ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 62 109 Number 5, 2014

http://dx.doi.org/10.11118/actaun201462051049

STABILITY ANALYSIS OF DURUM WHEAT GENOTYPES BY REGRESSION PARAMETERES IN DRYLAND CONDITIONS

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Abstract

MOHAMMADI MOHTASHAM, SHARIFI PEYMAN, KARIMIZADEH RAHMATOLLAH. 2014. Stability Analysis of Durum Wheat Genotypes by Regression Parameteres in Dryland Conditions. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 62(5): 1049–1056.

The objectives of this study were to estimate genotype × environment (GE) interaction effects and to determine the stable durum wheat (*Triticum turgidum* var. durum Desf.) genotypes for grain yield in warm winter areas of Iran. Twenty durum wheat genotypes, including 18 experimental lines and two local checks were evaluated during three cropping seasons (2004–2006) at five research sites. The combined analysis of variance indicated that the main effects of location and genotype and interaction effects of genotype × year, genotype × location and genotype × year × location were highly significant for grain yield. GE interaction was analyzed using linear regression techniques. There was considerable variation for grain yield among both genotypes and environments. Stability was estimated using the Eberhart and Russell method. Stability analysis of grain yield in different environments showed that the variance of genotypes and genotypes × environment (linear) interactions were significant. Due to the stability analysis, genotype 12 (D68-1-93A-1A//Ruff/Fg/3/Mtl-5/4/Lahn) indicated relatively minimum value for S^2d and a b-value close to unity and hence, it may be considered stable for grain yield in all of the environments. The results showed that G10 (Bcr//Memo/goo) also favor for its stability in high yielding environments. The broad sense heritability was 77%, indicating selection should give a good response for grain yield.

Keywords: Durum wheat, grain yield, stability; genotype × environment (GE) interaction; heritability

INTRODUCTION

Durum wheat (*Triticum turgidum* L. subsp. durum Desf) is an important food crop. This kind of wheat is suitable for production of pasta and spaghetti due to some of its characteristics such as heavy gluten, non-sticky and heavy dough (Sissons, 2008). Developing crop cultivars with high grain yield has been the principal aim of durum wheat breeding programs worldwide.

The genotype × environment interactions have been studied in different methods such as estimation of variance components, regression stability parameters (Akura *et al.*, 2005). Stability analysis for some of crop characters such as earliness, yield and yield components are very important from the point of stable production. Different concepts and explanations of stability have been described by some of researchers (Lin *et al.*, 1986; Becker and Léon, 1988).

A genotype is considered to be stable if (i) its variance among the environments is small (static or a biological stability), (ii) its response to environments is parallel to the mean response of all genotypes in the experimental (dynamic or agronomic stability) or (iii) the residual mean square from the regression model on the environmental index is small (Lin *et al.*, 1986; Becker and Léon, 1988). According these three concepts of stability, several methods have been used to describe the responses of genotypes to environments. Parameters used to describe the first type of stability are coefficient of variability (*CVi*) (Francis and Kannenburg, 1978) for each genotype and the genotypic variances across environments (S^2i). A regression coefficient (bi) (Finlay and Wilkinson, 1963) and Shukla's (1972) stability variance (σ_i^2) used to estimate the second type stability. Third type of stability is also part of dynamic or agronomic stability (Becker and Léon, 1988). Methods of Eberhart and Russell (1966) and Perkins and Jinks (1968) are the methods to describe the third type of stability. Lin and Binns (1988) proposed type 4 stability concepts on the basis of predictable and unpredictable non-genetic variation. The predictable component related to locations and the unpredictable component related to years. They suggested the use of regression approach for the predictable portion and the mean square for years × locations for each genotype as a measure of the unpredictable variation.

Analytical methods for examining the total behavior of a genotype across the tested environments which consider both yield and stability components simultaneously could be desirable for identifying the high yielding and stable genotypes (Hernandez *et al.*, 1993; Kang, 1993; Bajpai and Prabhakaran, 2000).

Rasul *et al.* (2006) analyzed stability analysis of eighteen wheat genotypes for grain yield and revealed that only two wheat lines showed non-significant deviation from regression and their regression coefficient values were close to unity classified as stable varieties. Afzal Arain *et al.* (2011) was applied the regression analysis to estimate the grain yield stability parameters viz., regression coefficient (b) and deviation from regression coefficients (S^2_d) for each genotype and indicated wide adaptation and stability of performance of Msh-14 in all environments according to its regression coefficient (b) close to unity (0.86) and S^2_d close to zero (0.7923). Pompiliu *et al.* (2009) used coefficient of variation (CV%), the regression intercept(a), Ecovalence (W^2), regression slope (b) and Deviations from regression (S^2_d) for evaluation of fourteen Romanian winter wheat cultivars in 52 testing environments. Amin *et al.* (2005) evaluated grain yield stability of ten wheat genotypes under varied environments at nine locations by regression coefficients and deviations from regression. Mohammadi *et al.* (2012) used linear regression and deviations from the regression model for estimation of stability of twenty durum wheat genotypes in dryland conditions and determined the stable genotypes. Karimizadeh *et al.* (2012) considered stability parameters of twenty durum wheat genotypes in fifteen environments and indicated that genotype × environment interaction effects significantly influenced genotypes yield. The information generated by stability studies will be helpful for breeders to develop wheat genotypes which could produce higher and stable yields over diversified environments.

The current investigation was carried out evaluate the performance of durum wheat genotypes and to investigate their yield stability by several stability parameters across a range of environments over three consecutive years.

MATERIALS AND METHODS

Experimental Data

Twenty durum wheat genotypes, including 18 durum wheat lines selected from the joint project of Iran/ICARDA and two local checks (Seimareh and Koohdasht) were evaluated during three cropping seasons (2004–2006) at five research sites, representative of major durum wheat dryland areas of Iran. A list of durum wheat genotypes are given in Tab. I. The locations are: Ghachsaran in the southwest of Iran; Moghan in the northwest of Iran; Gonbad in the north of Iran; Khoram abad and Ilam in west of Iran. Altitude of testing sites varies from 45 to 1125 meter above from sea level. More descriptions of the experimental sites are given in Tab. II. The genotypes were grown in a randomized complete block design with four replications at each site. Plot size was 7.35 m^2, 6 rows with 7 m long, and 17.5 cm between rows. Where an area of 6.3 m^2 was harvested to estimate grain per plot and then converted to kg ha^{-1}. At harvest grain yield was determined for each genotype at each environments.

I: *Code, pedigree, and origin of 20 durum wheat genotypes used in this study*

Code	Pedigree/Name	Origin
G1	E90040/Mfowl13	ICARDA
G2	Srn1/Laru/3/Yav /Fgo//Roh/4/Lican	ICARDA
G3	Tantlo//Crex/Alla/3Tantlo	ICARDA
G4	Zegzag/Altar84//Dipper	ICARDA
G5	31-19-2-2	Iran
G6	18-18-1-4	Iran
G7	43-25-2-4	Iran
G8	Arislahn-4	ICARDA
G9	Lgt3/4/Bcr/3/Chi//Gta/Stk	ICARDA
G10	Bcr//Memo/goo	ICARDA
G11	Bcr//Memo/goo/3/Stjy	ICARDA
G12	D68-1-93A-1A//Ruff/Fg/3/Mtl-5/4/ Lahn	ICARDA
G13	Terbo 167-3	ICARDA
G14	Bcr//fg/snbipe/3/Gdovz 578/swan// Ddra2	ICARDA
G15	Fadda-98	ICARDA
G16	Villemur/3/Lahn//gs/stk/4/Dra2/Bcr	ICARDA
G17	Terbo 197-4	ICARDA
G18	Stj3//Bcr/LKS4	ICARDA
G19	Koohdasht (Check)	Iran
G20	Seimareh (Check)	Iran

II: *Name, latitude, longitude, altitude, precipitation and soil texture classes of Iranian durum wheat testing locations*

Locations	Code	Year	Coordinates	Altitude (m)	Rainfall (mm) a	Temperature b			Soil type	Climate c
						Max	Min	Annual average		
Gachsaran	E1	2004	50° 46' N; 50° 46' E	738	515.2	47.8	–0.6	18.9	Silty-clay-loam	HSA d
	E6	2005			570.6	44.6	–2.6	19.9		
	E11	2006			511.2	45.0	–1.6	18.6		
Khoramabad	E2	2004	33° 29' N; 48° 22' E	1,125	482.9	39.0	–7.0	13.4	Silty-clay-loam	MSR
	E7	2005			438.3	41.0	–6.0	14.1		
	E12	2006			658.1	40.0	–6.6	12.6		
Gonbad	E3	2004	37° 15' N; 55° 10' E	45	700.6	41.0	–3.0	15.3	Silty-clay-loam	MSR
	E8	2005				40.0	–2.0	15.5		
	E13	2006			456.8	40.4	–3.6	15.7		
Ilam	E4	2004	33° 38' N; 46° 25' E	973	591.2	40.4	–2.8	12.78	Clay-loam	HSA
	E9	2005			574.5	42.0	–0.4	17.2		
	E14	2006			470.3	41.0	–2.4	13.9		
Moghan	E5	2004	38° 44' N; 47° 01' E	100	256.7	35.0	–5.2	11.7	Clay-loam	MSR
	E10	2005			182.8	36.4	–4.8	15.1		
	E15	2006			173.7	37.0	–6.0	11.8		

a* – Precipitation from October to June.
b** – Temperature includes months form October to June.
c – According to Koppen classification system. The Koppen climate classification is one of the most widely used climate classification systems. It was developed by Wladimir Koppen, a Russian climatologist, around 1900 (with several further modifications by Köppen himself, notably in 1918 and 1936). It is based on the concept that native vegetation is the best expression of climate; thus, climate zone boundaries have been selected with vegetation distribution in mind. It combines average annual and monthly temperatures and precipitation, and the seasonality of precipitation (McKnight and Darrel 2000).
d – HSA: Hot and Semi-Arid; MSR: Mediterranean with Spring Rains.

The statistical model was given for experimental design is:

$$Y_{ijkl} = \mu + E_i + R(E)_{j(i)} + G_k + GE_{ik} + e_{ijk},$$

where
μ .... general mean,
E_i .... effect of i^{th} environment (i = 1, 2, …, 3),
$R(E)_{j(i)}$.... effect of j^{th} block within the i^{th} environment (j = 1, 2, 3, 4),
G_k .... effect of k^{th} genotype (I = 1, 2, …, 20),
GE_{ik} ...... effect of the interaction of the k^{th} genotype with the i^{th} environment,
e_{ijk}.......... experimental Error.

Statistical Procedures

Combined analysis of variance was done on grain yield that obtained from fifteen environments according to the Comstock and Moll (1963) Method. Three stability parameters were applied to assess stability performance of genotypes and to identify superior genotypes; bi, the linear regression of the phenotypic values on environmental index (Finlay and Wilkinson, 1963), S^2d, the deviation mean square from regression (Eberhart and Russell, 1966) and coefficient of determination (R^2).

All analysis was performed using the statistical package IRRISTAT 5 and PBSTAT.

RESULTS AND DISCUSSION

Partitioning sum of squares to its components revealed that year × location interactions caused 53.8% of total variation, 0.04% due to year, 21.85% due to location, 1.05% due to replication (year × location). Sum of squares for the genotype, genotype × year, genotype × location, genotype × year × location and error were low with 5.02%, 0.80%, 4.78%, 4.99% and 8.14%, respectively. This indicates the big influence of environmental effects on grain yield performance of durum wheat genotypes in five considered station. The equal proportion of genotype × year and genotype × year × location variance with genotypes main effect is an important consequence and indicating the significance of genotype × environmental interaction effects. The combined analysis of variance indicated that the main effects of location and genotype and interaction effects of genotype × year, genotype × location and genotype × year × location were all highly significant ($P < 0.01$) for grain yield (Tab. III). Karimizadeh *et al.* (2012) considered stability parameters of twenty durum wheat genotypes in fifteen environments and indicated that genotype × environment interaction effects significantly influenced genotypes yield.

Environment mean yield for all of the genotypes ranged from 617.04 kg/ha in E15 (Moghan, 2006) to 4488.54 kg/ha in E11 (Gachsaran, 2006).

III: *Analysis of variance (ANOVA) for grain yield of 20 durum wheat genotypes in 15 environments in Iran*

Source	DF	MS	Components of SS (%)
Year	2	359768.4ns	0.04
Location	4	93282853.1**	21.85
Y*L	8	113795859.2**	53.32
Replication (Y*L)	45	398874.9	1.05
Genotype	19	4510540.2**	5.02
Y*G	38	358062.1**	0.80
L*G	76	1074037.2**	4.78
Y*L*G	152	560861.1**	4.99
Error	855	162628	8.14
Coefficient of Variation		12.00691	

ns, not significant, * and ** significant at the 0.05 and 0.01 probability level, respectively

Stability analysis of grain yield in different environments indicated that the variance of genotypes and genotypes × environment (linear) interactions were significant at 1% probability, but mean squares of deviations from the regression was not significant for grain yield. It can be concluded that there was a clear linear relationship between grain yield and environmental indices (Tab. V).

The average yield across all of environments and some of stability parameters such as coefficient of regression (b) and deviation from regression (S^2di) were presented in Tab. VI. The highest grain yield was obtained from genotype 10, while the lowest grain yield was obtained from genotype 5. Thirteen genotypes (G1, G2, G3, G9, G10, G11, G12, G13, G14, G16, G17, G18 and G20) provided yields above the average yield. Pompiliu *et al.* (2009), Akura *et al.* (2005) and *Amin et al.* (2005) and Mohammadi *et al.* (2013) also found significant differences in grain yield of different wheat genotypes in response to different environmental conditions.

Based on Eberhart and Russel (1966) a stable cultivar had a regression coefficient equal or near the unity and low or near the zero deviation from regression mean square. The coefficient of regression (b) values for twenty genotypes used in this study ranged from 0.81 (G6) to 1.19 (G9) (Tab. VI). Regression values of unity are interpreted as average stability. The variations in b values proposed that the response of 20 genotypes is differed to the various environments. Variability among environments is a prominent factor and mostly determines the usefulness of b values (Mohammadi *et al.*, 2012). There was no genotype with b-values equal to unity, while the regression coefficient values for some of genotypes including G2, G3, G5, G7, G11, G12 and G16 were close to 1. Genotype 9 had the highest (1.19) regression coefficient, followed by G10 (1.16). The yields of these genotypes were higher than the other genotypes and significantly influenced by varying environmental conditions and yield of these genotypes increased when the environmental conditions were suitable and reduced to below average when the conditions were unsuitable. Genotype 4, G6, G8 and G12 had b-values lower than unity (Tab. VI).

The regression analysis as one of the important parameter which has been frequently employed by plant breeders for stability analysis, showed that there were wide ranges of deviations in genotypes. Deviation from regression for any of the genotypes were not equal to zero ($S^2d = 0$) and the range of this stability parameter varied from 38252 (G18) to 401914.2 (G5) (Tab. VI). The estimate of deviations from regressions suggests the degree of reliance that should be put to linear regression in interpretation of the data. If these values are significantly deviating from zero, the expected phenotype cannot be predicted significant. When deviations are not significant, the conclusion may be drawn by the joint consideration of mean yield and regression values (Finlay and Wilkinson, 1963 and Eberhart and Russell, 1966) given. Coefficient of regression for G3 (Tantlo//Crex/Alla/3/ Tantlo), by having a grain yield of 3371.53 kg/ha, is equal to unity (bi = 0.99) and also its deviation from regression is as small as possible ($S^2di = 76286.22$), therefore in studied areas it can be recommended for cultivation (Tab. VI). The other stable genotype for recommendation is G12 which its coefficient of regression is near the unity and deviation from regression is lower than the other genotypes (Tab. VI).

Genotype 10, which provided the highest grain yield (3810), had the high b (1.16) and S^2d (136982.97) values. Therefore, it is a genotype with below average stability and specifically adapted to favorable environments. Among the genotypes with regression coefficient values near to zero (G2, G3, G5, G7, G11, G12 and G16), regression coefficient value of G3, G5, G7 and G16 was near 1, but their mean yield was below the average grain yield (3359). The average value of grain yield of G2, G11 and G12 were higher than the average grain yield. The deviation from regression for G5 and G7 is high, whereas this parameter is low for G3 and G12. Hence, G12 appeared as a stable genotype based on the estimates of these two stability parameters, and well adapted to the all of environments (Tab. VI).

IV: *Grain yield (kg/ha) of 20 durum wheat genotypes in the three environmental conditions during 2004 to 2006 in Iran*

Genotype	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
G1	2895.49	4531.25	2758.33	2682.00	4134.67	5082.00	3433.33	3008.33	4168.75	2098.00	4505.37	4479.17	4018.75	3735.00	385.56
G2	2670.14	4689.58	3816.67	2856.50	3953.13	4395.00	3127.08	2868.75	4231.25	2318.75	4744.07	4935.42	4172.92	3180.00	501.12
G3	2854.86	4712.50	2529.17	2525.25	3858.27	4783.00	3070.83	2900.00	3726.25	2604.25	4295.22	4602.08	3464.58	3975.00	671.68
G4	2628.13	4787.50	2650.00	2628.25	4280.64	2460.00	3370.83	2900.00	2850.00	2766.75	4085.84	4755.83	3883.33	3603.75	520.01
G5	1962.15	3814.58	1406.25	2512.50	3329.09	4740.00	3075.00	2202.08	3460.00	1564.50	4489.23	2439.58	2379.17	4160.00	376.67
G6	2029.17	3495.83	1945.83	2500.25	3612.02	2798.00	3050.00	2910.42	3443.75	1579.75	3940.94	2502.08	4377.08	3656.25	376.12
G7	2106.25	3345.83	1870.83	2856.50	3633.27	4835.00	2977.08	1997.92	3138.75	1481.00	4841.59	2818.75	2762.50	3537.50	372.23
G8	2653.13	4570.83	2777.08	3181.50	4258.42	4460.00	3308.33	2477.08	3790.00	2568.50	4053.41	3768.75	3585.42	3958.75	653.35
G9	2621.53	6043.75	3256.25	2781.50	4475.78	4881.00	3462.50	2718.75	4162.50	2507.25	4755.84	4654.17	3941.67	4645.00	690.01
G10	2874.31	5658.33	2672.92	2753.25	5007.04	4617.00	3456.25	3035.42	4443.75	3002.75	4652.20	5097.92	4145.83	4945.00	787.24
G11	2718.75	5500.00	3185.42	2409.50	4306.06	4473.00	3745.83	3220.83	3500.00	2727.50	4499.94	4525.00	4210.42	3370.00	607.23
G12	2279.51	4895.83	3033.33	2719.00	4260.64	4568.00	3318.75	2606.25	3593.75	2240.50	4430.47	4300.00	3958.33	3570.00	736.13
G13	2603.47	4229.17	3085.42	2722.00	4200.78	5267.00	3331.25	2612.50	4100.00	2524.00	4904.62	4268.75	4175.00	4087.50	548.34
G14	2335.07	4512.50	2943.75	2656.25	3955.36	4430.00	2870.83	2704.17	4718.75	2414.75	4623.51	3968.75	3589.58	4866.25	497.79
G15	2580.90	3900.00	2972.92	2619.00	4278.28	4219.00	3029.17	2887.50	3345.00	2755.25	3961.84	4591.67	3602.08	3250.00	689.46
G16	2781.60	4677.08	2872.92	2959.50	4998.43	4526.00	3506.25	2843.75	3307.50	2782.25	4613.01	4570.83	4085.42	3413.75	748.90
G17	2462.85	5012.50	2879.17	2990.00	4704.12	4671.00	3025.00	2622.92	3956.25	2209.00	4405.91	4270.83	3710.42	3782.50	588.90
G18	2789.24	4600.00	3083.33	2568.75	4538.70	4623.00	3281.25	2900.00	4206.25	2655.75	4614.06	4885.42	4104.17	4170.00	773.35
G19	2998.96	3818.75	3672.92	2028.25	4384.95	4585.00	2885.42	2304.17	3856.25	2200.75	4794.72	2864.58	4343.75	3617.50	1091.69
G20	2657.99	3502.08	3181.25	2878.25	4575.65	4787.00	3566.67	2868.75	4057.50	2703.00	4559.05	4347.92	3818.75	3581.25	725.01
Mean	2575.17	4514.90	2829.69	2691.40	4237.27	4460.00	3244.58	2729.48	3802.81	2385.21	4488.54	4132.38	3816.46	3855.25	617.04
LSD5%	238.06	1201.6	616.82	619.56	480.26	410.98	475.94	387.47	723.73	400.2	484.02	656.15	514.75	425.02	235.61

V: *Regression Analysis of variance*

Source	df	MS
Environment	14	22946200
Genotype	19	1123500
E*G	266	189626**
E*G lin	19	460702**
E*G dev	247	168774ns
Error	855	157,678.8805

ns, not significant, * and ** significant at the 0.05 and 0.01 probability level, respectively

The deviation from regression for G3 is also low and because of low value of genotypic mean, this genotype is an intermediate stable and poorly adapted to all environments. A desirable genotype with stability and above average grain yield should have a regression line with a positive intercept and slope equal to 1.0 (Eberhart and Russel, 1966). Mohammadi *et al.* (2012) used linear regression and deviations from the regression model for estimation of stability of twenty durum wheat genotypes in dryland conditions and determined the stable genotypes.

However, according to Eberhart and Russell (1966), an ideal genotype would have both a high average performance over a wide range of environments and stability. Therefore, the genotypes including G3 and G12 are as stable cultivars.

Coefficient of determination ranged from 0.01 to 28.39% (Tab. VI). The coefficient of determination of some durum wheat genotypes was very small. This was possibly due to evaluating in quite different locations. Genotypes 9 and 10 were the most stable for grain yield, because their high coefficient of determination conform their stability.

Heritability of a trait is important for plant breeders, because it reflects its response to selection. The broad sense heritability (phenotypic variance due to genetic variability) was 77% (Tab. VII), indicating genotype plays a significant role in the expression of the phenotype and selection should give a good response.

The important purpose for breeders is to find genotypes with good and stable not only for end users, but also to provide parents in the future

VI: *Mean grain yields and estimates of stability parameters for yield of 20 durum wheat genotypes in the three environmental conditions during 2004 to 2006 in Iran*

Genotype	Yield	(b) ± s.e (b)	S^2di	R^2(%)
G1	3461.07	1.10 ± 0.06	160736.97	18.00
G2	3497.36	1.03 ± 0.11	181131.52	0.01
G3	3371.53	0.99 ± 0.07	76286.22	0.01
G4	3211.39	0.85 ± 0.16	395095.66	7.03
G5	2794.05	0.99 ± 0.16	401914.16	0.02
G6	2814.50	0.81 ± 0.15	346085.53	11.06
G7	2838.33	0.99 ± 0.14	304748.47	0.01
G8	3337.64	0.92 ± 0.06	49176.30	13.28
G9	**3706.50**	**1.19 ± 0.09**	117868.48	28.39
G10	**3809.95**	**1.16 ± 0.06**	136982.97	19.01
G11	3533.30	1.03 ± 0.10	151717.20	1.01
G12	3367.37	1.03 ± 0.05	38842.45	3.11
G13	3510.65	1.09 ± 0.06	63944.04	14.12
G14	3405.82	1.07 ± 0.10	166349.36	3.14
G15	3245.47	0.85 ± 0.08	94016.13	23.87
G16	3512.48	0.99 ± 0.08	103658.05	0.05
G17	3419.42	1.09 ± 0.05	45475.95	17.06
G18	3586.22	1.04 ± 0.05	38252.00	6.57
G19	3296.51	0.87 ± 0.14	315989.88	7.81
G20	3454.01	0.91 ± 0.09	121721.95	7.82
Min	2794.05	0.81	38252	0.01
Max	3809.95	1.19	401914.2	28.39

bi: regression coefficient; **S^2di**: mean square deviation from regression line; R^2: coefficient of determination.

VII: *Estimation of Broad Sense Heritability*

Variable	V_G	V_{GxM}	V_{GxL}	V_{GxMxL}	V_P	h^2_{bs} (%)
Yield	60408.26	0.00	42437.70	101028.97	78259.05	77.19

breeding programs. The results of this study indicated that grain yield was significantly influenced by changes in environmental conditions because there were significant variations in grain yields of the genotypes were tested in response to the environment. None of the genotypes evaluated was perfectly stable in all of the environments due to lack of b value equal to unity. However, G12 (D68-1-93A-1A//Ruff/Fg/3/Mtl-5/4/Lahn) indicated relatively minimum value for Sd^2 and a b-value close to unity and hence, it may be considered stable genotype for this character in all of the environments. The above stability parameters also favor G10 (Bcr//Memo/goo) for its stability in high yielding environments. The coefficient of determination of this wheat genotype were also confirmed their stability.

SUMMARY

Durum wheat (Triticum turgidum L. subsp. durum Desf) is an important food crop. Stability analysis for some of crop characters such as earliness, yield and yield components are very important from the point of stable production. The current investigation was carried out evaluate the performance of durum wheat genotypes and to investigate their yield stability by several stability parameters across a range of environments over three consecutive years. Twenty durum wheat genotypes, including 18 durum wheat lines selected from the joint project of Iran/ICARDA and two local checks (Seimareh and Koohdasht) were evaluated during three cropping seasons (2004–2006) at five research sites, representative of major durum wheat dryland areas of Iran. Three stability parameters were applied to assess stability performance of genotypes and to identify superior genotypes; bi, the linear regression of the phenotypic values on environmental index, S^2d, the deviation mean square from regression and coefficient of determination. Partitioning sum of squares to its components revealed that year × location interactions caused 53.8% of total variation, 0.04% due to year, 21.85% due to location, 1.05% due to replication (year × location). The results indicate the big influence of environmental effects on grain yield performance of durum wheat genotypes in five considered station. Environment mean yield for all of the genotypes ranged from 617.04 kg/ha in E15 (Moghan, 2006) to 4488.54 kg/ha in E11 (Gachsaran, 2006). Coefficient of regression for G3 (Tantlo//Crex/Alla/3/ Tantlo), by having a grain yield of 3371.53 kg/ha, is equal to unity (bi = 0.99) and also its deviation from regression is as small as possible (S^2di = 76286.22), therefore in studied areas it can be recommended for cultivation (Table VI). The other stable genotype for recommendation is G12 which its coefficient of regression is near the unity and deviation from regression is lower than the other genotypes. The above stability parameters also favor G10 (Bcr//Memo/goo) for its stability in high yielding environments. The coefficient of determination of this wheat genotype were also confirmed their stability.

Acknowledgement

The authors are grateful for the support provided by Dry Land Agricultural Research Institute of Iran. Sincere gratitude goes to other colleagues in the other Agricultural Research Stations (Khorram-Abad, Moghan, Ilam and Gonbad) for their technical assistance.

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