Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2012, 3 (12):5540-5544
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

The study of compatibility and stability of grain yield in barley advanced genotypes in tropical and subtropical reinfed regions

Atefeh Bolandi[*1], Ali Akbar Imani[1], Hossein Shahbazi[1] and Asghar Mehraban[2]

[1]Department of Agronomy and Plant Breeding Ardabil branch, Islamic Azad University, Ardabil, Iran
[2]Research Center for Agriculture and Natural Resources of Ardabil, Parsabad

---

ABSTRACT

The study of the interaction of genotype and environment adaptability and yield stability of promising barley lines is one of the major issues in the race which is very important in The development of improved cultivars. In order to achieve these goals promising lines should be cultivated in different climatic conditions and evaluated. The test was done to determine the adaptability and yield stability of barley lines with 16 lines with 2 control for two years and two locations in a randomized complete block design with three replications. Combined analysis showed a significant difference at the 1% level. This means that the lines were in the same behavior and this proves Genotype-environment interaction effects in this case. Univariate parametric stability methods showed that Lines 1 and 13, with good stability and lines 5, 10, 12 and 14 were lines of Group C (low and stable product, respectively).

Keywords: barely, the interaction of genotype and environment compatibility, stability

---

INTRODUCTION

Genotype-environment interaction in plant breeding is a major issue for the introduction and development of crop varieties [1]. When a number of digits are compared in a context to the genotype Genotypes are generally ranked in terms of performance, are different in different environments and this makes the problem of selecting the best varieties for different environments [2]. The performance of each genotype has been formed of the effects of the environment (E), the main effect of genotype (G), and the interaction between genotype and environment (GE). Although the environment accounts more than 80 percent of the total variance in performance In evaluating the genotypes, only the main effect of genotype and genotype environment interaction is used [3]. GE interaction generally refers to the functional diversity that cannot be justified by the main effects of genotype and genotype interactions in environments [4]. A genotype interaction by environment reduces correlation between genotype and environment and thus it is difficult to select genotypes [5]. Relative performance of genotypes interaction makes clear the importance of the environment to another environment so that when the relative performance of genotype interaction and other environments are fixed, it can be said that there is no Genotype interaction in environment [6]. No change in yield during the test and the locations are the main objectives of the reformers. But this goal is not accessible. Although some of the figures have been modified with wide compatibility but some of them also have specific adaptations to particular environmental conditions. In the area performance tests it will be tried to use the proper requirements to run tests, however, it is not practical. And experiments are performed in predetermined stations that may not be a good representative of the study area. It is even possible in the area where the test is not representative of annual changes And thus cannot obtain the proper conclusion of the experiments [7]. So choosing figures is not correct according to their performance and interaction between genotype and environment should be regarded significant. An important issue that is influence by the interaction of genotype × environment is the issue of adaptation to environmental conditions [8]. In the presence of genotype × environment interaction for selection and breeding of superior genotypes in relation to the selection there is a need for significant correlation between

phenotypic and genotypic values because Genotype × environment interaction reduces the correlation of the value of phenotypic and genotypic correlations and makes careful analysis of the results difficult [9]. generally the effect of genotype × environment interaction is considered a deterrent to plant breeding in the area. [10]. This study investigated the interaction of genotype and environment and introduced the most consistent and stable lines for the area.

MATERIALS AND METHODS

To introduce and select barley consistent genotypes stable yield and high yield, the genotypes were tested in a randomized complete block design with three replications at two locations for two years crop was 2010-2011 and 2011-2012 this test consists of 16 advanced barley genotypes with 2 control varieties (Table 1) which were conducted in two points in dry land areas of Moghan plain, one of them was dry land Research Station, Agriculture and Natural Resources Research Center of Ardabil (Moghan) Located in Jafarabad moghan and the second place was in the field of agricultural service Anjilo. To analyze the stability first, the normality of data using skewness and elongation index calculation and analysis of variance of grain yield of barley lines were individually done for each environment And environmental coefficient of variation (CV) was calculated, then The homogeneity of variances of test errors was tested using the F max Hartley's. To analyze the stability and consistency, stability parameters were calculated.

Table 1. Specification for 18 Line barley assessment in rain fed tropical and subtropical climates (Moghan)

NO	Genotypes
1	Soufara-02/3/RM1508/Por//Wi2269/4/Hml-02-ArabiAbiad//ER/ApmICB92-0926-0AP-18AP-0AP-3TR-0AP(12-PRBYT2009-10
2	Soufara02/3/RM1508/Por//Wi2269/4/Hml02ArabiAbiad//ER/Apm ICB92-0926-0AP-18AP-0AP-17TR-0AP(16-PRBYT2009-10)
3	Lignee527/ArarICB92-0755-22AP-0AP-6AP-0AP-0AP-1AP 0AP(4-PRBYT2009-10)
4	ALELI/GOB//E.QUEBRACHO/3/MSEL CBSS00Y00227T-K-0Y-OM-2Y-1M-0M(39-PRBYT2009-10)
5	ALELI/GOB//E.QUEBRACHO/3/MSEL CBSS00Y00227T-K-0Y-OM-2Y-1M-0M(39-PRBYT2009-10)
6	TOCTE/5/ABETO//GLORIA-BAR/COME/3/SEN/4/… CBSS00Y00485T-S-0Y-0M-2Y-0M(36-PRBYT2009-10)
7	Rt013/4/Rhn03//Lignee527/NK1272/3/Lignee527/Chn-01//Losaika ICB98-0888-0AP-8AP-0AP-5TR-0AP.(79-PRBYT2009-10)
8	Hml/Galleon ICB93-1096-0AP-12AP-25TR-3TR-0AP.(77-PRBYT2009-10)
9	AwBlack/Aths//Rhn-08/3/Malouh(47-PRBYT2009-10)
10	ESCOBA/MORADILLA/3/ZHEDAR#2/ND B112//MORA/4/…CBSS00Y00241T-E-OY-0M-2Y-0M(44-PRBYT2009-10)
11	Avt/Attiki//M-Att-73-337-1/3/Aths/Lignee686/4/M-Att-73-337-1/3/Mari/Aths*2//Avt/Attiki(56-PRBYT2009-10)
12	Alanda/Hamra//Alanda-01(59-PRBYT2009-10)
13	Eldorado//Alanda/Hamra-01 ICB94-0189-0AP-18AP-0AP(65-PRBYT2009-10)
14	GOB/HUMAI10/3/MPYT169(76-PRBYT2009-10)
15	Courlis/Rhn-03 ICB93-0923-0AP-2AP-0AP(64-PRBYT2009-10)
16	MONA//MZQ/DL71/3/5.(75-PRBYT2009-10)
17	Mahoor
18	Khorram

Environmental variance [11,12]:

$$C.Vi = (\frac{si}{\bar{x}i.})(100)$$

Coefficient of Environmental change [10]:

$$C.Vi = (\frac{si}{\bar{x}i.})(100)$$

Rick Ecovalance [9,13]:

$$Wi^2 = \sum_{j=1}^{q} (xij - \bar{x}i. - \bar{x}.j + \bar{x}..)^2$$

Shukla stability Variance [14]:

$$SHi = \frac{p}{(p-2)(q-1)} \sum_{j=1}^{q} (xij - \bar{x}i. - \bar{x}.j + \bar{x}..)^2 - \frac{SS(GE)}{(p-1)(p-2)(q-1)}$$

Plasted and Peterson (mean-variance) [15,13]:

$$PPi = \frac{P}{2(P-1)(q-1)} \sum_{j=1}^{q} (xij - \bar{x}i. - \bar{x}.j + \bar{x}..)^2 + \frac{ss(GE)}{2(p-1)(q-1)}$$

In order to perform statistical analysis, charting and tables, computer software MSTAT-C, SPSS Minitab, Excel were used.

RESULTS AND DISCUSSION

Results of combined analysis of variances and mean grain yield over the two years and two locations combined analysis of data from yield assessment within two years and two locations showed that (table 2) there was significant difference at 5% level in the two-year study of the property's So that the average yield in the first year was more than the second year. ($2.878_{t/ha} > 2.794_{t/ha}$) The locations were also significant at the 1% level the average yield in the first place was more than the second place. ($3.298_{t/ha} > 2.374_{t/ha}$) and there was no significant difference between the interaction of year × location. The results showed that there were significant differences between genotypes in terms of yields. The interaction line × year and line x location were significant at the 1% level. There was no difference between the triple effects of line × year × location (table 2).

The results of Univariate methods for analyzing the stability and consistency of barley lines in two years and two locations (types 1 and 2). Ranking of figures is shown in Table (3) based on parameters of environmental changes coefficient and environmental variances. According to The environmental variance Roemer [11], Line No. 13 (M13) is the lowest and most stable yield And also in terms of performance is ninth in the rankings. This line is the most stable genotype (Table 4). Figure 1 shows that Group A genotypes are genotypes that have high levels of performance and stability, In contrast, group B genotypes are genotypes with high performance but were less stable Group C genotypes are genotypes with low performance but stable in contrast, genotype D are genotypes which are less stable.

Ghazvini and Yousefi (1999) used the environmental variance parameter in the study of 19 figures and barely lines and introduced figure 8 with average 77/4 tons per acre as a figure with General compatibility [16].

Annenberg Francis (1978) introduced the environmental coefficient of variation for determining the stability of genotypes To neutralize the effect of the average environmental variance. The results show that according to the environmental coefficient of variation Annenberg Francis (Francis and annenberg, 1978), Line No. 13 (M13) is known as the lowest and most stable in terms of yield. Figure 2 shows the lines of group A are lines with high yielding and according to the environmental coefficient of variation have the high stability [10].

Ansari Maleki et al 2005, in the study of Stability and compatibility of 19 genotypes of barley in the past three years using environmental coefficient of variation (CV) showed that Genotypes number 4 and 14 were introduced as stable and consistent for the three regions [17].

Table 2. Combined Analysis of The data from the evaluation of yield over the two years and two locations

S.O.V	df	MS
Year (Y)	1	0.387*
Location (L)	1	46.037**
Y×L	1	0.010 ^{ns}
Error 1	8	0.311
Line	17	1.104**
Line×Y	17	1.276**
Line×L	17	0.029**
Line×Y×L	17	0.034 ^{ns}
Error 2	136	0.061
CV %		8.73

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

Mohammad Dashtaki et al 2004 , in the study of Stability of grain yield and harvest index In 20 bread wheat genotype using environmental coefficient of variation (CV) showed that 1,2,3,4,5,6 genotypes were used in the region of maximum performance and the lowest coefficient of variation (CV) [18]. Roustaei et al 2004, in the study of the compatibility and stability of grain yield in tropical and subtropical regions using environmental coefficient of variation (CV) reported Koohdasht figure As the most stable and high yielding varieties among the genotypes studied. According to stability methods of Shukla and Rick Ecovalance (w_i) is presented in Table 4 , the Stable figure was 1 in these methods, The ranking of the methods given in Table 3 Shows the ranking of these methods are quite similar to each other [19]. In the ranking based on environmental variance and coefficient of variation, genotype 1 was known as one of the genotypes of Group A (stable and high yielding) (Fig. 1 and 2). Ghazvini et al 1999 used Rick Ecovalance method in the study of 19 figures and advanced lines for three years in warm climates of north and could introduce dessert barely in warm climate or north in Iran [16]. Plasted mean, variance, and Peterson (PP) are given in Table 4. So that lines 8 and 18 were stable lines in the methods, the Ranking of this method (Table 3), the results show that the ranking based on the average performance of the lines were ranked first and second. Both lines were reported based on environmental variance as lines in group A (high yielding and stable). 1,7,13 genotypes were as stable genotypes the genotypes were in good to excellent for their performances. Thus, according

to this method and based on acceptable performance and minimal interaction between genotype and environment, lines 8 and 18 can be introduced as stable lines.

Table 3. The results of ranking method barley lines (MT / ha) in two years and two locations

Genotype	Code	Average yield ($\bar{x}$)	Environmental variance (EV)	Coefficient of Environmental change (EVi)	Shukla Stability Variance	Rick Ecovalance (Wi)	Average variance Plasted and Peterson (p.p)
1	M_1	10	3	3	1	1	10
2	M_2	12	10	9	6	6	12
3	M_3	13	7	5	3	4	13
4	M_4	6	2	2	7	8	6
5	M_5	11	6	6	4	7	11
6	M_6	15	18	17	17	16	15
7	M_7	3	4	4	10	10	3
8	M_8	2	12	10	12	12	2
9	M_9	4	13	12	18	18	4
10	M_{10}	8	11	11	11	11	8
11	M_{11}	18	17	14	16	17	18
12	M_{12}	14	14	16	15	15	14
13	M_{13}	9	1	1	2	3	9
14	M_{14}	17	16	15	13	13	17
15	M_{15}	7	9	7	9	9	7
16	M_{16}	16	15	13	14	14	16
17	M_{17}	5	5	8	8	5	5
18	M_{18}	1	8	18	5	2	1

Table 4. the results of univariate methods to analyze stability and consistency yield (t / ha) barley lines in two years and two locations based on the classification (type 1 and 2) LIN, et al (1986)

Genotype	Code	Average ($\bar{x}$)	Environmental variance (EV)	Coefficient of Environmental change (EVi)	Shukla Stability Variance	Rick Ecovalance (Wi)	Average variance Plasted and Peterson (p.p)
1	M_1	3.43	0.129	0.045	0.015	0.039	5.29
2	M_2	3.39	0.307	0.071	0.082	0.203	6.05
3	M_3	3.57	0.212	0.056	0.052	0.138	6.09
4	M_4	3.34	0.079	0.037	0.099	0.276	5.34
5	M_5	3.09	0.183	0.059	0.071	0.22	5.95
6	M_6	3.34	1.905	0.179	0.458	1.203	6.16
7	M_7	3.44	0.144	0.048	0.181	0.479	5.15
8	M_8	3.36	0.378	0.079	0.23	0.631	5.13
9	M_9	3.32	0.700	0.109	0.547	1.444	5.18
10	M_{10}	3.83	0.361	0.092	0.208	0.572	5.76
11	M_{11}	3.24	1.026	0.135	0.45	1.229	6.6
12	M_{12}	3.56	0.778	0.149	0.355	0.979	6.12
13	M_{13}	3.48	0.072	0.033	0.044	0.136	5.86
14	M_{14}	3.08	0.971	0.138	0.246	0.655	6.52
15	M_{15}	3.57	0.270	0.063	0.176	0.475	5.53
16	M_{16}	3.31	0.961	0.128	0.29	0.734	6.21
17	M_{17}	3.47	0.180	0.064	0.112	0.185	5.33
18	M_{18}	3.73	0.262	0.379	0.073	0.047	1.65

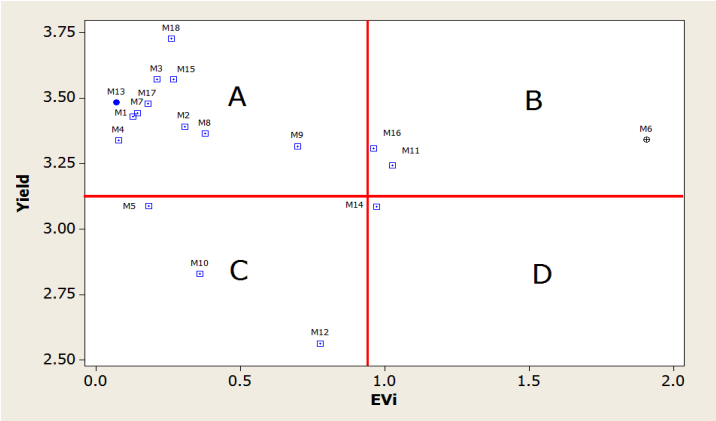

Figure 1. Grouping genotypes based on yield and environmental variance

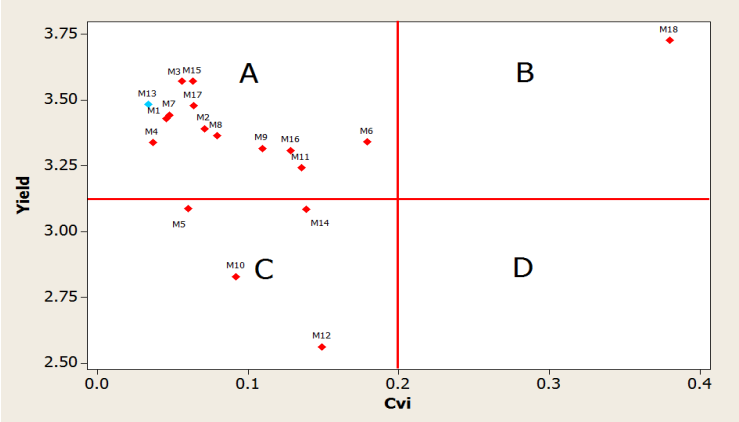

Figure 2. Grouping genotypes based on yield and the environmental changing coefficient

CONCLUSION

The combined analysis of data showed a significant difference at the 1% level, this means that's did not have the same behavior in environments and this proved the interaction between genotypes in the environment. Univariate parametric stability methods, results showed that lines 1 and 13, had good stability and lines 5, 10, 12 and 14 were the lines in group C (low yielding and stable).

REFERENCES

[1] Kang. M. S. and Pham, H.N. **1991**. *Agrom. J.* 83: 161 – 165.
[2] Allard, R. W. and A. D. Bradshaw. **1964**. *Crop Sci*. 4: 503 -508.
[3] Yan, W. **2002**. *Agronomy Journal*, 94:990-996.
[4] Yan, W. and Hunt L.A. **2002**. *Genomics and Plat Breeding Journal*, 19:289-303.
[5] Comstock, R. E and R. H. Moll. **1964**. Genotype – environment interactions, in: Hanson. W. D. and H. F. Robinson (Ads). Statistical Genetics and plant breeding 164-196. Washington: Nat. Acad.Sci. Nat. Res. Councilpubl. 982.
[6] Abd-Mishani, S. **1997**. Further breeding. Educational pamphlets. College of Agriculture, Karaj. Tehran University.
[7] Yazdi Samadi, B and S.Abd-Mishani. **2004**. Breeding crop. Fifth Edition. Tehran University Publication Center.
[8] Alishah, A and et al. **2008**. Effect of genotype × environment interaction and yield stability of cotton cultivars through a parametric approach, Abstracts Crop Science Congress, Tehran University, pp. 237.
[9] Wricke, G. **1962**. Uber eine method zur refassung der okologischen streubretite in feldversuchen, Flazenzuecht, 47:92-96.
[10] Francis, T. R., and Annenberg, L. W. **1978**. *Canadian Journal of Plant Science* 58: 1026 – 1034.
[11] Roemer, T. **1917**. Sind dies Ertragsreichen Shorten Ertragssichers? Mitt.DLG. 32: 87-89.
[12] Flores, F., Moreno, M.T. and Cubero, J.I. **1998**. *Field Crop Research*, 56: 271-286.
[13] Lin, C. S., Bins, M. R. and Lefcovitch, and L. P. **1986**. *Crop Science*, 26: 894-900.
[14] Shukla, G K. **1972**. *Heredity* 29: 237-245.
[15] Plasted, R. L., and Peterson, L. C. **1959**. *American Potato Journal* 36: 381-385.
[16] Ghazvini, H. and A.Yousefi. **1999**. *Journal of Agricultural Sciences* 1 (4): 29-41.
[17] Ansari M.Y, Jafarzadeh J, Vaezi B, Hossein-Pour T and Ghasemi M. **2005**. *Seed and Plant Journal*, Vol 25(2): 303-297.
[18] Dashtaki, M., A. Yazdan-Sepas, T. Najafi mirak, M. Ghanadha, R. Jokar, M. Eslampour, A. Moayedi, A. kocheki, M. Abedi Oskoei, Gh. Aminzadeh, R. Soltani and Sh. Ashouri. **2004**.
[19] Roustaei, M., SF. Hosseini., T. Hossein-Pour., M. Kalaneh and Gh. Khelalzadeh. **2004**. *Agricultural Sciences*. 35(2):427 – 436.