N., Özcan, Bayramoğlu, HO., Özcan, H., "Determining the yield and main quality characteristics of some milling wheat (*Triticum aestivum* L.) genotypes", OMÜ Faculty of Agriculture Magazine, 22(2): 193-201, 2007.

Mutwali, NIA, Mustafa AI., Gorafi, YSA and Ahmed, IAM. "Effect of environment and genotypes on the physicochemical quality of the grains of newly developed wheat inbred lines". Food Science and Nutrition, 4(4): 508–520, 2016.

Nizamuddin, Qasim, M., Gurmani, ZA., Khan, A., Kabir, R., Rehmaz, N. and Imran, N. "Yield evaluation of different wheat varieties under climatic conditions of district Diamer". Life Sci. Int. J., 8, (1, 2, 3, & 4): 3043-3047, 2014.

Özen, S., Akman, Z. "Determination of yield and quality characteristics of some bread wheat cultivars in Yozgat ecological conditions", Süleyman Demirel University Faculty of Agriculture Journal 10(1): 35-43, 2015.

Posner, ES "Wheat flour milling. In Wheat Chemistry and Technology, pp121. (Ed. By Khan, K. and Shewry, P.)" AACC international, USA, 2009.

Protic, R., Jovin, P., Protic, N., Jankovic, S. and Jovanovic, Z. "Mass of 1,000 grains in several winter wheat genotypes, at different dates of sowing and rates of nitrogen fertilizer". Romanian Agricultural Research. 39-43, 2007.

Qasim, M., Qamer, M. and Alam, M. "Sowing dates effect on yield and yield component of different wheat varieties". Journal of Agriculture Research. 46(2): 135-140, 2008.

Refay, YA. "Yield and yield component parameters of bread wheat genotypes as affected by sowing dates". Middle-East Journal of Scientific Research, 7(4): 484-489, 2011.

Safdar, NM., Naseem, K., Siddiqui,N., Amjad, M., Hameed, T. and Khalil, S. " Quality evaluation of different wheat varieties for the production of unleavened flat bread (Chapatti)". Pakistan Journal of Nutrition, 8(11): 1773-1778, 2009.

Shewry, PR. and Halford, NG. "Cereal seed storage proteins: structures, properties and role in grain utilization". Journal of Experimental Botany, 53(370): 947-958, 2002.

Sezen, Y. "Fertilizers and Fertilizing" Atatürk University Paplications No:679, Agriculture Faculty Paplications No:303, s.15, Erzurum, 1995.

Sözen, E., Yağdı, K., "Determining the quality traits of some advanced durum wheat (*Triticum durum* Desf.) lines", Uludağ University Faculty of Agriculture Magazine 19(2): 69-81, 2005.

Şahin, M., Aydoğan, S., Akçaçık Göçmen, A., "Determining the multiyear yield and quality performances of durum wheat varieties registered for Central Anatolia dry and wet conditions", Cereal Symposium 2-5 June 2008 s: 859, Konya, 2008.

Tayyar, Ş., "Determining of yield and some quality characteristics of different bread wheat (*Triticum aestivum* L.) varieties and lines grown in Biga", Akdeniz University Faculty of Agriculture Magazine, 18(3): 405-409, 2005.

Tekdal, S., Kendal, E., Ayana, B., "Assessing the yield and some quality characteristics of advanced durum wheat lines through biplot analysis method", Turkish Agriculture and Nature Science Magazine 1(3): 322-330, 2014.

Tomar, SPS, Tomar, S. and Srivastava, SC "Yield and yield component response of wheat (*Triticum aestivum* L) genotypes to different sowing dates in Gird region of Madhya Pradesh". International Journal of Farm Sciences. 4(2): 1-6, 2014.

Tonk, FA., Lker, E. and Tosun, M. "A study to incorporate high protein content from tetraploid wheat (T. *turgidum dicoccoides*) to hexaploid wheat (*T. aestivum vulgare*)". Turkish Journal of Field Crops. 15(1): 69-72, 2010.

Yağdı, K., "Analysing some of the quality characteristics of milling wheat (*Triticum aestivum* L.) lines developed under Bursa conditions", Uludağ University Faculty of Agriculture Magazine 18(1): 11-23, 2004.

Yanga, X., Wua, L., Zhua, Z., Rena, G. and Lıu, S. "Variation and trends in dough rheological properties and flour quality in 330 Chinese wheat varieties". The Crop Journal, 195-200, 2014.

Yazar, S., Selantur, A., Özdemir, B., Alyamaç, M.E., Evlice, A.K., Pehlivan, A., Akan, K., Aydoğan, S. "Assessment of some agronomical characteristics in bread wheat breeding programs of central Anatolia region", Journal of Field Crops Central Research Institute, 22(1): 32-40, 2013.

Zhang, H., Turner, NC. and Poole, ML. "Increasing the harvest index of wheat in the high rainfall zones of southern Australia". Field Crops Research. 129: 111–123, 2012.

Žilić, S., Barać, M., Pešıć, M., Dodig, D. and Ignjatovıć-Mıcıć, D. "Characterization of proteins from grain of different bread and durum wheat genotypes". International Journal of Molecular Science. 12: 5878-5894, 2011.

BACKGROUND

He was born in Iraq's Sulaymaniyah in 1980. He completed his primary and secondary school education in Sulaymaniyah. In 1999, he was placed at Sulaymaniyah University Faculty of Agriculture. He was graduated from the Sulaymaniyah University Faculty of Agriculture Department of Field Crops in 2003. He was appointed as an Agricultural Engineer at Sulaymaniyah Agricultural Research Institute in 2003. He enrolled at the Postgraduate Programme in Bingöl University Institute of Science Department of Field Crops in 2015.