

(1) (1) (1)

2006/2005

24

19

2007/2006

(/ 350-250)

Crossover

GS

GE

GLS

(Static Stability)

(Dynamic Stability)

(Yield Reliability)

(Yield Reliability)

:

(1)

113

...

Genotype by Environment Interaction and Yield Stability of Cultivars and Promising Lines of Barley over Diverse Syrian Environments

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ABSTRACT

Twenty four genotypes were tested for grain yield in four diverse locations over two seasons i.e. 2005-06 and 2006-07. The genetic material contained 19 promising lines and five checks representing the local and improved cultivars for Zoon B (250-350 mm/year) in Syria. The results showed the significant role of the genotype by environment interaction of crossover type in the performance of the genotypes studied and their ranking across test environments. The largest portion of the variance due to GE interaction was attributed to genotype by season GS and Genotype by location by season GLS interactions which revealed the importance of selection for yield stability in addition to average yield across environments. Yield Stability of type1 (Static Stability) and type2 (Dynamic Stability) were estimated for the genotypes studied. And since both types of stability can be combined with either high or low grain yield, selection for yield reliability was done to combine stability and high yield. The best genotypes in terms of type1 stability had the lowest yields which assures that this type of stability is not useful when the yield testing is conducted over highly variable environments. While some lines had superior ranks for both average yield over environments and type2 yield stability in addition to their superiority over released checks in terms of the sum of both former ranks (Yield reliability) which reveals the importance of these lines to reach varieties that combine relatively good yield in drought conditions and responsiveness to improved agronomic conditions with high yield in favorable environments.

Key Words: Genotype by Environment Interaction, Yield Stability, Yield Reliability, Barley Cultivars, Selection.

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Ceccarelli *et al.*, (1991) (Oosterom *et al.*, 1993 a)
/ 32 / 1562

genotype by environment interaction (GE)

Crossover) GE GE (qualitative)
(Baker, 1988) (GE

(Voltas *et al.*, 2002)

(Ceccarelli, 1994)

Oosterom *et al.*, (1993 b)

20/1 %5 Ceccarelli, (1994)
/ 3

× (genotype-season (GS)) ×
(genotype-location-season (GLS)) × GE
(Voltas *et al.*, 2002; Annicchiarico, 1997)
GE Annicchiarico, (2002)

(Static Stability)
 (Dynamic Stability)

GE

24

2007/2006-2006/2005

19-1

.2005/2004

(24-20)

350-250)

4 2

.(/

() ()

.(1)

() ()

2006/2005

(1)

.2007/2006

1/6	1/7	12/21	12/11	12/26	12/24	12/25	12/1	
140	170	264	203	228	227	230	255	()
-	-	19	1	24	17	24	2	⁽¹⁾ >
-	-	19	1	-	17	20	21	⁽²⁾ 30<

(1)

(2)

30

(0.25 2.5
/ 50

6) ² 3.75
(² 2.5)

40.14

P2O5 40.14

Genstat7

(one way ANOVA in randomized blocks)

) × × (Combined ANOVA)
 (GL, GS, GLS) (GE) (GE × ×

(Static Stability)

$$S_i^2 = \sum_j (R_{ij} - m_i)^2 / (e - 1) \quad (\text{Francis and Kannenberg, 1968})$$

:Si²
 :Rij
 :mi
 :e

$$(S_i^2 = 0)$$

: (Dynamic Stability)

$$W_i^2 = \sum_j (R_{ij} - m_i - m_j + m)^2 \quad (\text{Annicchiarico, 2002})$$

(Stability Variance) :Wi²
 j :mj
 .(Grand Mean) :m

$$(W_i^2 = 0)$$

Kang and pham, (Yield Reliability)
 (Rank-sum Method) (1991)

.(Yield Reliability)

(× 4) (2)
 2006/2005

11

2007/2006

13

2006/2005

2006/2005

2007/2006

4 ()

(Crossover)

(S) (L) (G)
 (GL, GS, GLS)
 () × × ()
 (LS)

(GL, GS, GLS)

%194

GL

%389

GLS GS

.(4)

GL

GLS GS

.GLS GS GL G (4)

21738	1538400**	23	
42103	544706**	69	×
39323	764076**	23	×
45285	292085**	69	× ×
-	156228	380	

...

(Static Stability)

4

(S²)

17

Kang and pham,

(1991)

(Yield Reliability)

(3 5 8 23 4)

(5)

17 20 22 24 23

(5)

	/			
6	3072	17	1620960	1
11	2979	11	1118548	2
17	2728	5	836022.4	3
23	2411	1	365547.9	4
20	2638	4	718961.9	5
12	2967	14	1385728	6
18	2728	13	1376976	7
22	2549	3	697646.9	8
19	2681	7	1058903	9
13	2927	22	1939087	10
1	3343	20	1787726	11
14	2910	18	1674324	12
2	3143	21	1927740	13
16	2797	9	1091442	14
15	2907	16	1601992	15
5	3077	23	2013488	16
10	2991	24	2216540	17
7	3033	19	1736103	18
8	2994	8	1063452	19
21	2566	10	1115074	20
3	3132	6	1034804	21
4	3103	12	1186834	22
24	2296	2	616732.7	23
9	2994	15	1450626	24
	224			LSD 5%

(Dynamic Stability)

(Stability Variance W^2)

(20)

24 2 19 1 6

12

8 7 6 5 3

9 11 8 6 12

13

6 19 1

(6)

			/			
1	11	6	3072	5	380352	1
8	18	11	2979	7	429642	2
20	34	17	2728	17	1060616	3
23	45	23	2411	22	2062002	4
17	29	20	2638	9	679120	5
3	15	12	2967	3	299176	6
22	39	18	2728	21	1910916	7
19	33	22	2549	11	878467	8
12	23	19	2681	4	316405	9
15	25	13	2927	12	894025	10
4	16	1	3343	15	991740	11
21	38	14	2910	24	3266862	12
10	21	2	3143	19	1224202	13
9	18	16	2797	2	262963	14
16	25	15	2907	10	844005	15
13	23	5	3077	18	1105158	16
18	30	10	2991	20	1734654	17
14	23	7	3033	16	1054274	18
2	14	8	2994	6	387195	19
11	22	21	2566	1	192455	20
5	17	3	3132	14	968824	21
6	17	4	3103	13	920542	22
24	47	24	2296	23	2571820	23
7	17	9	2994	8	670737	24

(Genotype × Environment interaction)

(Singh *et al.*, 2006) () ()
(GE)
(Qualitative or Cross-over GE) (3)

(Genotype) (Phenotype)

)

(Voltas *et al.*, 2002 ; Annicchiarico, 2002 ; Romagosa and Fox, 1993
(Singh *et al.*, 2006; Trethowan *et al.*, 2005;

G

(%43) GE
(Trethowan *et al.*, 2005)

GE
%233

(Annicchiarico, 2002) GLS GS GL GE
GL
(Specific Adaptation) GE
GE (Mega-environments)

(Specific Recommendation)

GLS GS
Crossover GE

(Trethowan *et al.*, 2005; Voltas *et al.*, 2002)

GLS GS
GL (%389)
(%194)
(GLS GS)
(Annicchiarico, 2002) (> 150%)
(Static)
low) Sensitivity (Dynamic) (sensitivity = high stability
Responsiveness
GE

GE
Simmonds, 1991; Lin *et al.*, 1986;) (Annicchiarico, 2002; Cleveland, 2001; Romagosa and Fox, 1993;

(Lin *et al.*, 1986) ;(Annicchiarico, 2002)

2 (Yield Potential) 11 6 19 1 (Yield Reliability) 4

...

GE

Crossover

.()

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