

()

(*Hordeum vulgare* L.)

*

(// : // :)

()

° c

%

(Sprouting Index)

(Sprouting Score)

Archive of SID

(Stanch, 1983)

.(Noormohammadi et al., 1999)

.(Debeaujon & Koorneef, 2000)

.(Fretzdorff & Betsche, 1998)

1. after-ripening

E-mail: tavakkol@ut.ac.ir

:

:

*

(Gomez & Zentella, 2001)

(PHS)

(Sorrells, 2002)

(*Hordeum vulgare* L.)

(Przul et al., 1998)

(Stanch, 1983)

(Strand, 1989)

2,4-D

(Gomez & Zentella, 2001)

(Zadoks et al., 1974)

(Veronica Rodrigues et al., 2001)

-
1. Pre-harvest Sprouting
 2. Viability

...

:

Arcsin

() () %

()

(LSD)

/

(1994) Clark et al.
(1995) Hucl

)
(

()

Excel 2003 SPSS Minitab MSTATC

()

n
(Tavakol Afshari & Yazdi
.Samadi, 2000)

= [(50-n) × 2]/100

(/)

()

%

%

)

(

/ / /

/ /

-
1. Sprouting Score
 2. Sprouting Index

%

/

()

/ /

()

(Gomez & Zentella, 2001)

(1994) Clark et al.

()

(Z)

(Tavakol Afshari & Yazdi

(Ward)

.Samadi, 2000)

(Z)

(Ward)

()

()

(MS)

(° c)

(S.O.V.)

/ ns / ns / * / ns / ns

/ ** / ** / ** / ** / **

()

/ / / / /

% / % / % / % / % /

(%CV)

/ /

** * ns

...

:

()	°c	()	()				
/	/	/	/	/	/	/	CGN00002
/	/	/	/	/	/	/	CGN00047
/	/	/	/	/	/	/	CGN00064
/	/	/	/	/	/	/	CGN00176
/	/	/	/	/	/	/	CGN00341
/	/	/	/	/	/	/	CGN00495
/	/	/	/	/	/	/	CGN00508
/	/	/	/	/	/	/	CGN00537
/	/	/	/	/	/	/	CGN00588
/	/	/	/	/	/	/	CGN00589
/	/	/	/	/	/	/	CGN00599
/	/	/	/	/	/	/	CGN00614
/	/	/	/	/	/	/	CGN00628
/	/	/	/	/	/	/	CGN00651
/	/	/	/	/	/	/	CGN00683
/	/	/	/	/	/	/	CGN00710
/	/	/	/	/	/	/	CGN00711
/	/	/	/	/	/	/	CGN00715
/	/	/	/	/	/	/	CGN00720
/	/	/	/	/	/	/	CGN00737
/	/	/	/	/	/	/	CGN00877
/	/	/	/	/	/	/	CGN00914
/	/	/	/	/	/	/	CGN00962
/	/	/	/	/	/	/	CGN00970
/	/	/	/	/	/	/	CGN00982
/	/	/	/	/	/	/	CGN01023
/	/	/	/	/	/	/	CGN01024
/	/	/	/	/	/	/	CGN01058
/	/	/	/	/	/	/	CGN01081
/	/	/	/	/	/	/	CGN01088
/	/	/	/	/	/	/	CGN01120
/	/	/	/	/	/	/	CGN01163
/	/	/	/	/	/	/	CGN01196
/	/	/	/	/	/	/	CGN01209
/	/	/	/	/	/	/	CGN01214
/	/	/	/	/	/	/	CGN01215
/	/	/	/	/	/	/	CGN01271
/	/	/	/	/	/	/	CGN01286
/	/	/	/	/	/	/	CGN01288
/	/	/	/	/	/	/	CGN01350
/	/	/	/	/	/	/	CGN01461
/	/	/	/	/	/	/	CGN01643
/	/	/	/	/	/	/	CGN01648
/	/	/	/	/	/	/	CGN01657
/	/	/	/	/	/	/	CGN01685
/	/	/	/	/	/	/	CGN01689
/	/	/	/	/	/	/	CGN01924
/	/	/	/	/	/	/	CGN02234
/	/	/	/	/	/	/	CGN02242
/	/	/	/	/	/	/	CGN02249
/	/	/	/	/	/	/	CGN02255
/	/	/	/	/	/	/	CGN02257
/	/	/	/	/	/	/	CGN02265
/	/	/	/	/	/	/	CGN02266
/	/	/	/	/	/	/	CGN02271
/	/	/	/	/	/	/	CGN02274
/	/	/	/	/	/	/	CGN02554
/	/	/	/	/	/	/	

LSD

Archive of SID

c

(/)

%

() % /

(/)

%

()

(Debeaujon & Koorneef, 2000)

(2002) Tavakol Afshari & Hucl

(Ward)

(Z)

Archive of SID

(1998) Caddick & Shelton

)

(%)

(1986) Baskin & Baskin

genotype	Num	0	5	10	15	20	25
CGN01286	38	↓					
و الفجر	59	↓					
CGN00914	22	↓					
CGN01024	27	↓					
CGN02234	48	↓					
گرگان	58	↓					
CGN00002	1	↓	↓	↓	↓	↓	↓
CGN01924	47	↓	↔				
CGN01058	28	↓	↔				
CGN02257	52	↓	↔				
CGN01271	37	↓	↔				
CGN02258	51	↓	↔	↓	↓	↓	↓
CGN00970	24	↓	↔	↔			
CGN00982	25	↓	↔	↔			
CGN00962	23	↓	↔	↔			
CGN00508	7	↓	↔	↔			
CGN02271	55	↓	↔	↔			
CGN01023	26	↓	↔	↓	↓	↓	↓
CGN02249	50	↓	↔			↔	
CGN02266	54	↓	↔	↔		↔	
CGN00877	21	↓	↔	↔		↔	
CGN01215	36	↓	↔	↔		↔	
CGN00683	15	↓	↔	↔		↔	
CGN00737	20	↓	↔	↔	↔		
CGN02265	53	↓				↔	
CGN00710	16	↓				↓	↓
CGN00495	6	↓				↔	↔
CGN00711	17	↓				↔	↔
CGN00047	2	↓				↔	↔
CGN01689	46	↓				↔	↔
CGN01088	30	↓				↔	↔
CGN01120	31	↓				↔	↔
CGN00341	5	↓				↔	↔
CGN01648	43	↓	↔	↔	↔	↔	↔
CGN02554	57	↓					↔
CGN01685	45	↓					↔
CGN02242	49	↓					↔
CGN00651	14	↓					↔
CGN01643	42	↓					↔
CGN01657	44	↓					↔
CGN01081	29	↓					↔
CGN01163	32	↓					↔
CGN00720	19	↓					↔
CGN01288	39	↓					↔
CGN00588	9	↓					↔
CGN01214	35	↓					↔
CGN00537	8	↓	↓	↓	↓	↓	↔
CGN00614	12	↓	↔				↔
CGN01350	40	↓	↔				↔
CGN00628	13	↓	↔				↔
CGN00589					10		↔
CGN00715	18	↓	↔				
CGN02274	56	↓	↔				
CGN01461	41	↓	↔				
CGN01196	33	↓	↓	↓	↓	↓	
CGN01209	34	↓					
CGN00064	3	↓					
CGN00599	11	↓					
CGN00176	4	↓					

Genotype	Num	0	5	10	15	20	25
CGN01234	48	↓↘					
CGN02257	52	↓□					
CGN005087	7	↓↘↓↘					
CGN02249	50	↓□ ↔					
CGN01081	29	↓□ ↔					
CGN02266	54	↓↘ ↔					
CGN00711	17	↓↘ □↓↓↓↓↓↓↓↓↓					
CGN01286	38	↓□ ↔	↔				
CGN00737	20	↓□ ↔	↔				
CGN02265	53	↓□ ↔	↔				
والفجر	59	↓↘↓↘	□↓↓↓↓↓↓↓↓↓↓				
CGN01271	37	↓□	↔	↔			
CGN00914	22	↓↘	↔	↔			
CGN01288	39	↓↘	↔	↔			
CGN01924	47	↓□	↔	↔			
CGN01088	30	↓↘↓↓↓↓↓↓↓↓↓↘			↔		
CGN02242	49	↓□			↔		
CGN01058	28	↓□			↔		
CGN01163	32	↓□			↔		
CGN01689	46	↓□			↔		
CGN00047	2	↓□			□↓↓↓↓↓↓↓↓↓↓		
CGN01120	31	↓↘			↔		↔
CGN00176	4	↓↘			↔		↔
CGN00599	11	↓□			↔		↔
CGN00715	18	↓□			↔		↔
CGN01209	34	↓↘↓↓↓↘			↔		↔
CGN00614	12	↓□ ↔			↔		↔
CGN01350	40	↓□ ↔			↔		↔
CGN00628	13	↓□ ↔			↔		↔
CGN00588	9	↓□ ↔			↔		↔
CGN01214	35	↓□ ↔			↔		↔
CGN00537	8	↓↘ □↓↓↓↓↓↓↓↓↓					↔
CGN00683	15	↓↘ ↔					↔
گرگان	58	↓□ ↔					↔
CGN00599	56	↓□ ↔					↔
CGN01196	33	↓□ ↔					↔
CGN01215	36	↓□ ↔					↔
CGN00064	3	↓↘↓↓↓↘					↔
CGN00002	1	↓□					↔
CGN00877	21	↓□					↔
CGN00710	16	↓□					↔
CGN01461	41	↓□					↔
CGN01023	26	↓□					↔
CGN02265	51	↓□					↔
CGN00495	6	↓□					↔
CGN00589	10	↓↘					↔
CGN00970	24	↓↘					↔
CGN01657	44	↓□					↔
CGN01648	43	↓□					↔
CGN00720	19	↓↘↓↘					↔
CGN00982	25	↓□ ↔					↔
CGN02271	55	↓□ ↔					↔
CGN01024					27		↘↗
CGN00962	23	↓↘ ↔					
CGN01685	45	↓□ ↔					
CGN00341	5	↓□ ↔					
CGN00651	14	↓↘↓↘					
CGN01643	42	↓□					
CGN02554	57	↓↘					

...

:

genotype	Num	0	5	10	15	20	25
CGN00508	7	↓↘					
والفجر	59	↓□					
CGN00002	1	↓□					
CGN00683	15	↓□					
CGN02257	52	↓□					
CGN00914	22	↓↕↓↘					
CGN02249	50	↓□ ↔					
CGN01081	30	↓□ ↔					
CGN01286	38	↓□ □↓↓↓↓↓↓↓↓↓↓↓↘					
CGN01023	26	↓□ ↔		↔			
CGN01214	35	↓↘ ↔		↔			
CGN00970	24	↓↘ ↔		↔			
CGN01058	28	↓↕↓↘		↔			
CGN02255	51	↓□		↔			
CGN02266	54	↓□		↔			
CGN00982	25	↓□		↔			
CGN02234	48	↓□	□↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↘				
CGN01081	29	↓↘		↔			↔
CGN00495	6	↓↘		↔			↔
CGN00737	20	↓□		↔			↔
CGN01461	41	↓↕↓↘		↔			↔
CGN02274	56	↓□ ↔		↔			↔
CGN00064	3	↓□ ↔		↔			↔
CGN00962	23	↓□ ↔		↔			↔
CGN00877	21	↓↘ ↔		↔			↔
CGN01350	40	↓↘ □↓↓↓↓↓↓↓↓↓↓↓↘					↔
گرگان	58	↓□ ↔					↔
CGN00537	8	↓□ ↔					↔
CGN00715	18	↓□ ↔					↔
CGN01209	34	↓□ ↔					↔
CGN00599	11	↓↕↓↘					↔
CGN00628	13	↓□					↔
CGN00710	16	↓□					↔
CGN01196	33	↓□					↔
CGN00589	10	↓□					↔
CGN00614	12	↓↘					↔
CGN01024	27	↓↘					↔
CGN01120	31	↓□					↔
CGN00720	19	↓□					↔
CGN01643	42	↓↕↓↓↓↓↓↓↓↓↓↓↓↘					↔
CGN01685	45	↓□		↔			↔
CGN00651	14	↓□		↔			↔
CGN01657	44	↓□		↔			↔
CGN02554	57	↓□		↔			↔
CGN01648	43	↓□	□↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↘				↔
CGN01689	46	↓↘		↔			↔
CGN00341	5	↓↘		↔			↔
CGN02271	55	↓↕↓↘		↔			↔
CGN00176	4	↓□ ↔		↔			↔
CGN00588	9	↓□ ↔		↔			↔
CGN00711	17	↓↘ □↓↓↓↓↓↓↓↓↓↓↓↘					↔
CGN01288	39	↓↘ ↔					↔
CGN02265	53	↓□ ↔					↔
CGN01163	32	↓□ ↔					↔
CGN01924	47	↓↕↓↘					↔
CGN02242	49	↓□					↔
CGN00047	2	↓□					↔
CGN01215	36	↓□					↔
CGN001271	37	↓↘					↔

(MS)							(df)	S.O.V.
/ **	/ **	/ *	/ ns	/ ns	/ *	/ ns		
/ **	/ **	/ **	/ **	/ **	/ **	**	()	
/	/	/	/	/	/	/		
% /	% /	% /	% /	% /	% /	% /	(CV%)	
							** * ns	

($r = / **$ $r = / **$)

()

Veronica Rodrigues et al. (2000) Eira & Caldas
 (2001) Gomez & Zentella (2001)
 (2001) Gomez & Zentella

(2001) Romagosa et al. .

(2002) Tavakol Afshari & Hucl

($r = / **$)

(2000) Eira & Caldas
 (ABA)

(% <)

(1998) Fretzdorff & Betsche

($r = / **$)

(2000) Debeaujon & Koorneef

($r = / **$ $r = / **$)

(ABA)

()

Przul et al. (1998) Fretzdorff & Betsche

Tavakol Afshari & Hucl (2002) Sorrells (1998)

()

(2002)

Veronica Rodrigues et al.

(2001)

...

:

/				/	/	/	CGN00002
/	/	/	/	/	/	/	CGN00064
/	/	/	/	/	/	/	CGN00495
/	/	/	/	/	/	/	CGN00508
/	/	/	/	/	/	/	CGN00537
/	/	/	/	/	/	/	CGN00589
/	/	/	/	/	/	/	CGN00599
/	/	/	/	/	/	/	CGN00614
/	/	/	/	/	/	/	CGN00628
/	/	/	/	/	/	/	CGN00683
/	/	/	/	/	/	/	CGN00710
/	/	/	/	/	/	/	CGN00715
/	/	/	/	/	/	/	CGN00737
/	/	/	/	/	/	/	CGN00877
/	/	/	/	/	/	/	CGN00914
/	/	/	/	/	/	/	CGN00962
/	/	/	/	/	/	/	CGN00970
/	/	/	/	/	/	/	CGN00982
/	/	/	/	/	/	/	CGN01023
/	/	/	/	/	/	/	CGN01058
/	/	/	/	/	/	/	CGN01081
/	/	/	/	/	/	/	CGN01088
/	/	/	/	/	/	/	CGN01196
/	/	/	/	/	/	/	CGN01209
/	/	/	/	/	/	/	CGN01214
/	/	/	/	/	/	/	CGN01215
/	/	/	/	/	/	/	CGN01271
/	/	/	/	/	/	/	CGN01286
/	/	/	/	/	/	/	CGN01350
/	/	/	/	/	/	/	CGN01461
/	/	/	/	/	/	/	CGN02234
/	/	/	/	/	/	/	CGN02249
/	/	/	/	/	/	/	CGN02255
/	/	/	/	/	/	/	CGN02257
/	/	/	/	/	/	/	CGN02266
/	/	/	/	/	/	/	CGN02274
/	/	/	/	/	/	/	
/	/	/	/	/	/	/	LSD

x6	x5	x4	x3	x2	x1	
						x1
					/ **	x2
				/ ns	/ ns	x3
			/ **	/ ns	/ ns	x4
	/ ns	/ ns	/ **	/ **	/ **	x5
/ **	/ ns	/ ns	/ *	/ *	/ *	x6

** * ns

REFERENCES

1. Baskin, J. M. & Baskin, C. C. (1986). Temperature requirements for after-ripening in seeds of nine winter annuals. *Weed Research*, 26, 375-380.
2. Caddick, L. P. & Shelton, S. P. (1998). *Effect of cooling on the recovery from dormancy in Australian malting barley*. Australian Postharvest Technical Conference. pp: 338-344.
3. Clark, J. M., Depauw, R. M., Grant Mcleod, J. & McCaig, T. N. (1994). Variation for pre-harvest sprouting resistance in durum wheat. *Crop Science*, 34, 1632-1635.
4. Debeaujon, L. & Koorneef, M. (2000). Gibberellin requirement for Arabidopsis seed germination is determined both by testa characteristics and embryonic abscisic acid. *Plant Physiology*, 122, 415-424.
5. Eira, M. T. S. & Caldas, L. S. (2000). Seed dormancy and germination as concurrent processes. *R. Bras. Fisiol. Veg.*, 12, 85-104.
6. Fretzdorff, B. & Betsche, D. (1998). Is oxalate oxidase indicative of pre-harvest sprouting related deterioration of cereal grains? 8th Int. Symp on Pre-harvest Sprouting Cereals. pp: 119-122.
7. Gomez, A. C. & Zentella, R. (2001). Gibberellin/Abscisic acid antagonism in barley aleurone cells: Site of action of the protein kinase PKABA1 in relation to gibberellin signaling molecules. *Plant Cell*, 13, 667-679.
8. Hucl, P. (1995). Divergent selection for sprouting resistance in spring wheat. *Plant Breeding*, 114, 199-204.
9. Noormohammadi, G., Siadat, S. A. & Kashani, A. (1999). *Cereal Agronomy*. First edition. Chamran University Press. Ahwaz. 411p. (In Farsi).
10. Przul, J. N., Momcilovic, V. & Mladenov, N. (1998). *Resistance of two-rowed barley to pre-harvest sprouting*. 8th Int. Symp on Pre-harvest Sprouting in Cereals. pp: 169-179.
11. Romagosa, I., Parada, D., Moralejo, M. A., Sopena, A., Munoz, P., Casas, A. M., Swanston, J. S. & Molinacano, J. L. (2001). Dormancy, ABA content and sensitivity of a barley mutant to ABA application during seed development and after-ripening. *Journal of Experimental Botany*, 52, 1499-1506.
12. Sorrells, M. (2002). Quality traits of pre-harvest sprouting tolerance (PHS). *Journal of American Society Brewing and Chemistry*, 62, 156-167.
13. Stanch, N. (1983). *Effect of temperature and rainfall on seed dormancy of small grain cultivars*. 3rd Int. Symp. on Pre-harvest Sprouting in Cereals. pp: 260-266.
14. Strand, E. (1989). A seed dormancy index for selection of cultivars of cereals resistance to pre-harvest sprouting. *Cereals Research Communications*, 8, 219-223.
15. Tavakkol Afshari, R. & Yazdi Samadi, B. (2000). *Evaluation of two screening methods for preharvest sprouting methods*. Academy of Science, Islamic Republic of Iran. 371-381. (In Farsi).
16. Tavakkol-Afshari, R. & Hucl, P. (2002). Variation of seed dormancy and after-ripening in tetraploid wheat (*Triticum durum*, *T. turgidum*, *T. turanicum*, *T. carthlicum*, *T. polonicum*). *Journal of Agricultural Science and Technology*, 4, 23-36. (In Farsi).
17. Veronica Rodrigues, M., Margineda, M., Insausti, P. & Benech, R. L. (2001). Predicting pre-harvest sprouting susceptibility in barley. (A model based on temperature during grain filling). *Agronomy Journal*, 93, 1071-1079.
18. Zadoks, J. C., Chang, T. T. & Konzak, C. F. (1974). A decimal code for the growth stages of cereals. *Weed Research*, 14, 415-421.