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Determination of Yield and Agronomic Characteristics of Some Durum Wheat Genotypes in Turkey and Iraq Conditions[1]

Abdul Hussein Mahdi[1]and Ali TOPAL[2]
[1]Kirkuk Grain Trade General Company, Kirkuk, Iraq
[2] Seljuk University, Faculty of Agriculture, Field Crops Department, Konya, Turkey

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Corresponding Author:
Abdul Hussein Mahdi

E-mail:
Firesun600@yahoo.com

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ABSTRACT

This research was conducted using Augmented Experimental Design during 2015-2016 growing season in Konya and Kirkuk conditions. 17genotype materials (12 lines and 5 check genotypes of durum wheat) obtained from different sources were used by which yield and some of yield characteristic were analyzed in Turkey and Iraq locations. The durum wheat lines in this study were pure and stable.

Observations and measurements related to plant height, spike length, number of grains head, harvest index, thousand grains weight and grain yield were recorded. According to the research results, changes in the characteristics varied based on the genotype and locations. Average values observed for check durum wheat genotypes and durum wheat lines at Konya Location were 101.8 cm and 108.7 cm for plant height,6.99 cm and 8.10 cm for spike length, 51.16 pieces and 42.24 pieces for number of grains in head,50.89 g and 53.45 g for thousand grains weight, 30.63% and 23.48%for harvest indexand 3.963 ton/ha and 3.494 ton/ha for grain yield. At Kirkuk location, these average values for the check durum wheat genotypes and durum wheat lines respectively were 116.61 cm and 119.15 cm for plant height, 9.25 cm and 9.59 cm for spike length,47.31 pieces and 42.45 pieces for number of grains in head, 37.64% and 38.79%for harvest index,44.55 g and 48.49 g for thousand grains weight and 3.339 ton/ha and 3.749 ton/ha for grain yield. In general, at Konya location the check durum wheat genotypes and durum wheat lines for plant height, spike length and harvest index wear showed low level of values, either in Kirkuk there was a significant difference in values. while the thousand grain weight increased at Konya location. The number of grains in head did not show significant in both locations for durum wheat lines,while the genotypes found a significant difference compared to the location of Kirkuk .Durum wheat lines and check durum wheat genotype reactions with respect to grain yield showed difference according to the locations. While average yield of the durum wheat lines was found to be lower at the rate of 6.8% compared to Kirkuk location, average yield values for check durum wheat genotypes were found to be higher at the rate of 15.76% at Konya location compared to Kirkuk location. It was observed from the average values of the check durum wheat genotypes that Umrabi had the highest value appeared, for durum wheat lines one of the superior was AT-060had the highest value appeared as well as 060,5020-7 and Gir at Kirkuk location. Ether in location of Konya for check durum wheat genotypes was Kunduru-1149had the highest value appeared, for durum wheat lines wasAT-061 had the highest value appeared. This situation revealed that check durum wheat genotypes being different from the durum wheat lines showed positive reaction to the regions in which they were registered with respect to yield.

[1] This article is a part of thesis for the first author.

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تحديد الغلة والخصائص لبعض التراكيب الوراثية للحنطة الخشنة تحت ظروف في تركيا والعراق

عبدالحسين عباس مهدي* وعلي توبال**

*الشركة العامة لتجارة الحبوب– كركوك– العراق ** قسم المحاصيل الحقلية– كلية الزراعة– جامعة سلجوق– تركيا

الخلاصـة

اجريت هذه الدراسة باستخدام التصميم التجريبي من خلال موسم النمو لعام 2015–2016 في الظروف المناخية في موقعين في تركيا والعراق باستخدام 17 من التراكيب الوراثية للحنطة الخشنة (12 سلالة و5 أصناف مقارنة) في هذا البحث والتي تم فيها تحليل الغلة وبعض خصائصها المميزة لأصناف وتراكيب وراثية للحنطة الخشنة والتي تم الحصول عليها من مصادر مختلفة من موقعين في تركيا والعراق .أن الخطوط التراكيب الوراثية في الدراسة هي نقية ومستقرة خلال هذه الدراسة تم إجراء القياسات والملاحظات لخصائصها المتعلقة بارتفاع النبات وطول السنبلة وعدد حبوب بالسنبلة ووزن ألف حبة ودليل الحصاد وحاصل الحبوب, ووفقا لنتائج البحث ظهرت تغييرات واختلافات في الخصائص على أساس التركيب الوراثي واختلاف المواقع . حيث أظهرت القيم المتوسطة في موقع تركيا / كونيا لأصناف وخطوط التراكيب الوراثية لطول النبات (101.8 سم) و (108.7سم) ولطول السنبلة (6.99سم) و (8.10سم) ولعدد الحبوب بالسنبلة (51.16) حبة و (42.24) حبة ولوزن آلف حبة كانت القيم المتوسطة (50.89 غم) و (53.45غم) وبينت دليل الحصاد 30.36% و 23.48 % ولحاصل الحبوب بينت 3.963 طن/هكتار و 3.494 طن/هكتار.أما القيم المتوسطة في موقع العراق / كركوك وعلى نفس المنوال حيث ظهرت لطول النبات (116.61سم) و (119.15 سم) ولطول السنبلة كانت (9.25 سم) و (9.59سم) ولعدد الحبوب في السنبلة ظهرت القيم (47.31 حبة) و (42.45 حبة) ولوزن ألف حبة كانت (44.55غم) و (48.49 غم) ولدليل الحصاد أظهرت القيم 37.64% و 38.79% ولحاصل الحبوب (3.339 طن/ هكتار) و (3.749 طن /هكتار) المبينة في موقع كركوك . بصفة عامة في موقع تركيا / كونيا أظهرت النتائج لأصناف وتراكيب الوراثية لحنطة الخشنة للصفات طول النبات وطول السنبلة ودليل الحصاد أظهرت مستوى منخفض من القيم، أما في موقع كركوك فأظهر تفوقا معنويا وزيادة في القيم .حين زاد وزن ألف حبة حيث أعطت مستوى زيادة ملحوظة بالقيم في موقع كونيا، ومستوى اقل بالقيم في موقع كركوك ، ولصفة عدد الحبوب بالسنبلة في كلا الموقعين لم تظهر فرقا معنويا في خطوط التراكيب الوراثية ، في حين وجد في أصناف التراكيب الوراثية فرقا معنويا في موقع كونيا بحيث لوحظ زيادة ملحوظة بالقيم مقارنة بموقع كركوك، وأظهرت أصناف وخطوط التراكيب الوراثية فيما يتعلق بحاصل الحبوب وفقا للاختلاف مواقع الدراسة التجريبية فرقا معنويا بالقيم ، حيث وجد أن متوسط أنتاج الحبوب لخطوط التراكيب الوراثية للحنطة الخشنة اقل بنسبة 6.8% مقارنة بموقع كركوك فقد بينت أن متوسط أنتاج الحبوب لأصناف الحنطة الخشنة أعلى بنسبة 15.67 % في موقع كونيا مقارنه مع موقع كركوك، لوحظ من قيم متوسطات الأصناف التراكيب الوراثية أن الصنف Umrabi قد سجل أعلى قيمة متفوقا على الأصناف الأخرى ،ومن الخطوط التراكيب الوراثية المتفوقة كانت التركيب الوراثيAT-060 قد سجل أعلى قيمة ومن ثم5020-7 , Gir, 060 حسب الظروف في موقع الدراسة بكركوك .أما في موقع كونيا كانت الصنف Kunduru-1149 قد سجل أعلى قيمة متفوقا على الأصناف الأخرى ،ومن الخطوط التراكيب الوراثية المتفوقة كانت التركيب الوراثيAT-061 سجل أعلى قيمة متفوقا على خطوط التراكيب الوراثية. وقد كشفت هذه الحالة أن أصناف الحنطة الخشنة المسجلة تختلف عن خطوط التراكيب الوراثية حيث أظهرت رد فعل ايجابي على مواقع التي سجلت فيها فيما يتعلق بالحاصل .

الكلمات المفتاحية:
الحنطة الخشنة، الموقع، محصول، عناصر المحصول.

للمراسلة:
عبدالحسين عباس مهدي
البريد الالكتروني:
Firesun600@yahoo.com

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INTRODUCTION

Grains are the leading product group with respect to not only cultivation but also production in Turkey and Iraq just like the rest of the world. Grains crop constitute 70% of the field crops cultivation area in Turkey while, constitute 16% of the field crops cultivation area in Iraq (FAW,2015). Wheat which is the most cultivated crop among the grains has a significant contribution for human food and animal nutrition for both countriesIraqandTurkey. According to the 2015 data, wheat cultivation is 7.809.41 ha, with total production 22.600.000 tonandwheat yield value is 2.890 ton/ha in Turkey (TUİK, 2015). However, wheat cultivation is 1.036.67 ha, wheat production is 2.645.061 ton and wheat yield value is 3.302 ton/ha in Iraq (FAW , 2015).When the ecological conditions of Turkey and Iraq are taken into consideration, it could be seen that there is a serious potential to increase the wheat productionwhich is one of the most strategic products of our age. Although researches centered upon durum wheat improvement, there are still some inadequacies. Therefore, it is necessary to develop durum wheat types which can grow in different ecological environments successfully and have high quality and yield.Determining the wheat types that are appropriate to regional conditions through testing the wheat types in different regions and ecologies is important for improving wheat farming and increasing the production when the fact that quality of durum wheat is under the influence of genotype, environment and genotype x environment interaction (Kılıç et al. 2012) is taken into consideration. In Study carried out by (Al-Falahi and others,2003) they used 12 genetically modified compounds from soft wheat the results showed a significant difference in the number of spike/m2 and where strains showed (G1-4,118-S2,183-S2,183,S2,B and 35) superior to the rest of the genotypes. The number of the grains in the spike is associated with environmental and genetic factors (Baldawi,2006). Studies have shown that the weight of a thousand grains, the difference in the weight of the extreme grains is attributed to speed or slow grain growth for long or short time(Dennis,2000). Difference in the number of the spike grains to compete between the external and internal growth factors of the plant (Izzat Al-Lami,2004). There is a significant negative correlation between plant b height and grain yielde in drought prone species in later of their life cycle (Ginkel and others,1998). Observed difference between breed wheat genotypes to flag leaf area, number of tillers per meter square grain per spike, weight of 1000 grains and grain yield (Amer,2004).

The aim of this study is to analyze yield and yield components of some durum wheat lines and types in Kirkuk region of Iraq which is located in the south of Southeastern Anatolia Region of Turkey which is the high quality durum wheat production region of Turkey and Central Anatolia Region in Turkey that have appropriate conditions considering the fact that wheat have more quality in regions where the generative stages of durum wheat's go through hot and dry climatic process and determine the most appropriate wheat types and prospective wheat types for the regions.

MATERIAL AND METHOD

The study was conducted in Turkey and Iraq conditions during 2015-2016 growing season. 11 durum wheat lines (AT-062, 060, AT-038, AN-110; An-111, AT-061, AT-050, 043”1”, 5004, 5020-7 and AT-060) and a local type wheat obtained from Eruh District of Siirt (12 genotypes in total) .5 durum wheat types, four of which were registered in Turkeyand one of which was registered in Iraq (Kundur 1149, Dumlupınar, Kızıltan 91, Ç-1252andUmrabi) were used as a checkgenotypes in the study. Trials were set as 4 blocks each of which consists of8parcels according to Augmented Experimental Design in central district of Konya and Leylan Village of Kirkuk. Control types were repeated in every block as a basis of calculating the trial errors while wheat lines which were tested were distributed to the block without repeating.

Wheat's were planted by hand in 4-6 cm depth with 20 cm row space as 1m, 1 row and the number of transplanted lines of genotypes was 32 lines and the quantity of grain 500 grains/1000m^2 planting density. Wheat's were sown in 15th of October 2015 in Turkey while wheat's were sown in

1st of December 2015 in Iraq. DAP fertilizer in 6kg/1000m^2 ,P_2O_5 was supplied during cultivation in both of the locations. N 25 kg/1000m^2 of the 10 kg/1000m^2 nitrogen was given in cultivation and the rest was given in till ring period. Per unit of N available in the soil according to (Moll et al.,1982). Wheat's in the location of Konya were given water for one tine on 4th of April. Wheat's were harvested in Konya on the date of 25 July 2016 while wheat was harvested in Iraq on the date of 5 June 2016 by stickling and blended by hand.

Climatic characteristics belonging to 2015-2016 growing season when the research was conducted and long years in Konya and Kirkuk locations were presented in chart1. While average temperature in 2015-2016 wheat growing season is 11.3ºC which is close to average temperature over the years (11.2ºC) in Konya location, average temperature in 2015-2016 wheat growing season is 19.2ºC in Kirkuk location which is lower than the average over the years (22.7ºC). Areal precipitation during time period when the research was conducted is 203.2 mm which is 38% lower than the average over the years (329.0 mm) in Konya location; likewise, areal precipitation during time period when the research was conducted is 224.9 mm which is 30% lower than the average over the years (322.9 mm) in Iraq location.

Chart 1. Values belonging to some of the climatic characteristics in Konya and Kirkuk locations

Months	KONYA-TÜRKEY*						KIRKÜK-IRAQ**					
	Temperature (ºC)		Precipitation (mm)		Relative Humidity (%)		Temperature (ºC)		Precipitation (mm)		Relative Humidity (%)	
	Long[1)] Years	2015/ 2016	Long Years	2015/ 2016	Long Years	2015/ 2016	Long Years	2015/ 2016	Long Years	2015/ 2016	Long Years	2015/ 2016
2015-September	20.3	22.6	19.7	23.7	43.4	37.4	38.3	34.1	0	0	22.3	22.62
October	**13.5**	**14.6**	**35.7**	**38.9**	**60.5**	**59.9**	30.7	26.4	10.0	46.3	32.9	24.14
November	**6.7**	**7.9**	**39.8**	**2.0**	**63.8**	**56.9**	21.4	16.0	42.1	77.4	54.1	29.39
December	**2.8**	**-0.8**	**44.2**	**0.8**	**54.7**	**77.0**	**14.4**	**11.1**	**59.2**	**63.2**	**69.5**	71.64
2016-January	**1.6**	**0.1**	**49.7**	**39.3**	**76.4**	**75.0**	**12.6**	**9.8**	**68.5**	**27.4**	**71.3**	70.47
February	**3.0**	**6.4**	**31.3**	**4.4**	**68.7**	**64.0**	**15.5**	**12.9**	**65.7**	**39.6**	**66.0**	68.55
March	**7.8**	**7.8**	**26.6**	**34.2**	**56.5**	**53.6**	**19.4**	**16.1**	**67.1**	**64.8**	**60.1**	56.83
April	**12.4**	**14.7**	**28.3**	**6.1**	**52.2**	**39.8**	**25.1**	**21.5**	**45.8**	**23.2**	**51.7**	43.44
May	**17.4**	**15.8**	**35.5**	**58.3**	**49.3**	**53.4**	**32.8**	**28.7**	**16.6**	**6.7**	**34.5**	29.67
June	**21.7**	**22.0**	**33.2**	**17.3**	**40.2**	**40.0**	**39.3**	**34.4**	**0**	**0**	**21.6**	19.39
July	**25.3**	**24.8**	**4.7**	**1.9**	**35.4**	**32.4**	43.5	38.1	0	0	19.9	17.22
August	25.5	25.6	7.5	0.0	34.5	32.5	42.7	36.1	0	0	20.0	15.58
Tot./Avr.	13.2	13.5	356.2	226.9	52.9	51.8	28.0	23.7	375.0	348.0	43.65	39.07
Gr. Per.	**11.2**	**11.3**	**329.0**	**203.2**	**55.8**	**55.2**	**22.7**	**19.2**	**322.9**	**224.9**	**53.53**	**51.42**

1) Between the years of 2007-2015 for Konya, between the years of 2004-2014 for Kirkuk.
* RegionalDirectorate of Meteorology, Konya, Turkey; ** RegionalDirectorate of Meteorology, Kirkuk, Iraq

According to the analysis results of the soil samples taken from the terrains where the testing was carried out from0-30 cm depth for Konya location and 0-40 cm depth for Kirkuk location, testing soil in Konya location was sandy clay SC in texture. According to the values stated by (Ergene,1982), testing soil in Konya location is saline soil, shows mild alkali reaction pH:7.94, pure water:2.88water/cm. and according to the values stated by(Schroo,1963), it contains plenty of lime (31.4%mg/l). Organic substance amount of the testing soil is low (1.83%) phosphor 1.79 mg and does not contain inorganic nitrogen Chart 2. According to analysis belonging to the testing place in Laylan village of Kirkuk, soil samples taken from 40 cm depth of soil which were taken from 5 different spots of the soil and values stated by (Alkubeyisi et al, 2000) Chart 2.Testing soil in the Kirkuk location is silt clay SC in texture class and pH:7.94. It contains pure water

EC:0.63water/cm, lime (CaCo3) at the rate of 22.81% mg/l. Organic substance amount of the testing soil is low (2.81%) and does not contain inorganic nitrogen (Al-Naimi, Saadallah Necim,1999).

Chart 2. Some physical and chemical properties of soils where Konya and Kirkuk locations were conducted

Soil properties	Unit	Konya* (0-30 cm)	Kirkuk** (0-40 cm)
Texture			
Sand	% g. kg-1	46.2	9.7
Silt	% g. kg-1	17.4	54.6
Clay	% g. Kg-1	36.4	35.6
Texture class		SC	SC
pH (1: 2.5; Soil: pure water)		7.94	7.65
EC (1:5; Soil: pure water)	water/cm	2.88	0.63
$CaCO_3$ (lime)	% mg/L	31.4	22.81
Organic elements	%	1.83	2.01
Fosfor	mg kg	1.79	2.6

*Analyzes were carried out at S.Ü. Faculty of Agriculture soil laboratory.
**Analyzes were carried out in Kirkuk Agriculture Directorate Soil section laboratory.

Plant height, spike length, number of grains in head, thousand grains weight harvest index, and grain yield which were examined through the research conducted with 17 durum wheat genotypes in ecological conditions of Konya and Kirkuk were presented below as discrete titles. The values obtained from these observations and measurements were subjected to variance analysis according to the Augmented trial design ,discretely for each property, attachment and slope coefficient spending SPSS overture and average were discrete by L.S.D at $P<0.05$ (Peterson,1994).

RESEARCH RESULTS AND DISCUSSIONS

Plant Height

Average values and significance groups belonging to wheat lines and types in the research conducted in Konya and Kirkuk conditions were presented in Chart 3. While plant height for control types in Konya location is 101.80 cm and it is 116.61 cm in Kirkuk location which is higher at the rate of 14.5%. Maximum plant height among the control types in both Konya and Kirkuk locations is Kunduru-1149 with 129.10 cm and 142.77 cm; however, the lowest plant height is Umrabi type with 75.05 cm. Kızıltan (18.8%) and Umrabi (17.1%) types had the highest rate of increase with respect to plant height according to the locations.

When the plant height of durum wheat lines that was tested inKonya and Kirkuk locations was analyzed, the highest value was obtained in AN-110 line in Konya which is 128.3 cm while the highest value in Kirkuk was obtained in AT-062 numbered line which is 144.45 cm, a significant difference of 12.5% was observed in the location of Kirkuk and an increase in plant height. The lowest value in Konya was obtained in 5020-7 numbered line which is 81.5cm while the lowest value in Kirkuk was obtained in AT-060 numbered line which is 72.63 (Chart 3). When the lines were compared with control types, AN-110 and AT-062 numbered lines had a value close to Kundurlu-1149 type which has the maximum plant height while there was not any line shorter than Umrabi type which has the shortest plant height.

Plant heights of types and lines in Konya conditions range between 129.10 cm and 75.05 cm while plant heights range between 144.45 cm and 72.63 cm in Kirkuk conditions. In general the reason why plant height of the genotypes in Kirkuk is more than the Konya location can be higher values of rain and temperature, Significant differences were observed in the average values in Kirkuk location, which gave a significant increase of 9.5% compare the location of Konya.

When the plant height and control types of durum wheat lines were compared ($LSD_{(0,05)}$= 13.84), it was seen that Kunduru-1149 type had the longest plant height among all the genotypes. In a study conducted in Konya with 44 durum wheat genotypes, it was reported that plant heights range between 124.36 cm and 65.98 cm and Kunduru-1149 type had the longest plant height (Soylu and Sade, 2003).

Plant height of cold climate grains ranges between 50cm and 200cm (Kun ,1996). Plant height which is also related to the internodes size of the plant is a significant morphological element which plays a role on bending strength, earliness and yield factors and consists of nodes and internodes and harvest index, fertile tiller numbers, internodes number and heights are related characters (Jain et.al.1973; Soylu and Sade, 2003). Plant height is quantitative feature and controlled by many genes (Cattivelli et al.1994). (Akdamar et al. 2002) states that there is a significant relation between plant height and grain yield.

Head Size

Average values and significance groups belonging to head size of wheat lines and types in the research conducted in Konya and Kirkuk conditions were presented in Chart 3. Head size showed significant differences according to the locations. While head size for control types in Konya location is 6.99 cm, this value is 9.25 cm in Kirkuk location which is higher at the rate of 32.33%. The longest head size in both Konya and Kirkuk locations is Ç-1252 type with 8.21 cm and 11.25cm restively; however , the lowest head size is Umrabi type with 5.94 cm and 7.27cm. Kızıltan 91 (47.6%) type had the highest rate of increase with respect to head size according to the locations. While the average head size of lines in Konya location is 8.10cm, it is 10.38cm in Kirkuk location which increased at the rate of 28% and ordering of the lines changed. According to this, AT-038 genotype was the line which had the longest head size with 14.84 cm and cm respectively in Konya and Kirkuk locations. The lowest head size value in Konya was obtained in Gır genotype which is 5.12 cm while the lowest head size value in Kirkuk was obtained in AN-110 numbered line which is 8.33 cm (Chart 3). When the head size of durum wheat lines were compared with control types($LSD_{(0,05)}$= 0.64) in Konya, it was seen that 4 lines (AT-038, AT-062, AN-110 and AN-111) had a higher head size than Ç-1252 while Gırhad a lower head size than Umrabi type which had the lowest head size durum wheat control type. When the head size of durum wheat lines were compared with control types ($LSD_{(0,05)}$= 0.84) in Kirkuk location, it was seen that 2 lines (AT-038 and 060) had a higher head size than Ç-1252 control type which had the highest head size. In Kirkuk location, there was not any line which had lower head size than control types (Chart 3). Through morphological elements works, 12 class durum wheat *(triticum durum desf*) types, plant height, internodes height and head size showed difference (Boudour ,2006).

Chart 3.Significance group belonging to average values and control types and analyzed features of genotypes used in the research

Line/ Type	Plant Type (cm)		spike length (cm)		number of grains in head (pieces/head)		1000 grains Weight (g)		Harvest Index (%)		Grain Yield (ton/ha)	
	Konya	Kirkuk	Konya	Kirkuk	Konya	Kirkuk	Konya	Kirkuk	Konya	Kirkuk	Konya	Kirkuk
AT-062	128.0	144.45	9.0	9.63	46.1	48.72	61.29	48.8	22.63	24.83	2.575	1.982
060	124.7	143.73	7.74	12.05	36.0	45.87	61.85	54.49	23.18	45.85	5.061	4.243
AT-038	112.6	142.23	14.84	15.95	37.9	28.77	53.85	46.24	15.84	25.88	1.409	2.865
AN-110	128.3	141.47	8.94	8.33	66.2	39.71	45.35	38.75	22.98	28.89	3.400	3.288
AN-111	126.9	138.67	8.54	9.53	39.9	32.11	59.35	57.25	29.49	28.35	3.942	2.913
AT-061	118.3	135.03	7.38	8.59	55.1	49.67	54.49	47.45	31.35	42.59	7.163	3.849
AT-050	98.0	126.83	7.74	10.89	33.5	47.17	53.49	61.7	11.95	45.0	2.155	4.117
043"1"	96.4	115.25	7.3	10.33	36.3	41.22	62.29	55.3	22.26	35.45	0.890	3.743
5004	82.6	103.97	6.84	10.43	40.9	56.11	46.35	41.0	32.55	40.07	3.896	3.808
5020-7	81.5	86.75	6.7	9.43	46.1	40.32	44.29	50.05	20.4	49.96	5.216	4.849
GIR	86.8	78.83	5.12	8.99	33.0	42.27	44.51	45.7	18.56	48.24	3.103	4.399
AT-060	120.7	72.63	7.14	10.45	35.9	37.47	54.37	35.24	30.65	50.39	3.113	4.933
Line Avr.	**108.73**	**119.15**	**8.10**	**10.38**	**42.24**	**42.45**	**53.45**	**48.49**	**23.48**	**38.79**	**3.493**	**3.749**
Kunduru-1149	129.10 a*	142.77 a	6.66 c	7.82 c	44.02 c	47.92 ab	53.05 a	45.37 ab	26.17 bc	32.90 bc	5.413 a	2.922 b
Dumlupınar	120.00 b	133.90 b	6.65 c	8.82 b	52.15 ab	42.52 b	51.50 a	44.68 ab	25.80 c	29.75 c	3.652b	2.799 b
Kızıltan-91	93.87 c	115.60 c	7.52 b	11.10 a	55.72 a	44.45 b	52.25 a	41.40 b	36.56 a	36.73 bc	3.721b	3.209ab
Ç – 1252	91.00 c	100.27 d	8.21 a	11.25 a	56.42 a	54.79 a	50.17 a	41.17 b	32.68 ab	40.27 b	3.310 b	3.756 ab
Umrabi	75.05 d	90.52 e	5.94 d	7.27 d	47.52 bc	46.90 ab	47.50 a	50.12 a	31.96 abc	48.55 a	3.721 b	4.010a
Type Avr.	**101.80**	**116.61**	**6.99**	**9.25**	**51.16**	**47.31**	**50.89**	**44.548**	**30.63**	**37.64**	**3.963**	**3.339**
VK (%)	5.09	3.67.	3.46	3.43	9.63	11.26	8.90	8.14	14.50	12.72	27.15	18.66
ControlTypes LSM (0.05)	7.99	6.59	0.37	0.48	7.59	8.20	6.98	5.58	6.80	7.38	165.80	96.01
Lines in the same block LSD (0.05)	16.0	13.19	0.74	0.97	15.18	16.41	13.96	11.17	13.69	14.7	331.61	192.00
Lines in Different Blocks LSD (0.05)	17.5	14.45	0.81	1.07	16.63	17.98	15.30	12.24	15.00	16.1	361.70	210.3
Line and Type Comparison. LSD (0.05)	13.84	11.42	0.64.	0.84	13.15	14.21	12.09	9.68	287.18	12.78	285.97	166.29

*There is a difference at the level of 0.05 between the averages indicated with different letters in the same column.

In general, head size of types and lines in Konya conditions ranges between 14.84 cm and 5.12 cm while head size ranges between 15.95 cm and 7.27 cm in Kirkuk conditions. (Cattivelli*et al*, 1994) stated that head size and density were controlled by a series of genes, rachis internodes lengths and numbers were effective in terms of head size and highly productive types are generally among sparse headed and mutants group. In addition to type characteristics, head size is also affected by seed amount, nutritional element condition of the soil and climatic factors. As a matter of fact, in studies conducted in different locations and growing environments, it was reported that head size of genotypes can show great differences and these differences depending on year, location, growing environment and genotypes could range between 5.22 - 9.81 cm (Gummadov, 2012), 8.70 - 12.27 cm (Akçura, 2006) and 6.74 - 11.67cm (Ayrancı, 2012)

Number of Grains in Head

In the research conducted in Konya and Kirkuk conditions, number of grains in head for line and types showed significant differences according to the locations. While average number of grains for control types in Konya location is 51.1 pieces, this value is 47.31 pieces in Kirkuk location which is lower at the rate of 7.1% . In the (Chart 3) Ç-1252 type had the highest number of grains in head 56.42 pieces and 54.79 pieces) where it showed significant superiority and the size of head in both locations; however, the lowest values were determined in Kunduru 1149 type with 44.02 pieces and 7.27 and Dumlupınar type with 42.52 pieces in Konya location. Likewise, number of grains in head of lines in Konya location is 42.24 pieces while number of grains of lines in Kirkuk is 42.45 pieces and ordering of the lines changed. According to this, AN-110 was the line which had the highest number of grains in head with 66.2 pieces while 5004 genotype had the highest number of grains in head in Kirkuk location with 56.11 pieces. The lowest number of grains in head in Konya location was obtained in Gır which had 33.0 pieces while the lowest number of grains in head in Kirkuk was obtained in AT-038 numbered line which had 28.77piece. When durum wheat lines and control types were compared in terms of number of grains in head ($LSD_{(0,05)}$= 13.15) in Konya, it was seen that AN-110 numbered line had a higher number of grains in head than Ç-1252 type which had the highest number of grains in head value and 8 lines (5004, AN-111, AT-038, 043"1", 060, AT-060, AT-050 and Gır) had a lower value than Kunduru-1149 type which gave the lowest number of grains in head value. When durum wheat lines and control types were compared in terms of number of grains in head ($LSD_{(0,05)}$= 14.21) in Kirkuk location, it was seen that 5004 numbered line had a higher number of grains in head than Ç-1252 type which had the highest number of grains in head value and 7 lines (Gır, 043"1", 5020-7, AN-110, AT-060, AN-111 and A-038) had a lower number of grains in head than Dumlupınar which gave the lowest number of grains in head value. In general, number of grains in head of types and lines in Konya conditions ranges between 66.2 pieces and 33.0 pieces while number of grains in head ranges between 56.11pieces and 28.77 pieces in Kirkuk conditions. For increasing the production of durum wheat, high grain yield and number of grains in head is important (Belkharchouche et al., 2009; Erchidi et al ark., 2000). It was also stated that high temperature rise had an effect on grain weight in head and number of grains (Bahlouli et al , 2005).

1000 Grains Weight

Thousand grains weight showed significant differences according to the locations and genotypes. While average thousand grains weight of control types in Konya location is 50.89 g, this value is 44.55g in Kirkuk location which is lower at the rate of 25.61%. There were not any differences between types in terms of thousand grains weight in Konya location. While Umrabi which is a regional type had the highest value with 50.12 g, thousand grains weight of

Ç-1252 (41.17 g) and Kızıltan 91 (41.40 g) were found to be low. Likewise, thousand grains weight average of lines in Konya location is 53.45g while thousand grains weight of lines in Kirkuk is 48.49g.The 043''1''genotype among the lines had the highest thousand grains weight with 62.29g in Konya location while AT-050 line had the highest thousand grain weight in Kirkuk location with 61.70 g. In a similar way, the lowest thousand grains weight in Konya location was obtained in 5020-7 (44.29 g) and GIR (44.51 g) genotypes while the lowest thousand grains weight in Kirkuk was obtained in AT-060 numbered line which had 35.24g. When durum wheat lines and control types were compared in terms of thousand grains weight ($LSD_{(0,05)}$= 12.09) in Konya, it was seen that 8 lines (043"1", 060, AT-062, AN-111, AT-061, AT-060, AT-038 and AT-050) had a higher thousand grains weight than Kunduru-1149 type which had the highest thousand grains weight value. The 4 of the lines (5004, AN-110, Gır and 5020-7) had a lower value than Umrabi which had the lowest thousand grains weight value. In Kirkuk location ($LSD_{(0,05)}$= 9.68), 4 of the lines (AT-050, AN-111, 043"1" and 060) had a higher thousand grains weight than Umrabi which had the highest thousand grains weight value. In general, thousand grains weight in head valueof types and lines in Konya conditions range between 69.29 g and 44.29 g, while thousand grains weight in head ranges between 61.7g and 35.24 g in Kirkuk conditions.Thousand grains weight affects product yield in appositive way (Obeidi and Ghadeer,1999) and it also affects semolina yield in a positive way. Although genetic structure of the type may changes depending on climate and soil conditions (Sade, 1997), thousand grains weight is also affected by water deficiency which comes out during the last period of growing (Triboi et al., 1995). Since the ecological conditions are different in this study, thousand grains weight average which is 56.79g in Konya location decreased to 48.47g in Kirkuk location.

Grain Yield

Grain yield showed significant differences according to the locations (Chart 3). While average grain yield of control types in Konya location is 3.963 ton/ha this value is 3.339 ton/ha in Kirkuk location which is lower at the rate of 15.98%. The highest grain yield in Konya location was obtained from Kunduru-1149 type which is 5.413ton/ha and the highest grain value in Kirkuk location was obtained from Umrabi type which is 4.010 ton/ha. The lowest grain yield in Konya location was obtained from Ç-1252 type 3.310 ton/ha while the lowest grain yield in Kirkuk was obtained from Dumlupınar type 2.779 ton/ ha . Average grain yield of the lines in Konya location was 3.494 ton/ha while the average grain yield in Kirkuk location was 3.749 ton/ha which increased at the rate of 7.31%. In the research, AT-061 line was the genotype which had the highest grain yield value in Konya location with 7.163 ton/ha while the highest grain yield value in Kirkuk location was obtained from AT-060 line with 4.933 ton/ha. The line which had the lowest grain yield value in Konya location was 043''1'' with 0.890 ton/ ha while the line which had the lowest grain yield value in Kirkuk location was T-062 with 1.982ton/ha. When durum wheat lines and control types were compared in terms of grain yield($LSD_{(0,05)}$= 287.18) in Konya location, it was seen that only AT-061 had a higher grain yield value than Kunduru-1149 type which had the highest grain yield value. 6 of the lines (AT-060, GIR, AT-062, AT-050, AT-038 and 043"1")had a lower grain yield value than control type (Ç-1252) which had the lowest grain yieldvalue. When durum wheat lines and control types were compared in terms of grain yield ($LSD_{(0,05)}$= 166.29) in Kirkuk location, it was seen that 5 of the lines (5020-7, 060, GIR, AT-060 and AT-050) had a higher grain yield value than Umrabi control type which had the highest grain yield value. AT-038 and AT-062 genotypes had a lower grain yield value than control type Dumlupınar which had the lowest grain yield value. Likeness were finding so jointed by Sharma and Smith(1987), Al-Anbari(2004) and AL-Hassan (2007) . In general, grain yield valueof types and lines in Konya conditions ranges between 0.890 ton/ha and 7.163ton/ha while grain yield ranges between 1.982ton/ha and 4.933

ton/ha in Kirkuk conditions. As a matter of fact, it was reported that yield obtained from durum wheat in dry and wet conditions ranged between 2.269 ton/ha and 4.862 ton/ha in a research conducted with 12 types and lines in Konya (Tulukcu and Sade, 2002).

Harvest Index

In the research conducted in Konya and Kirkuk conditions, harvest index showed significant differences according to the locations (Chart 3). While average harvest index for control types in Konya location is 30.6%, this value is 37.6% in Kirkuk location which is higher at the rate of 22.87%. While the highest harvest index in Konya location was determined in Kızıltan-91 which is 36.56%, the highest value in Kirkuk location was measured in Umrabi type. However, the lowest values were determined in Dumlupınar type for both locations which were 25.80% and 29.75% respectively. Likewise, harvest index average of lines in Konya location is 23.48% while harvest index of lines in Kirkuk location is 38.79%. 5004 numbered line had the highest harvest index with 32.55% while AT-060 numbered line had the highest harvest index in Kirkuk location with 50.39. Similarly, the lowest harvest index in Konya location was obtained in AT-050 numbered line which had 11.95% value while the lowest harvest index in Kirkuk was obtained in AT-062 numbered line which had 24.83 value. When durum wheat lines and control types were compared in terms of harvest index ($LSD_{(0,05)}$= 11.85) in Konya, it was seen that 7 of the lines had a lower value than Dumlupınar type which gave the lowest harvest index value. In Kirkuk location($LSD_{(0,05)}$= 12.78), 2 of the lines (AT-060 ve 5020-7)had a higher harvest index value compared to Umrabi which had the highest harvest index value. In general, harvest index of types and lines in Konya conditions were found to be lower than Kirkuk location. This situation proves that harvest index is highly affected by environmental conditions. Increasing the harvest index of grains in cold climates to 50% is a target to be reached by plant cultivators and plant breeders. This rate is around 35-40% today (Kün, 1996). It is also stated that harvest index can change according to planting density, number of main stalks in unit area, year (Geçit, 1982), type and planting time (Kenar and Şehriali 2001; Akdamar et al. 2002), number of fertile stalks in unit area, number and weight of grains in head and stalk length (Cattivelli et al. 1994).

CONCLUSION AND RECOMMENDATIONS

Lines and types were compared with respect to plant height, heading date, head size, number of grains in head, harvest index, thousand grains weight and grain yield within this research which was carried out with 17 durum wheat genotypes in ecological conditions of Konya and Kirkuk locations. While Kunduru 1149 among types and AT-061 among lines became prominent in terms of grain yield in conditions of Konya location, Umrabi and AT-060 came to the forefront in Kirkuk conditions. It is recommended that AT-060, 5020-7, Gır and 060 numbered genotypes which are more fruitful than Umrabi which has been registered in Iraq and provides the highest yield in planting for the region should be tested through multi-year trials and the appropriate ones should be presented for registration.

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