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Introduction of elite wheat line for cold regions of Iran

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ABSTRACT

Receiving high and stable grain yield at different environments is one of the aims in cereal breeding programs. In order to compare results of research under on-farm conditions, it is necessary to carry out research-extension project to receive high grain yield and adaptability lines. In this project, EWYT-C-91-4 with pedigree "Zm/Shiroodi/6/Zm/5/Omid/4/Bb/Kal//Ald/3/Y50E/Kal*3//…" as promising line and Haydari "Ghk"s"/Bow"s"//90Zhong87/3/Shiroodi" as control and commercial cultivar were sowed under irrigated and on farm conditions in Nagadeh and Miandoab Regions, North West of Iran. The planted area per location for each genotype was 5000 m^2. Land preparation and sowing were accomplished according to on-farm conditions of the region. Seed rate was based on 1000-kernal weight (450 seed/m^2) and fertilizer applications was done based on recommendations from soil tests. Results analysis using Hotellings T^2 test showed significant differences for nine characteristics. In addition, *t*-student mean comparison revealed that EWYT-C-91-4 line was superior to the control cultivar. This line had the lowest coefficient and range of variations, and standard deviations within two regions. Combined analyses of variance showed significant differences within locations. Finally, EWYT-C-91-4 due to more grain yield, total dry matter and diseases resistance could replace commercial cultivar. One thousand spikes of EWYT-C-91-4 promising line was provided for producing breeder seed.

INTRODUCTION

Wheat was sown in more than 1000 hectares in the west Azerbaijan province of Iran in the growing seasons of 2016-2017 (personal communication). It is the first product within crops and one of the main sources of income of farmers planting wheat. Therefore, identifying promising lines with high grain yield potential and compatible to limiting input production in terms of income and employment is important in this region.

There are different methods and tools for technology transfer to the farmers' field. On-farm research has been known as an essential implement and effective method for developing and transmitting the newly applied researchers' results into the farmers' field. It also has an indispensable duty of screening and substantiation of farming practices under local farmers' conditions. Furthermore, on-farm research creates suitable conditions for participatory management of the researchers, extension agents and farmers for the finding of agricultural problems in rural areas (Tta-Krah and Francis, 1987). In order to transmit the new applied researchers' results into farmers' field, Moayedi (2012) compared promising durum wheat lines in two farmers' field. Results showed that there were significant differences for impact of genotype × location on grain yield. D-84-3 produced the highest grain yield and it might be used as stable breeding materials under farmers' field conditions. Eivazi et al. (2017) evaluated wheat-promising lines under on-farm conditions. They introduced C-89-15 with more than 8.0 th^{-1} grain yield for

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cold regions of Iran.

Grain yield and its stability of wheat genotypes are important in breeding programs. This can be used to select promising wheat genotypes across multiple environments. Therefore, Aydin et al. (2011) sowed different wheat genotypes in seven environments in central black sea region and selected three genotypes for release procedure with good yield potential and acceptable end use quality. Ahmadi et al. (2012) in targeting promising bread wheat lines for cold climate environments with using of AMMI and GGE bi-plot analyses found out that two lines had high grain yield at different environments. They concluded that AMMI and GGE bi-plots facilitated visual comparison and identification of superior genotypes. Khan et al. (2014) in evaluating five promising wheat lines revealed that the overall mean grain yield of genotypes across environments ranged from 1198 to 2202 kgh^{-1} at three locations under rainfall conditions of Balochistan, Pakistan. Cultivar "AZRC-3" having regression coefficient close to unity and higher grain yield showed consistent performance and was considered as stable and widely adopted. Khajavi et al. (2014) tested genetic diversity of twenty barley lines based on pheno-morphological traits and selected five promising lines. These genotypes were introduced as superior lines for releasing and replacing common cultivars. Nabaty and Shaban (2012) compared barley promising lines under two temperate locations of Iran. Results showed that barley yield in Boroujerd was the highest for "MB83-3" line and in Dorud location was the highest for common Nosrat cultivar. They selected "MB83-3" line for complimentary studies. Mohammadi and Haghparast (2010) in analyzing of genotype by farmers' field trials data showed that farmers' field main effect was the predominant source of variation. Great variations exit in the agro-ecological conditions within the region in terms of altitude, temperature, and soil characteristics etc. Therefore, Baig et al. (2008) evaluated wheat-promising lines for grain yield over three locations. Results showed that "Chakwal-97" line gave high grain yield with 4955kgh^{-1}. Ramazani and Tajalli (2016) in testing triticale-promising line recommended ET-83-18 new line could be replaced with "Juanillo-92" as old cultivar under Birjand and similar areas conditions of Iran. The objective of this research was evaluation grain yield of winter wheat promising line "EWYT-C-91-4" and comparison with "Haydari" as control and commercial cultivar and possibility replacing it with old, landraces and conventional varieties under on-farm and cold regions of Iran.

MATERIALS AND METHODS

Experimental locations

Two field experiments conducted in cropping seasons of 2015-16 under on-farm conditions at Nagadeh and Miandoab north-west regions of Iran. "EWYT-C-91-4" with pedigree "Zm/Shiroodi/6/Zm/5/Omid/4/Bb/Kal//Ald/3/Y50E/Kal*3//…" promising line evaluated with Haydri "Ghk"s"/Bow"s"//90Zhong87/3/Shiroodi" as commercial and control cultivar. Each genotype was planted at 5000 m^2 at two locations under irrigated growth conditions.

Climatic conditions

Regions of Nagadeh and Miandoab are located in west Azerbaijan province, north-west of Iran and have semi-arid region. Average period of below-freezing temperature is 90 to 100 days, which in seasons of January, February and March reach to its minimum values (Table 1).

Autumn precipitation almost starts from late of October and most rainfall occurs when plant growth is slow. With increasing temperature, precipitation interrupt and evaporation rate rise in the second half of the May. During grain filling period in May and cut-off rainfall, in addition, temperature rise, relative humidity reduces and hot winds start and haying-off damage can be seen in various areas.

Husbandry practices

Husbandry operations were carried out based on conventional methods. Therefore, the field was deep plowing in April and given triple-super-phosphate, fertilizer at the rate of 100 kgh^{-1} and then the disc was struck in August. At the sowing time (15 September, 30 October), 200 kgh^{-1} nitrogen fertilizer was applied based on soil test. 70 kgh^{-1} nitrogen was spread at first time and topdressing was added at two stages during stem elongation and heading. Cultivation was carried out with farmers' method. Furrow irrigation was done five-times at growing stages until physiological maturity. To prevent smut infection, before sowing, seeds were sterilized with Carboxyinthiram fungicide. For weed-controlling Topic and Ganstar toxins were used for board-leaf weeds and grasses at the stem elongation stage, respectively. During the period of plant growth were recorded germination time, cold damage, date of tillering, number of days to heading and maturity.

Measured traits

Ten samples were randomly selected at harvesting time. The evaluated traits were plant height, spike length, number of spikelets per spike, grains per spike, number of spikes per square meter, 1000-kernal weight, grain yield, total dry matter and harvest index. Grain yield and

Table 1. Meteorological parameters of Nagadeh and Miandoab experimental locations in 2015-2016 seasons.

Parameter	Nagadeh experimental location											
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Sum**	**Average**
Precipitation (mm)	9	61	49	44	34	59	73	35	18	1	383	38
Maximum temp. (ºC)	32	26	18	14	15	19	22	28	30	38	242	24
Minimum temp. (ºC)	-1	-2	-8	-15	-13	-10	-10	4	7	11	37	4
Average temp. (ºC)	15	12	5	1	1	5	6	16	19	25	105	11
Maximum humidity (%)	83	92	91	88	82	83	84	78	73	70	824	82
Minimum humidity (%)	44	63	66	65	53	51	52	43	38	39	514	51
Sunny (h)	198	142	135	133	164	186	215	275	336	353	2137	214
Evaporation (mm)	132	62	13	---	---	---	77	199	231	264	978	140
Frosty (day)	1	2	25	22	25	10	6	---	---	---	91	13
	Miandoab experimental location											
Precipitation (mm)	10	84	28	16	15	25	69	17	2	16	282	28.2
Maximum temp. (ºC)	32	27	17	16	17	19	21	29	32	39	249	25
Minimum temp. (ºC)	-1	-3	-12	-11	-12	-4	-3	3	8	10	25	3
Average temp. (ºC)	16	12	3	3	3	8	9	16	20	25	115	12
Maximum humidity (%)	86	90	91	83	90	86	86	80	68	65	825	83
Minimum humidity (%)	32	51	54	59	48	42	44	32	24	23	409	41
Sunny (h)	222	134	120	106	195	184	211	270	352	379	2173	217
Evaporation (mm)	101	22	11	---	---	---	64	165	239	323	926	132
Frosty (day)	2	10	24	23	25	4	8	---	---	---	96	14

total dry matter measured separately from areas of two square meters for each genotype at two locations.

Statistical analysis

The skewness to the right, left and kurtosis of data were calculated with Mstat-C software for regions of Nagadeh and Miandoab. After ensuring be normal data, amounts of skewness and kurtosis calculated. Analysis of Hotellings T^2 test, t-student and combined analysis, range of variation, standard deviation and coefficient of variations were calculated for two experimental locations (Cochran and Cox, 1957).

RESULTS AND DISCUSSION

Skewness and kurtosis of data were calculated for nine traits of bread wheat genotypes including EWYT-C-91-4 as promising line and Haydari commercial check cultivar in Nagadeh and Miandoab regions. Results showed that for the except of total dry matter, 1000-kernal weight and harvest index, other traits with ten samples were normally distributed and had not statistically significant differences with student's t test ($p \leq 0.05$) (Table 2). For achieving the most possible grain yield at each location, farmers must use promising lines that are adapted to particular environments, which fluctuate with different seasons and locations (Ingver et al., 2008) as like our results.

Multivariate analysis

Multivariate analysis of T^2 Hotellings was done separately for means of each and combined locations at Naghade and Miandoab conditions. Results showed that there were significant differences at least in one of traits within characters of EWYT-C-91-4 and Haydari (Table 3). It was proven in *t*-student test and null hypostases (H_0) is rejected. It indicates that the two genotypes are not equal in terms of nine measured traits. Grain yield of EWYT-C-91-4 in Nagadeh and Miandoab locations was 12.5 and 11.52t/h, respectively. In contrast, Haydari had 9 and 8.2 t/h in each region. Increasing grain yield in EWYT-C-91-4 in compared to Haydari under on-farm conditions in Naghadeh and Miandoab were 38 and 40%, respectively. The significant differences among traits of genotypes imply the presence of substantial variation among genotypes, which is central to the study of traits and gives an opportunity to plant breeders for improvement of these characters through breeding. Grain yield variability was result of the potential growing conditions in each location generated by differences in lines and its distribution during the vegetative and reproductive stages

Table 2. Skewness, kurtosis and probability levels of wheat traits under Nagadeh and Miandoab on-farm conditions in 2015-16.

Trait	Haydari commercial cultivar					
	Skewness	t-student value	Probability	Kurtosis	t-student value	Probability
Total dry matter (g/m^2)	1.35	2.87	0.04	1.80	1.97	0.06
Spike/m^2	0.13	0.29	0.38	-0.15	-0.16	0.43
Grain per spike	0.46	0.98	0.16	0.03	0.03	0.48
Spikelet per spike	0.45	0.96	0.17	-1.21	-1.32	0.09
Plant height (cm)	0.13	0.29	0.38	-0.06	-0.07	0.47
Spike weight (g)	0.60	1.28	0.10	-0.12	-0.13	0.44
Grain yield (g/m^2)	0.62	1.31	0.10	0.07	0.07	0.46
1000-kernal weight (g)	1.32	2.81	0.04	3.14	3.41	0.01
Harvest index (%)	-1.25	-2.64	0.07	0.11	0.12	0.45
	EWYT-C-91-4 promising line					
Total dry matter (g/m^2)	0.50	1.06	0.14	-0.63	-0.68	0.24
Spike/m^2	0.53	1.13	0.13	-0.16	-0.17	0.43
Grain per spike	0.58	1.23	0.11	-0.99	-1.08	0.14
Spikelet per spike	0.16	0.35	0.36	-1.05	-1.14	0.13
Plant height (cm)	0.39	0.83	0.20	-0.25	-0.28	0.38
Spike weight (g)	0.58	1.23	0.11	-0.39	-0.43	0.33
Grain yield (g/m^2)	0.55	1.17	0.12	-0.40	-0.43	0.33
1000-kernel weight (g)	2.13	4.52	0.01	8.32	9.06	0.01
Harvest index (%)	-1.34	-2.85	0.04	2.33	2.54	0.09

Table 3. T^2 Hotellings test for traits of wheat genotypes at each locations under on-farm conditions in 2015-16.

Combined analysis		Nagadeh location		Miandoab location	
F= 11.89	T_2= 129.50	F= 6.10	T2= 86.30	F= 22.47	T2 321.63
((0.00))	Probability level	((0.001)	Probability level	((0.00))	Probability level
Grain yield (t/h)	Haydar cultivar	9.0		8.2	
	C-91-4 promising line	12.5		11.52	

(Longove et al., 2014).

Naghadeh conditions

Number of grain and spikelets per spike, plant height, spike weight, grain yield and harvest index were statistically significant between EWYT-C-91-4 and Haydari (Table 4). The reason of significance T^2 Hotelling was due to above mention traits. Number of grain at per spike for EWYT-C-91-4 was 63.5 while Haydari had 53.3. In addition, this line had lower range and coefficient of variations (30 and 16) than Haydari (42 and 19.32) due to more number of spikelets. So that the elite line had 20.2 spikelets per spike but Haydari had 18.9. EWYT-C-91-4 had lower plant height (84.1 cm) than Haydari (89.3 cm). Low plant height in new cultivar is desirable in mechanized cultivation including drip irrigation due to have no lodging.

With considering that number of grain per spike is one of the three main components of grain yield, with increasing it, grain yield will rise. This was evident on the EWYT-C-91-4. By replacing promising line with common cultivar, it could be about 23% more grain yield. More grain yield alone cannot be criterion for assessing cultivars. In addition, the dispersion parameters should also be considered. Salari et al. (2015b) to determine similarity and genetic distances of advanced lines divided them into three groups under Kabul, Afghanistan conditions. They found exotic lines to be adapted to the same conditions, and it could be utilized in local breeding programs (Salari et al., 2015a). Grain yield of EWYT-C-91-4 had range of variation 560 g/m^2, coefficient of variation 12.71% and standard deviation 171.1 g/m^2, which was less than Haydari 832, 19.85 and 216.26%. Therefore, this line in Naghadeh can have better performance than Haydari. Harvest index is one of the

Table 4. Mean comparison traits of wheat genotypes under Nagadeh and Miandoab on-farm conditions in 2015-2016.

Trait	Nagadeh location									
	C-91-4 promising line				Haydari commercial cultivar				Statistical parameter	
	Mean	Range of var.	Coeff of var.	Std. error	Mean	Range of var.	Coeff. of variation	Std. error	t-student value	Prob. level
Total dry matter (g/m^2)	2761.3	928	12.6	348.5	2726.0	2696	27.6	753.6	0.14	0.88
Spike/m^2	810.0	316	13.8	111.9	783.7	320	13.0	102.0	0.60	0.55
Grain per spike	63.5	30	16.1	10.2	53.3	42	19.3	10.3	2.43	0.02
Spikelet per spike	20.3	6	8.4	1.7	18.9	5	8.4	1.6	1.99	0.05
Plant height (cm)	84.1	10	3.7	3.1	89.3	20	6.6	5.9	-2.69	0.01
Spike weight (g/m^2)	1896.0	752	12.8	242.0	1560.0	1176	20.0	312.7	2.94	0.00
Grain yield (g/m^2)	1346.0	560	12.7	171.1	1096.0	832	19.8	217.6	3.12	0.00
1000-kernal weight (g)	49.1	5.6	3.6	1.79	48.1	6.5	3.6	1.7	1.40	0.17
Harvest index (%)	48.7	5.2	3.5	1.74	41.1	15.4	13.9	5.7	4.42	0.00
	Miandoab location									
Total dry matter (g/m^2)	1857.3	624	10.9	202.0	1744	856	14.1	245.6	1.23	0.22
Spike/m^2	651.7	348	14.5	94.4	730	416	15.7	114.8	-1.82	0.08
Grain per spike	42.6	16	9.4	4.0	35.9	19	16.5	5.9	3.34	0.00
Spikelet per spike	16.1	5	8.7	1.4	15.3	3	5.2	0.8	1.83	0.07
Plant height (cm)	86.4	15	5.6	4.8	82.6	19	6.8	5.6	1.82	0.08
Spike weight (g/m^2)	1317.3	448	10.5	137.8	1169.3	536	13.9	162.1	2.41	0.02
Grain yield (g/m^2)	938.7	320	10.7	100.9	832.7	400	14.2	118.2	2.36	0.02
1000-kernal weight (g)	49.7	5.6	6.6	3.3	47.4	2.1	1.4	0.7	2.43	0.02
Harvest index (%)	50.5	2.6	1.7	0.9	47.7	3.5	2.6	1.2	6.34	0.00

most effective physiological traits, and it is more than that shows conversion of raw materials absorbed by the root into nutrients prepared in the leaves and transferring it to the spike as sink. In this study, EWYT-C-91-4 had 48.73% harvest index and Haydari was 41.09%.

Miandoab conditions

Grain number per spike, spike weight, grain yield, 1000-kernal weight and harvest index had significant differences (p≤0.05) (Table 4). Number of grains for EWYT-C-91-4 (42.6); similar to Nagadeh was higher than Haydari (35.8). The range of variation (16 grain per spike), coefficient of variation (9.38%) and standard deviation (4.40 grain per spike) in EWYT-C-91-4 was less than Haydari 19, 16.48 and 5.9, respectively. Increasing number of grain per spike resulted in gain weight of spike. EWYT-C-91-4 and Haydari had 1317.3 and 1169 g/m^2 spike weight. In these conditions, trend of changing was similar to that of Naghadeh. More grain yield in the EWYT-C-91-4 (978.3 g/m^2) than Haydari (832.7g/m^2) was due to increasing of two main components including number of grain per spike and 1000-kernal weigh. While increasing grain yield in the Naghda site resulted from only one main component such as number of grain at per spike. Rising of grain yield by replacing this line instead to commercial cultivar was 12.74%, which was lower than the Naghadeh conditions (22.81%). EWYT-C-91-4 not only had more grain yield stability than Haydari, but also was high adaptability and less grain yield variations at different conditions. Nabaty and Shaban (2013) examined the effects of location and lines on yield and other favorable characteristics of wheat genotypes at Aligoodarz and Dorud, Iran conditions. They selected "Homa" genotype to complimentary evaluations.

West Azarbaijan province considers one of the livestock country's poles. The total dry matter including grains and straw yield, as well as economic performance, is important in wheat. Due to in many years, it is dry, and the price of alfalfa increases, the price of the straw from wheat was equal to grain and even more. Wheat straw is great importance to farmers in terms of higher nutritional value (5% more digestible nutrients) than cereal straw. The presence of total dry matter in both conditions for EWYT-C-91-4, although was not significant with Haydari, can be important in improving economic situation of farmers.

Table 5. Mean comparison traits of C-91-4 promising line and Haydari commercial cultivar regardless experimental locations.

Trait	C-91-4 promising line				Haydari commercial cultivar				Statistical parameter	
	Mean	Range of var.	Coeff. of var.	Std. error	Mean	Range of var.	Coeff. of var.	Std. error	t-student value	Prob. level
Total dry matter (g/m^2)	2309.3	1768	23.3	539.2	2235	3048	33.2	743	0.39	0.69
Spike/m^2	730.8	496	17.7	129.6	756.8	252	14.5	109.7	-0.75	0.45
Grain per spike	53.0	43	24.7	13.1	44.5	51	27.2	12.1	2.33	0.02
Spikelet per spike	18.2	9	14.3	2.6	17.1	7	12.9	2.2	1.54	0.12
Plant height (cm)	85.3	15	4.8	4.1	85.9	27	7.7	6.6	-0.39	0.69
Spike weight (g/m^2)	1606.7	1216	21.9	352.7	1364.7	1176	23.1	314.9	2.50	0.01
Grain yield (g/m^2)	1142.3	872	21.8	249.3	964.3	832	22.6	217.7	2.63	0.01
1000-kernal weight (g)	49.41	5.6	5.3	2.6	47.7	6.5	2.8	1.32	2.81	0.00
Harvest index (%)	49.61	6.7	3.3	1.6	44.4	15.4	11.9	5.3	4.61	0.00

Table 6. Statistical parameters of C-91-4 promising line and Haydari commercial cultivar under on-farm conditions in 2015-16.

Trait	C-91-4 promising line						
	Min	Max	Sum	Mean	Variance	Std. error	Std. dev
Total dry matter (g/m^2)	1600	3368	55424	2309.3	290769.6	539.2	110.0
Spike/m^2	504	1000	17540	730.8	16793.7	129.6	26.4
Grain per spike	33	76	1273	53.0	171.2	13.1	2.7
Spikelet per spike	14	23	436	18.1	6.8	2.6	0.5
Plant height (cm)	80	95	2046	85.2	16.9	4.1	0.8
Spike weight (g/m^2)	1144	2360	38560	1606.6	124425.2	352.7	72.0
Grain yield (g/m^2)	800	1672	27416	1142.3	62141.1	249.2	50.8
1000-kernal weight (g)	45.4	59.1	1185.8	49.4	6.74	2.6	0.5
Harvest index (%)	45.4	52.1	1190.6	49.6	2.6	1.6	0.3
	Haydari commercial cultivar						
Total dry matter (g/m^2)	1376	4424	53640	2235	552012	742.9	151.6
Spike/m^2	512	960	18164	756.8	12027	109.6	22.3
Grain per spike	23	74	1069	44.5	147	12.1	2.4
Spikelet per spike	14	21	410	17.1	5	2.2	0.4
Plant height (cm)	73	100	2061	85.8	44	6.6	1.3
Spike weight (g/m^2)	912	2088	32752	1364.7	99143	314.8	64.2
Grain yield (g/m^2)	648	1480	23144	964.3	47409	217.7	44.4
1000-kernal weight (g)	45.3	51.8	1145.6	47.7	1.7	1.3	0.2
Harvest index (%)	33.4	49	1065.8	44.4	27.8	5.2	1.0

Comparison of mean traits regardless of experimental locations

Number of grains at per spike and 1000-kernal weight in the EWYT-C-91-4 was more than Haydari, which increased spike weight. Increasing two main above components of grain yield led to more grain yield. EWYT-C-91-4 and Haydarei had 1142.3 and 964.3 g/m^2 grain yield, respectively. High grain yield increased harvest index with more than five percent. The highest grain yield in Naghad compared to Miandoab in both genotypes is due to favorable climatic conditions for wheat cultivation in this region (Tables 5 and 6). Farmers in developing countries, which use no or limited inputs and grow cereals under marginal and unpredictable environments, require promising varieties. In these cases, genotypes with good performance should be recommended such as EWYT-C-91-4. Environmental effects were large for the expression of most agro-morphological traits which also supported by Subhashchandra et al. (2009). Similar results are further supported by Longove et al. (2014) who reported considerable variations in grain yield of

Table 7. Simple correlation coefficient of wheat traits under on-farm conditions in 2015-16.

Trait	Spike/m^2	Grain per spike	Spikelet per spike	Plant height (cm)	Spike weight (g/m2)	Grain yield (g/m2)	1000-kernel weight (g)	Harvest index (%)
	C-91-4 promising line							
Total dry matter (g/m^2)	0.90**	0.79**	0.71**	-0.29	0.99**	0.98**	0.20	-0.52**
Spike/m^2		0.60**	0.51**	-0.22	0.92**	0.91**	0.32	0.36
Grain per spike			0.83**	-0.33	0.79**	0.80**	0.10	-0.33
Spikelet per spike				-0.27	0.73**	0.72**	-0.20	-0.30
Plant height (cm)					-0.28	0.27	0.30	0.28
Spike weight (g/m^2)						0.99**	0.19	-0.43
Grain yield (g/m^2)							0.19	-0.40
1000-kernal weight (g)								-0.15
	Haydari commercial cultivar							
Total dry matter (g/m^2)	0.59**	0.57**	0.65**	0.64**	0.92**	0.90**	0.28	-0.77**
Spike/m^2		0.11	0.14	0.23	0.74**	0.70	0.12	-0.28
Grain per spike			0.81**	0.67**	0.53**	0.52**	0.34	-0.49*
Spikelet per spike				0.54**	0.62**	0.61**	0.43*	-0.55**
Plant height (cm)					0.52**	0.48*	0.16	-0.67**
Spike weight (g/m^2)						0.98**	0.32	-0.51**
Grain yield (g/m^2)							0.30	-0.46*
1000-kernal weight (g)								-0.17

* and **, are significant differences at 0.05 and 0.01 probability levels, respectively.

promising wheat lines when planted under agro-ecological conditions of Quetta, Pakistan. Moayedi and Azizi (2012) in studying improvement of knowledge and skills level of wheat-cultivating farmers using on-farm researchers concluded that the new selected promising lines are able to increase income and productivity of farmers. In addition, our farmers with sowing new cultivar raise economic level of family.

Correlation of coefficients

In the line EWYT-C-91-4, grain yield with total dry matter, number of spike per square meter, number of grain per spike, number of spikelet per spike and spike weight, had 0.98**, 0.91**, 0.80**, 0.72** and 0.99** significant positive correlations, respectively (Table 7). The most positive correlation observed between the total dry matter and spike weight and grain yield with spike weight (0.99**). It seems that by increasing total dry matter, with using of nitrogen fertilizers will increase grain yield.

In the Haydari cultivar, total dry weight, number of spikes per square meter, number of grain per spike, number of spikelets per spike, plant height and spike weight had positive and significant correlation with grain yield. The lowest positive and significant correlation was observed in plant height with grain yield (0.48*). In contrast the highest positive and significant correlation with grain yield was related to spike weight (0.98**). In most cases, there is a negative correlation between grain yield components. Therefore, selection for all desirable traits that have positive correlation with grain yield is difficult (Gupta et al., 1999). Considering that, the 1000-kernal weight is determined at the maturity, so topdressing fertilizers can be very effective in increasing 1000-

kernal weight.

High plant height due to its lodging and fungal diseases has an important role in reducing grain yield. Genotypes with higher grain yield had shorter plant height. Promising lines have shorter height than old cultivars, and it is more responsive to chemical fertilizers. Short-plant height store photosynthetic materials as a source in grains (Garcia Del Mora et al., 1985). Tahmasebi et al. (2013) with assessing genetic diversity and interrelationship of traits in some promising wheat lines and determine the traits effective on grain yield observed high genotypic and phenotypic coefficient variations for traits of grain yield, number of spike and 1000-kenal weight. Plant height, number of spike and 1000-kernal weight had significantly positive relationship with grain yield (Tahmasebi et al., 2013) like our results. Information on diversity and relationship among the agro-morphological traits will be helpful to breeders in constructing their breeding populations or lines and implementing selection strategies.

Conclusion

Wheat breeders should try to select promising lines responsive to the environmental changes for improving grain yield and yield components. Most of new high yielding varieties have been selected under on-station research conditions. However, on-farm research can help the research and development process. The EWYT-C-91-4 promising line had more total dry matter and grain yield than Haydari in both regions of Nagadeh and Miandoab. The coefficient of variation, the standard deviation and the range of variations for these traits on the EWYT-C-91-4 line were less than Haydari which indicated better adaptation of this line to several conditions of climatic parameters of cultivated areas. With regard to other factors such as disease resistance, especially yellow and brown rust and tolerant to low irrigation EWYT-C-91-4 shall be replaced instead of Haydari and other old and conventional cultivars such as Mihan, Urum, Zare, Pishgam and Zarrin in the wheat growing lands of west Azerbaijan province. Among the main components of grain yield, characters number of spikes per square meter and grain per spike had positive significant correlation with grain yield. Therefore, they could be used as indirect criterion for increasing grain yield. One-thousand spikes of EWYT-C-91-4 were selected for propagating breeder seed and consequently producing certificate seeds between wheat farmers.

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