

The Study of lines and Different Cultivars of Barley in Terms of Germination Index in Laboratory Condition

Ali Mohammadpour Khanghah^{*1}, Aliakbar Imani¹, Marefat Ghasemi² and Hossein Shahbazi¹

1- Department of Agronomy and Plant Breeding, Ardabil Branch, Islamic Azad University, Ardabil, Iran

2- Agriculture and Natural Resources Research Center, Ardabil, Iran

Corresponding author Email: ali.mohammadpour.khanghah@gmail.com

ABSTRACT: Barley is one of the most important grains and essential resources for provide animal food and human in the world. This study was conducted in a randomized complete block design (CRD) with three replications at the Agricultural Laboratory of Islamic Azad University of Ardabil. Analysis of variance results showed that there were significant differences between lines in terms of the all evaluated traits at 1% level. Results of data indicated that the range of variation Germination Rate Index (GRI) between the lines and studied cultivars from 9.35 percent (line 6) to 3.72 (line number 28) was variable. Also results showed that the Coefficient of Velocity of Germination (CVG), line 34 with the mean of 16.40 had highest value and was in class A. The results also showed that in terms of germination rate (Rs) line 8 with an average of 0.1246 was the top line; in front line 34 with a mean of 0.1640 accounted the lowest germination rate.

Keywords: Barley, Germination indices, Laboratory Condition

INTRODUCTION

Barley is one of the most important grains and essential resources for provide animal food and human in the world. They are growing in areas where other crops not grow well due to low rainfall, soil salinity, high height and heat and cold. Almost a third of the world's total land 85 percent of land in Iran located in the dry zone (Badripour; 2004). The most important use of barley is as human and animal food, and preparing the malt. The area under cultivation of barley in the world is over 56 million hectares in 2006 and its performance is over 137 million tons and 7/1 million acres in Iran in 2005, also it is the most important comprehensive product which is proportional to extensive growth under stress conditions. Barley cropping is for grain production and it used to be feed humans and animals, in addition, barley malt produced in the industry and is used in pastry (Khodabandeh, 2003). The most basic way to increase economic efficiency of barley agriculture is using compatible varieties, resistant and high yielding is proportional to the area. In this regard, it is noteworthy

that the study and evaluation of data consistency in different environments and conditions has a special place in plant breeding (Rahimian et al, 1998). Nickhah (2002) with studding the qualitative and quantitative traits of barley varieties and promising lines in testing of steady performance comparison of temperate zone and analysis of variance showed that the interaction between genotype and environment was significant and revealed superior numbers and lines based on the performance.

The main objective to the following research is to study barley lines cultivars of indicators of seed germination.

MATERIALS AND METHODS

This study was designed at the Agricultural Laboratory of Islamic Azad University of Ardabil in 2011-2012 crop years. In this experiment, 34 barley lines received from the International Research Institute of ICARDA and varieties of Bulbul, Sadik-02, Radical,

Tokak and Makooei were investigated as control. Pedigree of tested lines is included in Table 1. This study was conducted in a randomized complete block design (CRD) with three replications. First, seeds were disinfected in a solution of sodium hypochlorite 15% for 30 seconds. After placing the seeds in Petri (25 seeds per Petri) distilled water (6 mm in each Petri) was poured into the Petri and was prevented tangible changes in water potential until the end of the experiment. To prevent Bunt and disinfection of the all seeds, fungicide Karbuksyn Tyram ratio 2 in a thousand was added and mixed to distilled water. Coefficient of velocity of germination (CVG), germination rate index (GRI), mean germination time (MGT), final germination percentage (FGP), germination rate (Rs) and mean daily germination (MDG) were calculated using the following formula (Table2).

Then ensuring the normal distribution of data, for data analysis with statistical methods such as analysis of variance and comparison of lines mean by Duncan's test at the 5% level. Computer software MSTAT-C, Minitab-16 was used for statistical computing.

RESULTS AND DISCUSSION

Analysis of variance and mean comparison was normally distributed by Duncan's test after examining the data distribution at the laboratory. Variance analysis of data from evaluating studies characteristics in laboratory conditions (Table 3) showed that there were significant differences between lines in terms of the all evaluated traits at 1% level.

Jafari et al (2013) reported that there were significant differences between studied cultivars in terms of the coefficient of velocity of germination, germination rate

index, final germination percent, mean time germination, germination rate and mean daily germination at 1% level. Results of data indicated that the range of variation Germination Rate Index (GRI) between the lines and studied cultivars from 9.35 percent (line 6) to 3.72 (line number 28) was variable (Table 4). Results showed that the Coefficient of Velocity of Germination (CVG), line 34 with the mean of 16.40 had highest value and along lines 3, 4, 10, 12, 29, 32, 33, and Tokak cultivar was in class A. In front line 8 had lowest value (Table 4). Changes range of final germination percent (FGP) among studied lines, from 100 percent (lines 13,23) to 52.33 (Makooei cultivar) was variable (Table 4).The results of lines mean comparison showed that the line number 8 had the highest value of mean time germination (MTG) and were located in class A. and line number 34 had the lowest value and were located in class F. The results also showed that in terms of germination rate (Rs) line 8 with an average of 0.1246 was the top line; in front line 34 with a mean of 0.1640 accounted the lowest germination rate (Table 4). Changes range of Mean Daily Germination (MDG) among studied lines, from 10.74 percent (line 23) to 5.22 (Makooei cultivar) was variable (Table 4).

Alaei et al (2012) in their study concluded that the Cross Sabalan with an average of 37.70, had the highest mean time germination and Sardari with an average of 31.38 had the lowest mean time germination. In terms of germination rate, Sardari with an average of 0.03322 the highest and Cross Sabalan with an average of 0.02661 had the lowest germination rate. Cultivars of Chamran, Cross Sabalan and Kouhdasht with an average of 95% had highest final germination percent and Sardari with an average of 80% had the lowest final germination percent.

Table 1. Pedigree and characteristics of 39 barley lines and cultivars

No	SOURCE11	SN11	ORIGIN	FAO_Status	SCTH11	RTTH11
Bulbul	CHECK11	25	TURKEY	U	W	2
Radical	CHECK11	24	RUSSIA	U	W	6
Makooei	National_Check	-	-	-	-	6
Tokak	CHECK11	23	TURKEY	U	W	2
Sadik-02	CHECK11	43	ICARDA	U	W	2
L1	IBON12_W_INC11	3	ICARDA	U	W	2
L2	IBON12_W_INC11	7	ICARDA	U	W	2
L3	IBON12_W_INC11	13	ICARDA	U	W	2
L4	IBON12_W_INC11	18	ICARDA	U	W	2
L5	IBON12_W_INC11	21	ICARDA	U	W	2
L6	IBON12_W_INC11	24	ICARDA	U	W	2
L7	IBON12_W_INC11	30	ICARDA	U	W	2
L8	IBON12_W_INC11	33	ICARDA	U	W	2
L9	IBON12_W_INC11	41	ICARDA	U	W	2
L10	IBON12_W_INC11	51	ICARDA	U	W	2
L11	IBON12_W_INC11	54	ICARDA	U	W	2
L12	IBON12_W_INC11	61	ICARDA	U	W	2
L13	IBON12_W_INC11	67	ICARDA	U	W	2
L14	IBON12_W_INC11	68	ICARDA	U	W	2
L15	IBON12_W_INC11	77	ICARDA	U	W	2
L16	IBON12_W_INC11	93	ICARDA	U	W	2
L17	IBON12_W_INC11	98	ICARDA	U	W	2
L18	IBON12_W_INC11	107	ICARDA	U	W	2
L19	IBON12_W_INC11	113	ICARDA	U	W	2

L20	IBON12_W_INC11	120	ICARDA	U	W	2
L21	IBON12_W_INC11	122	ICARDA	U	W	2
L22	IBON12_W_INC11	132	ICARDA	U	W	2
L23	IBON12_W_INC11	135	ICARDA	U	W	2
L24	IBON12_W_INC11	139	ICARDA	U	W	2
L25	IBON12_W_INC11	146	ICARDA	U	W	2
L26	IBON12_W_INC11	150	ICARDA	U	W	2
L27	IBON12_W_INC11	159	ICARDA	U	W	2
L28	IBON12_W_INC11	162	ICARDA	U	W	2
L29	IBON12_W_INC11	163	ICARDA	U	W	2
L30	IBON12_W_INC11	170	ICARDA	U	W	2
L31	IBON12_W_INC11	171	ICARDA	U	W	2
L32	IBON12_W_INC11	175	ICARDA	U	W	2
L33	IBON12_W_INC11	176	ICARDA	U	W	2
L34	IBON12_W_INC11	180	ICARDA	U	W	2

Table 2. The formula used to calculate the index of germination

Germination indices	The Formula used
Coefficient of Velocity of Germination (CVG)	$CVG = \frac{\sum Ni}{\sum NiTi} \times 100$
Germination Rate Index (GRI)	$GR = G1 / 1 + G2 / 2 + Gx/x + \dots$
Final Germination Percent (FGP)	$FGP = Ng / Nt \times 100$
Mean Time Germination (MTG)	$MGT = \frac{\sum NiTi}{\sum Ni} = 100 / CVG$
Germination Rate (RS)	$Rs = 1 / MTG$
Mean Daily Germination (MDG)	$MDG = FGP/d$

Table 3. Analysis of variance of Study Germination indices in Laboratory Condition for 39 barley line and cultivar

S.O.V	df	Mean Square					
		CVG	GRI	FGP	MTG	RS	MDG
Lines	38	2.23**	4.93**	597.38**	0.56**	0.0002**	6.48**
Error	78	0.36	0.92	59.54	0.10	0.00006	0.62
CV%		4.34	15.87	10.53	4.36	4.31	10.70

* and **: Significant at p < 0.05 and < 0.01, respectively

Table 4. Mean comparison of traits being studied for barley lines and cultivars

Lines & Cultivars	Characters											
	CVG		GRI		FGP		MTG		RS		MDG	
Bulbul	13.34	cde	4.610	c-f	56.89	ef	7.520	a-e	0.1345	bcd	5.670	fg
Radical	14.33	b-e	6.260	a-f	67.67	def	6.980	a-f	0.1433	a-d	6.780	efg
Makooei	13.80	b-e	4.140	ef	52.33	f	7.290	a-e	0.1380	a-d	5.220	g
Tokak	15.13	abc	6.030	a-f	67.67	def	6.640	c-f	0.1513	a-d	6.780	efg
Sadik-02	13.27	cde	7.200	a-e	95.00	abc	7.540	a-e	0.1327	bcd	9.500	a-d
1	13.41	b-e	6.390	a-f	86.67	a-d	7.460	a-e	0.1341	bcd	8.670	a-e
2	14.32	b-e	6.520	a-f	70.00	cdef	6.980	a-f	0.1432	a-d	7.000	d-g
3	14.60	a-d	6.910	a-f	63.33	def	6.850	b-f	0.1460	a-d	6.330	efg
4	15.13	abc	6.210	a-f	56.67	ef	6.610	def	0.1513	a-d	5.670	fg
5	13.55	b-e	7.320	a-e	96.67	ab	7.380	a-e	0.1355	bcd	9.670	a-d
6	14.09	b-e	9.350	a	96.67	ab	7.120	a-f	0.1409	a-d	10.04	ab
7	12.92	de	5.340	b-f	66.67	def	7.740	abc	0.1292	bcd	6.670	efg
8	12.46	e	5.070	b-f	73.33	b-f	8.030	a	0.1246	d	7.330	c-g
9	12.70	de	4.310	def	70.00	c-f	7.880	ab	0.1270	cd	7.000	d-g
10	14.50	a-e	5.920	b-f	63.33	def	6.900	b-f	0.1450	a-d	6.330	efg
11	13.15	cde	4.200	ef	56.67	ef	7.630	a-d	0.1315	bcd	5.670	fg
12	14.49	a-e	6.470	a-f	63.33	def	6.910	b-f	0.1449	a-d	6.330	efg
13	13.37	b-e	7.500	a-e	100.0	a	7.480	a-e	0.1337	bcd	10.00	abc
14	12.88	de	6.420	a-f	96.67	ab	7.770	ab	0.1288	bcd	9.670	a-d
15	14.35	b-e	8.440	ab	90.00	a-d	6.970	a-f	0.1435	a-d	9.000	a-e
16	13.18	cde	4.300	def	53.33	ef	7.600	a-d	0.1318	bcd	5.330	fg
17	13.57	b-e	7.900	abc	90.00	a-d	7.380	a-e	0.1357	bcd	9.000	a-e
18	13.42	b-e	6.170	a-f	66.67	def	7.460	a-e	0.1342	bcd	6.670	efg
19	13.62	b-e	7.080	a-f	76.67	a-f	7.360	a-e	0.1362	bcd	7.670	b-g
20	13.32	cde	6.780	a-f	80.00	a-e	7.510	a-e	0.1332	bcd	8.000	b-f
21	14.15	b-e	5.520	b-f	56.67	ef	7.080	ab-f	0.1415	a-d	5.670	fg
22	13.93	b-e	5.580	b-f	63.33	def	7.190	a-e	0.1393	a-d	6.330	efg
23	13.12	cde	7.880	abc	100.0	a	7.620	a-d	0.1312	bcd	10.74	a
24	13.53	b-e	5.160	b-f	63.33	def	7.400	a-e	0.1353	bcd	6.330	efg
25	12.75	de	5.170	b-f	80.00	a-e	7.840	ab	0.1275	bcd	8.000	b-f
26	13.18	cde	5.370	b-f	73.33	b-f	7.590	a-e	0.1318	bcd	7.330	c-g
27	13.78	b-e	4.480	def	53.33	ef	7.300	a-e	0.1378	a-d	5.330	fg

28	12.95	de	3.720	f	66.67	def	7.730	abc	0.1295	bcd	6.670	efg
29	14.45	a-e	5.910	b-f	63.33	def	6.930	a-f	0.1445	a-d	6.330	efg
30	13.84	b-e	6.340	a-f	76.67	a-f	7.250	a-e	0.1384	a-d	7.670	b-g
31	13.80	b-e	5.190	b-f	76.67	a-f	7.280	a-e	0.1380	a-d	7.670	b-g
32	15.45	ab	5.800	b-f	73.33	b-f	6.480	ef	0.1545	ab	7.330	c-g
33	15.44	ab	5.500	b-f	76.67	a-f	6.480	ef	0.1544	abc	7.670	b-g
34	16.40	a	7.660	a-d	76.67	a-f	6.100	f	0.1640	a	7.670	b-g
Total Mean	13.84		6.05		73.24		7.26		0.1384		7.35	

Differences between averages of each column which have common characters are not significant at probability level of 5%.

CONCLUSION

The results showed that in terms of germination rate (Rs) line 8 was the top line; in front line 34 accounted the lowest germination rate.

REFERENCES

- Alaei, Y., Valizadeh, M., Imani, A.A. and Shahryari, R. 2012. Effect of two types biological fertilizers containing amino acids on germination indices of wheat varieties under in vitro drought stress conditions. *Annals of Biological Research*, 3 (2):1000-1002.
- Badripour H. 2004. Islamic republic of Iran Country pasture/forage resource profiles. rangeland management expert in the technical bureau of rangeland.

- Jafari, M., Imani, A.A., Aminzadeh, Gh. and Shahbazi, H. 2013. The Study of lines and Different Cultivars of Wheat in Terms of Germination Index in Laboratory Condition. *International Journal of Farming and Allied Sciences*. 2(6): 124-128.
- Khodabandeh, N. 2003. *Cereal crops*. Seventh Edition. Tehran University Press.
- Nickhah, H. 2002. Evaluation of quantitative and qualitative traits, the cultivars and promising lines of uniform yield trial in temperate zone climate, research reports, research design, research and educational organizations, Cereal Research Department.
- Rahimian, H., Kochaki, A. and Zand, A. 1998. Evolution, adaptation and yield of crops. First print. Press release Agricultural Education.