COMPARISON OF TWO AND SIX-ROWED BARLEY (*Hordeum vulgare* L.) GENOTYPES BASED ON YIELD AND AGRONOMIC CHARACTERS

Irfan Öztürk

Trakya Agricultural Research Institute, Edirne, Turkey

Abstract

Barley is one of the mainly field crops and because of the various environments condition grain yield and its component varies depending on a large number of genotypes, environmental, agronomical and physiological characters. In the study it was investigated and compared yield and agro-morphological characters in two and six rowed barley genotypes. The research were conducted with two experiments, with two and six-rowed barley genotypes, each one composed of 36 genotypes in alpha lattice design with three replications in 2016-2017 growing seasons. Data recorded on grain yield, days of heading, plant height, 1000-kernel weight, test weight, protein ratio, and grain uniformity also, relationship amongst those parameters were compared. There were various relations among investigated parameters based on two and six rowed barley genotypes. In two-rowed genotypes, minimum and maximum grain yield was in the range of 6843-9603 kg ha^{-1}, and mean of grain yield was 8576 kg ha^{-1}. In six-rowed genotypes, grain yield was in the range of 6798-10086 kg ha^{-1}, and mean of grain yield was 8454 kg ha^{-1}. Two rowed genotypes had more 1000-kernel weight, test weight, grain uniformity, and protein content than six-rowed genotypes. Based on investigated parameters, in two-rowed genotypes the mean values of TKW were 50.7 g, TW 73.1 kg, protein ratio 11.6%, grain uniformity 94.3%, days of heading 107.3 and plant height 100.3 cm. In six-rowed genotypes, mean values of TKW were 36.8 g, TW 69.9 kg, protein ratio 10.8%, grain uniformity 74.6%, days of heading 108.8 and plant height 99.6 cm. According to results two-rowed genotypes had higher grain yield, 1000-kernel weight, test weight, and protein ratio than six-rowed genotypes.

Keywords: *Barley, genotypes, two-six rowed barley, yield, agronomic traits*

1. INTRODUCTION

Barley (*Hordeum vulgare* L.) is the major cereal in many different areas of the Trakya region and is essential for the livelihoods of many farmers. Barley is an annual cereal crop and grown in environments ranging from the many of the area (Öztürk et al., 2018). Barley can be classified as two-row and six-row types on the basis of spike morphology. Since two-row barley produces larger seeds with higher test weight and seed weight than six-row barley it is very likely that two-row barley produces better quality feed than six-row barley (Raid et al., 2001). The two-row barley genotypes in comparison to the six-rowed barley genotypes generally had a higher absolute grain filling rate, with maximum values of the grain filling rate achieved later and the process of grain filling lasted longer. The gradual accumulation of dry matter showed to be of more importance than intensity of grain filling rate under post-anthesis stress. Another advantage of two-rowed barley over six rowed barley is earlier heading time, which is important for the future climate scenario to avoid high temperature and low precipitations during grain filling. Therefore, for terminal drought conditions breeders should develop early maturing two-rowed genotypes with a prolonged grain filling duration (Kandic et al., 2018). Cultivated barley (*Hordeum vulgare* L) is currently classified according to ear structure as either 2-row or 6-row. A better understanding of the potential grain yields of 2- and 6-row and of the ways in which their yield is obtained may help the plant breeder in planning his breeding programme (Gouis, 1992). Earliness is favourable characters in barley due to early maturating cultivars less affected by the diseases and other environment factors, followed after harvesting farmers produces second crops in same growing season. Barley is an economically important growing crop in Trakya region (Turkey). Because of various environmental conditions during growing season (October-June), in weather condition, some biotic and abiotic stress factors could reduce grain yield (Öztürk et al., 2014). The development of varieties, which can be adapted to a wide range of diversified

environments, is the ultimate goal of the plant breeders in barley improvement program (Vulchev et al., 2013; Valcheva et al., 2009). Winter barley is characterised by high stability of yield and a lesser demand on soil conditions than spring barley. The breeding of winter barley is orientated mainly on fodder quality and at two-row barley there is perspective to achieve malt production. Actual studies on barley genetic resources collections show that the right utilisation of appropriate varieties can substantially put forward and make effective the breeding work. Selection of suitable genetic resources is the first step to breeding barley varieties of high quality (Zakova and Benkova, 2004). Selecting different genotypes under environmental stress conditions is one of the main tasks of plant breeders for exploiting the genetic variations to improve the stress tolerant cultivars. Agronomic traits such as grain yield and its components are the major selection criteria for evaluating drought tolerance under field conditions (Talebi et al., 2009, Lopes et al., 2012). Grain yield in barley is a complex economically important trait resulting from the effect of genotype and the environment throughout the life cycle of a plant. It is particularly difficult to develop cultivars that would carry positive traits under different growing conditions and show resistance to biotic and abiotic stress factors (Przulj et al., 1998; Knezevic et al., 2007). This might probably be due to differences in growing season rainfall, which has been known to have considerable impacts on barley grain yield. Moreover, the highly significant GE interaction for grain yield indicates that the studied genotypes exhibited both crossover and non-crossover types of the interaction (Dyulgerova and Dyulgerov. 2016).

Yield and yield component in barley is a complex character depending on a large number of genotypes, environmental, agronomical and physiological characters. Regarding the barley spike row type, there are different results concerning grain yield in stress environments of the Mediterranean region. Terminal drought during grain filling becomes more common in Mediterranean environments. The purpose of the research was to investigate and comparison of two and six-rowed barley genotypes yield, quality and physiological parameters under rainfed condition in in Trakya region, Turkey. In this study, grain yield and some yield components, some physiological characters and correlation among these traits were investigated in two and six row barley genotypes.

2. MATERIALS AND METHODS

The experiment was conducted in Trakya Agricultural Research Institute (Edirne, Turkey) experimental area during 2016-2017 growing seasons. The research was established with two experiments each one composed of 36 genotypes in alpha lattice design with three replications. Each plot consisted of 6 m long with 6 rows, spaced at 17 cm. A seed rate was 500 grains per square meter. Sowings were performed by using a plot drill in October and nitrogen was applied at three times.

Table 1. Climate conditions in experimental field in 2016-2017 growing year

Months	Rainfall (mm) Long year	Rainfall (mm)	Humidity (%)	Temperature °C		
				Min.	Max.	Mean
September 2016	34.0	9.2	57.5	5.0	33.8	20.8
October 2016	52.9	44.4	69.5	1.3	28.8	14.3
November 2016	72.4	3.2	72.9	-9.9	15.4	0.7
December 2016	61.7	3.2	72.9	-9.9	15.4	0.7
January 2017	48.1	67.8	83.7	-17.0	8.4	-1.9
February 2017	46.9	43.4	80.0	-8.4	20.6	5.3
March 2017	52.2	51.0	73.0	-1.9	25.5	10.2
April 2017	51.0	65.6	63.1	-1.6	28.6	12.5

May 2017	56.0	85.0	65.4	4.4	30.0	17.9
June 2017	41.5	44.4	74.4	12.9	40.0	21.2
Total/Mean	516.7	417.2	71.2	-17.0	40.0	10.2

Summarized meteorological data for crop cycle from September to June is provided in Table 1. Monthly precipitations, relative air humidity, maximum, minimum and mean temperature were recorded from the weather station of the Institute experimental site. Average daily mean temperatures during plant growth stages (from September to June) were 10.2 °C, absolute maximum temperature was 40°C, and absolute minimum temperature -17.0 °C. Total rainfall was 417.2 mm and mean humidity was 71.2%.

Data recorded on grain yield (GY), days of heading (DH), plant height (PH), 1000-kernel weight (TKW), test weight (TW), protein ratio (PRT), and grain uniformity (GU) also, relationship amongst those parameters were compared. The parameter days to heading (DH) was estimated from 1st January to the moment when 50% of main stems in a plot had at least half of emerged ears. Thousand kernel weights and test weight (Blakeney et al., 2009), protein ratio (Köksel et al., 2000; Anonymous, 2002; Anonymous, 1990) were investigated.

To evaluate significant differences between genotypes, the analysis of variance (ANOVA) was performed. The differences between genotype means of parameters were tested by the L.S.D test. Letter groupings were generated by using a 5% level of significance. Data were analyzed statistically for analysis of variance the method described by Gomez and Gomez (1984). The significance of differences among means was compared by using L.S.D (%5) test (Kalaycı, 2005).

3. RESULTS AND DISCUSSION

Two different barley experiment, two and six rowed, each of them composed of 36 barley diverse genotypes were evaluated under field condition in Alpha Lattice Design with three replications. The study revealed wide range of variability for most of the traits (grain yield, plant height, days of heading, 1000-grain weight, test weight, protein ratio, grain uniformity and *Pyrenophora teres*). According to mean yield and other investigated traits statistically significant differences ($p<0.01$) were found among the means of genotypes except protein ratio in two-row genotypes.

Table 2. Results of variance analysis in two and six-rowed barley genotypes

Source of variation	DF	Genotypes 2-rowed			Genotypes 6-rowed		
		SS	MS	F value	SS	MS	F value
Replication	2	15755.3	7877.67	1.68	17311.5	8655.77	2.81
Genotypes	35	361436.0	10326.70	5.06**	657210.0	18777.40	8.87**
Error	55	112129.2	2038.71		116358.2	2115.60	

**: P<0.01, *: P<0.05; CV (%): 5.3 in two-rowed; CV (%): 5.4 in six-rowed genotypes

There were various relations among parameters based on two-row barley genotypes. In two-rowed genotypes, minimum and maximum grain yield was in the range of 6843-9603 kg ha^{-1}, and mean of grain yield was 8576 kg ha^{-1}. Based on investigated parameters, in two-rowed genotypes the mean values of TKW were 50.7 g, TW 73.1 kg, protein ratio 11.6%, days of heading 107.3, plant height 100.3 cm and grain uniformity 94.3%. The two- rowed genotypes, that achieved the highest average

yield under field conditions. Also, results showed that two-rowed genotypes had higher 1000-kernel weight, test weight, protein ratio and grain uniformity than six-rowed genotypes (Table 3 and 4).

The average date of heading is almost similar for the 2 groups of barley genotypes. In two-rowed barley genotypes, in 2016-2017 years, the days of heading were in the range of 99.1- 118.6 and mean were 107.3 days. According to their earliness (date of heading) all barley genotypes evaluated in this study were classified and TEA2586-4 was early, and entry number 36, 18 and 32 was late maturing genotypes (Table 3).

Stem length is one of the most important initial selection criteria in barley breeding works in the region, being a direct component of lodging resistance and an indirect component of both yield and quality. The plant height was slightly higher for the two-row genotypes compared with six-row genotypes. Table 3 shows the different values for plant height for two-row genotypes. The barley genotypes ABVD19-2014 produced the highest plant height under rainfed condition, although there was significant difference among genotypes. The mean plant height was 100.3 cm. Short plant was obtained in ABVD9-2016 (85.1 cm) line.

Grain weight is the mass of a given number of kernels and is a useful measure of grain size. Test weight is the weight of a specific volume of grain and is an indication of the bulk density of the grain (Blakeney et al., 2009). Although the number of grain spike has a predominant importance over kernel weight with regard to grain yield, kernel weight is well documented to be a major yield component determining final yield in Mediterranean environments (Peltonen-Sainio et al., 2007; Garcia Del Moral et al., 2003). The effect of different genotypes on TKW showed that the highest (58.8 g) and lowest weight (40.8) was shown by the TEA2423-23 and TEA2197-33 genotypes. Also, there are many genotypes had higher TKW and mean was 50.7 g (Table 3). The results of the present study show that there was significant difference among genotypes for grain uniformity. Many genotypes had higher grain uniformity.

There were various relations among investigated parameters based on six rowed barley genotypes. In six-rowed genotypes, minimum and maximum grain yield was in the range of 6798-10086 kg ha^{-1}, and mean of grain yield was 8454 kg ha^{-1}. Six-rowed barley genotypes had low TKW, TW and protein content than two-rowed genotypes. Based on investigated parameters, in six-rowed genotypes, mean values of TKW were 36.8 g, TW 69.9 kg, protein ratio 10.8%, grain uniformity 74.6%, days of heading 108.8 and plant height 99.6 cm.

Table 3. The mean yield and investigated parameters in two-rowed genotypes

No	Genotypes	GY	DH	PH	TKW	TW	PRT	GU	PYR
1	Sladoran	9175 a-h	105.8	95.5	47.6	72.7	12.0	93.6	78
2	Bolayır	8614 g-m	107.5	103.8	46.7	74.7	11.4	93.6	79
3	Harman	8924 a-j	105.0	105.8	50.5	74.5	11.3	95.8	32
4	Hasat	9479 a-f	108.0	101.5	49.8	72.7	11.6	95.0	43
5	Pınar	8688 e-m	107.1	93.9	52.6	73.2	11.4	96.7	23
6	ABVD19-2014	8633 f-m	108.3	109.9	51.4	73.1	11.6	95.0	54
7	ABVD9-2016	9535 ab	106.6	85.1	55.5	74.2	10.9	98.7	44
8	TEA2497-2	9059 a-ı	106.1	94.1	48.1	72.5	12.0	91.9	53
9	TEA2497-3	9603 a	104.1	92.1	50.1	75.5	12.0	94.2	22
10	TEA2586-4	8391 h-n	99.1	102.1	52.1	71.0	12.0	96.0	55
11	TEA2586-6	8687 f-m	103.1	101.1	53.9	73.5	11.9	95.4	65
12	TEA2600-7	7988 l-o	108.1	95.1	51.6	73.2	11.5	96.2	43

13	TEA2418-8	6843 p	105.1	103.1	53.7	71.4	12.2	98.2	53
14	TEA2464-9	7449 op	112.1	107.1	54.1	69.0	11.8	94.4	65
15	IBYT25-11	7889 mno	105.1	98.1	51.3	74.3	12.1	95.0	22
16	IBONW28-12	8789 a-l	101.1	103.9	47.6	75.5	12.2	95.9	22
17	TEA1619-13	8491 g-n	107.1	103.9	46.2	75.3	11.6	92.4	65
18	TEA1619-14	8426 h-n	107.1	98.9	48.4	75.4	11.6	94.7	43
19	TEA2364-16	8740 b-l	105.1	100.9	52.6	73.1	11.9	94.6	55
20	TEA2360-17	7729 no	107.1	105.9	58.7	71.5	11.8	97.3	11
21	TEA2168-18	8446 h-n	118.1	101.9	50.3	71.6	11.8	85.2	11
22	TEA2274-19	9041 a-ı	107.1	95.9	53.1	72.0	10.9	96.0	22
23	TEA2312-21	9517 abc	107.3	100.9	50.9	72.9	11.9	96.5	57
24	TEA2362-22	9508 a-d	107.3	100.9	57.4	71.6	11.7	96.0	54
25	TEA2423-23	8162 j-o	107.3	104.9	58.8	73.2	11.6	99.2	53
26	TEA2423-24	7760 no	107.3	103.9	57.8	72.1	11.5	98.8	44
27	TEA2343-26	8077 k-o	107.3	95.9	49.0	72.5	11.6	94.0	68
28	TEA2346-27	8843 a-k	107.3	100.9	52.9	73.1	11.8	93.2	22
29	TEA2346-28	8677 f-m	109.3	94.9	52.8	71.8	12.0	89.9	33
30	TEA2346-29	9148 a-h	107.6	97.1	52.7	72.8	11.0	96.9	24
31	TEA2346-31	8353 h-n	108.6	98.1	49.0	71.5	11.4	99.2	53
32	TEA2346-32	7457 op	116.6	101.1	51.3	73.5	11.4	98.8	52
33	TEA2197-33	9096 a-ı	109.6	90.1	40.8	71.2	10.5	82.7	52
34	TEA2417-34	9316 a-g	107.6	100.1	48.4	73.2	11.4	88.3	53
35	TEA2370-35	8313 ı-n	108.6	96.1	49.6	73.6	11.6	96.7	55
36	TEA2168-36	7886 mno	118.6	108.1	47.2	73.4	11.5	77.8	52
Mean		8576	107.3	100.3	50.7	73.1	11.6	94.3	
LSD (0.05)		80.9**	3.86**	3.21**	1.77**	1.11**	0.92ns	1.44**	

Note: **: P<0.01, *: P<0.05, GY: Yield (kg da^{-1}), DH: Days of heading, PH: Plant height (cm), TKW: 1000- kernel weight (g), TW: Test weight (kg), PRT: Protein ratio (%), GU: Grain uniformity (%), PYR (0-99): *Pyrenophora teres*

The mean date of heading was given in Table 3 and in six-row barley genotypes, the days of heading were in the range of 96.3- 117.3, and mean were 108.8 days. According to their earliness all barley genotypes assessed in this study and were classified and TEA2467-23 was very early, and TEA2330-26 was late maturing genotypes. The plant height was slightly lower for the six-row barley genotypes compared with two-row genotypes. Table 3 shows the different values for plant height for six-row genotypes. The barley genotypes TEA2601-9 had the highest plant height (118.4 cm) and TEA2456-15 had the short plant height (80.6 cm) under rainfed condition. Also, there was significant difference among genotypes and mean plant height was 99.6 cm.

Table 4. The mean yield and other investigated parameters in six-rowed genotypes

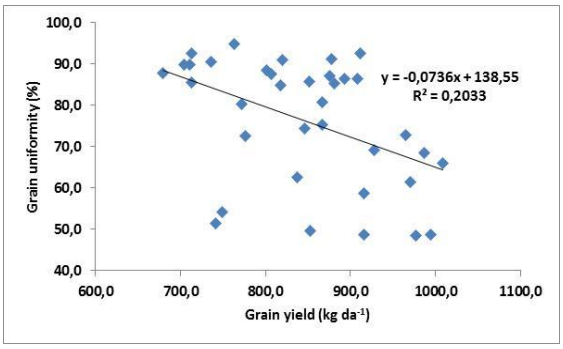
No	Genotypes	GY	DH	PH	TKW	TW	PRT	GU	PYR
1	Martı	8669 e-h	104.3	107.5	41.5	68.8	11.5	80.9	78
2	Hazar	9701 a-d	111.0	101.5	32.3	71.2	10.2	61.6	78
3	Lord	8516 e-j	116.3	110.5	41.9	73.8	10.4	85.9	53
4	Yaprak	9156 b-f	109.8	98.0	29.2	70.9	10.5	49.0	53
5	TEA2498-2	9161 b-f	105.3	90.4	31.5	68.3	9.3	59.0	53
6	TEA2575-3	8371 f-k	109.3	109.4	33.3	64.3	11.0	62.7	99
7	TEA2575-4	7768 ı-m	111.3	111.4	33.8	64.3	10.7	72.8	99
8	TEA2575-5	7717 j-m	111.3	106.4	36.1	67.4	11.6	80.4	53
9	TEA2585-6	8200 g-l	112.3	93.4	42.4	70.2	11.4	91.2	53
10	TEA2585-7	8752 e-h	111.3	93.4	41.2	70.1	11.0	87.3	43
11	TEA2585-8	8807 e-h	109.3	97.4	38.5	69.9	11.1	85.4	53
12	TEA2601-9	7634 k-n	110.3	118.4	44.8	68.0	11.1	95.0	53
13	TEA2603-11	7107 mn	102.1	110.6	43.3	65.1	12.5	90.1	75
14	TEA2434-12	9774 abc	105.1	98.6	29.8	66.2	11.1	48.8	68
15	TEA2434-13	9944 ab	105.1	96.6	31.4	65.1	10.6	48.9	87
16	TEA2456-14	6798 n	108.1	83.6	35.8	66.5	11.3	87.9	78
17	TEA2456-15	7361 lmn	109.1	80.6	38.2	68.4	11.4	90.6	84
18	TEA2456-16	7136 mn	105.1	84.6	36.2	65.9	11.5	85.7	85
19	TEA2456-17	8010 h-l	106.1	86.6	36.4	67.9	11.4	88.7	78
20	TEA2456-18	7043 mn	106.1	83.6	38.9	69.0	11.5	90.0	86
21	TEA2467-19	9110 b-f	99.3	96.4	42.9	71.5	11.0	92.8	55
22	TEA2467-21	9652 a-d	98.3	94.4	33.4	72.0	10.1	72.9	65
23	TEA2467-22	10086 a	97.3	96.4	33.3	70.9	10.5	66.3	77
24	TEA2467-23	9278 a-e	96.3	96.4	34.7	71.3	10.7	69.4	67
25	TEA2467-24	9864 abc	97.3	92.4	34.2	71.6	10.5	68.7	56
26	TEA1980-25	8456 e-k	110.3	89.4	40.3	70.8	11.1	74.5	22
27	TEA2330-26	7131 mn	117.3	104.4	46.3	69.7	11.3	92.8	52
28	TEA2330-27	8177 g-l	113.3	111.4	43.4	69.9	11.4	85.1	52
29	TEA2585-28	8777 e-h	111.3	94.6	39.5	72.4	10.3	91.4	75
30	TEA2585-29	8929 d-g	110.3	96.6	38.5	73.0	10.7	86.7	55
31	TEA2585-31	8073 h-l	113.3	87.6	41.8	72.3	10.2	87.8	53
32	TEA2403-32	7416 lmn	113.3	107.6	31.8	71.8	10.4	51.7	87
33	TEA2329-33	8531 e-ı	113.3	99.6	30.3	72.9	10.7	49.9	84
34	TEA2416-34	9079 c-f	111.3	99.6	36.9	71.9	10.3	86.5	54
35	TEA2403-35	7489 lmn	113.3	105.6	32.1	69.2	10.3	54.3	88

36	ABVD16-2016	8673 e-h	113.3	91.6	38.3	71.2	10.8	75.5	22
Mean		8454	108.8	99.6	36.8	69.9	10.8	74.6	
LSD (0.05)		82.4**	1.31**	0.92**	1.02**	0.64**	1.28**	2.51**	

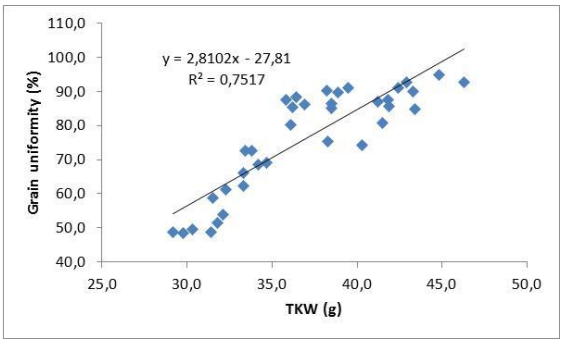
**: P<0.01, *: P<0.05, GY: Yield (kg da^{-1}), DH: Days of heading, PH: Plant height, TKW: 1000-kernel weight (g), TW: Test weight (kg), PRT: Protein ratio (%), GU (%): Grain uniformity, PYR (0-99): *Pyrenophora teres*

The effect of different genotypes on the TKW showed that the highest and lowest weight was shown by the TEA2330-26 (46.3 g) and Yaprak (29.2 g) genotypes. The mean 1000-kernel weight was 36.8 g. Also, there are significant differences among genotypes for TW and Lord had higher TW (73.8 kg), sister lines TEA2575-3 and TEA2575-4 had lowest test weight (64.3 kg). Mean test weight of the barley genotypes was 69.9 g (Table 4). The results of the present study show that there was significant difference among genotypes for protein ratio and grain uniformity. The highest protein ratio was determined in TEA2603-11 (12.5%) and the lowest protein ratio (9.3%) in TEA2498-2 line and mean was 10.8% among genotypes. There was widely variation in grain uniformity in six-row genotypes and varied from 48.8% (TEA2434-12) to 95.0% (TEA2601-9) and mean was 74.6% in barley genotypes (Table 4).

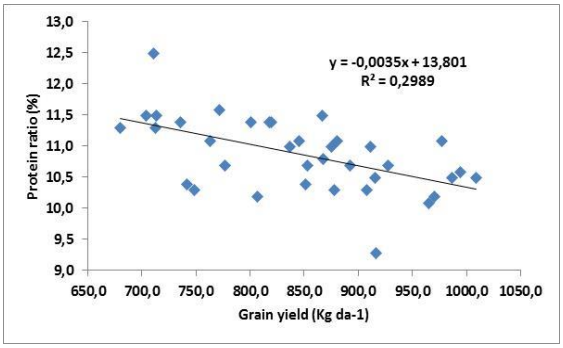
The higher infection of *Pyrenophora teres* was made epidemic in 2016-2017 growing cycle. The infection of *Pyrenophora teres* rate was higher in six-rowed barley genotypes than in to two-rowed barley genotypes under rainfed conditions. Comparing with two and six-rowed genotypes, they reached maximum values of 99 in six-rowed genotypes.



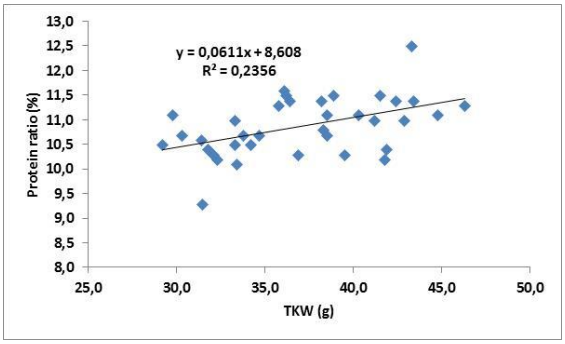
Grain yield and grain uniformity



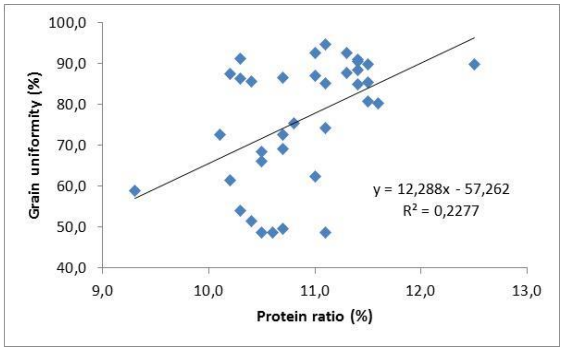
TKW and grain uniformity



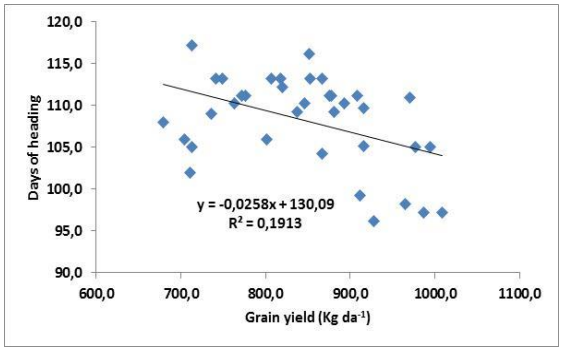
Grain yield and protein ratio



TKW and protein ratio



Protein ratio grain uniformity

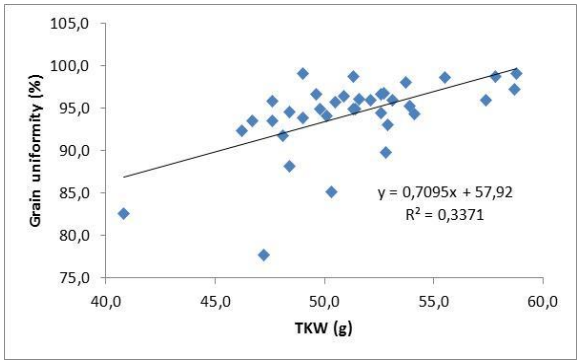


Grain yield and days of heading

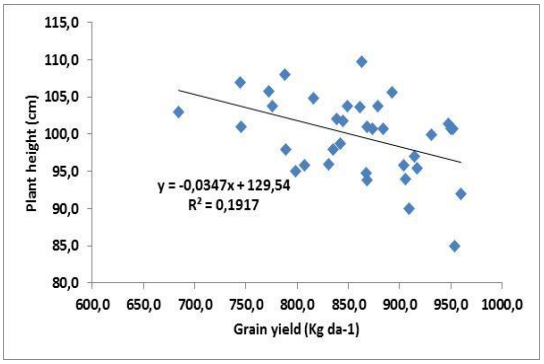
Figure 1. Relationship with yield, quality and other parameters in six-rowed genotypes

There were various relations between investigated parameters in two and six row barley genotypes. There was a negative relation between grain yield and days of heading (R^2=0.191) and protein ratio (R^2=0.203). This result showed that genotypes which have early maturing had higher grain yield. 1000-kernel weight had significantly positive relation with grain uniformity (R^2=0.751) in six-row barley genotypes. It is apparent that 1000-kernel weight (R^2=0.235) and sieve value (R^2=0.227) had the slightly significant effect on protein ratio in six-row barley genotypes. In grain yield slightly inverse correlations were found for the plant height (R^2=0.191) (Figure 1).

Among two-row barley genotypes 1000-kernel weight had slightly positive relation with grain uniformity (R^2=0.337) and there was slightly negative relation between grain yield and plant height in two-barley genotypes (Figure 2). This result showed that genotypes with short plant height exhibited higher yield potential.



TKW and grain uniformity



Grain yield and plant height

Figure 2. Relations with yield, grain uniformity and plant height in two-row genotypes

Correlation coefficients on the investigated parameters were determined by Pearson's correlation analysis (Table 5 and 6). Correlations among grain yield, quality and agronomic traits differed between two and six-row barley genotypes. Correlation studies exhibited that grain yield was negatively associated with plant height and varied associated with days of heading. The correlation analysis also revealed that protein ratio and 1000-kernel weight had a negative effect on grain yield. Therefore, these traits were found to be most important for barley genotypes for selection.

Table 5. Correlation coefficients among tested characters in two-rowed barley genotypes

Traits	GY	DH	PH	TKW	TW	PRT	GU
DH	-0.277						
PH	-0.438**	0.155					
TKW	-0.221	-0.123	0.192				
TW	0.275	-0.230	-0.090	-0.283			
PRT	-0.233	-0.289	0.328	0.180	0.032		
GU	-0.110	-0.500**	-0.026	0.581**	0.067	0.125	
PYR	-0.072	-0.025	0.112	-0.260	-0.090	0.013	-0.015

Note: Significance at **: P<0.01 and *: P<0.05; GY: Grain yield (kg ha^{-1}), DH: Days of heading, PH: Plant height, TKW: 1000-kernel weight (g), TW: Test weight (kg), PRT: Protein ratio (%), GU: Grain uniformity (%), PYR: *Pyrenophora teres*

The study revealed the existence of genetic differences among accessions as well as differences between two and six-row barley genotypes developed by barley breeding program. Results of this study provided information about diversity which should be of particular interest for the further collecting of genetic resources. Correlation coefficients among tested characters in two-rowed barley genotypes were given in Table 5 and it was found various relations among investigated parameters. There was negative relation between grain yield with days of heading (r=-0.277) and significant negative association with plant height (r=-0.438**). Grain yield also was negatively correlated with TKW (r=-0.221), and protein ratio (r= -0.233). Protein ratio was positively correlated with plant height (r=0.328). Days of heading was negatively correlated with test weight (r=-0.230), and grain uniformity (r=-0.500**). There was positively relation between TKW and grain uniformity (r=0.581**).

Table 6. Correlation coefficients among tested characters in six-row barley cultivars

Traits	GY	DH	PH	TKW	TW	PRT	GU
DH	-0.437**						
PH	-0.029	0.253					
TKW	-0.400*	0.237	0.131				
TW	0.341*	0.132	-0.113	0.130			
PRT	-0.547**	-0.026	0.061	0.485**	-0.469**		
GU	-0.451**	0.105	-0.136	0.867**	0.065	0.477**	
PYR	-0.210	-0.173	0.093	-0.435**	-0.468**	0.063	-0.279

Note: Significance at **: P<0.01 and *: P<0.05; GY: Grain yield (kg ha^{-1}), DH: Days of heading, PH: Plant height, TKW: 1000-kernel weight (g), TW: Test weight (kg), PRT: Protein ratio (%), GU: Grain uniformity (%), PYR: *Pyrenophora teres*

Correlation coefficients among investigated parameters in six-rowed genotypes were given in Table 6 and it was found various relations among characters. There was significant negative relation between grain yield with days of heading (r=-0.437**), 1000-kernel weight (r=-0.400*), protein ratio (r=-0.547**) and grain uniformity (r=-0.451**). Higher infection level of *Pyrenophora teres* negatively affected and reduced 1000-kernel weight (r=-0.435**), test weight (r=-0.468**) and grain yield.

Protein ratio was positively correlated with grain uniformity (r=0.477**) and 1000-kernel weight (r=0.485**).

4. CONCLUSION

In this research it was investigated and compared of two and six-rowed barley genotypes for yield, quality and physiological parameters under field condition in in Trakya region, Turkey. Yield and yield component in barley is a complex character depending on a large number of genotypes, environmental, agronomical and physiological characters. In this study, grain yield and some yield components, some physiological characters and correlation among these traits were varied association in two and six row barley genotypes. Regarding the barley row type, there are different results concerning grain yield in stress environments of the region. According to result of the research showed that two rowed barley genotypes had more 1000-kernel weight, test weight, protein ratio and grain uniformity than six-rowed genotypes. Another advantage of two-rowed barley over six rowed barley is earlier heading time, and slightly higher grain yield, which is important for to avoid high temperature and low precipitations during grain filling phase in the region. Therefore, for terminal drought conditions breeders should develop early maturing barley genotypes with a prolonged grain filling duration. In the study other advantage two-rowed barley genotypes had slightly higher grain yield compared with six rowed barley. These results indicate the two-row barley would have advantage over six rowed barley under favorable condition in Trakya region. Correlations among investigated parameters showed that grain yield, quality and agronomic traits differed between two and six-row barley genotypes. Correlation studies exhibited that grain yield was negatively associated with plant height and varied associated with days of heading. The correlation analysis also revealed that protein ratio and 1000-kernel weight had a negative effect on grain yield. Therefore, these traits were found to be most important selection parameters for barley genotypes. The study revealed the existence of genetic differences among accessions as well as differences between two and six-row barley genotypes developed by barley breeding program. Results of this study provided information about diversity which should be of particular interest for the further collecting of genetic resources.

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