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International Journal of Recent Scientific Research
Vol. 4, Issue, 10, pp.1638-1644, October, 2013

ISSN: 0976-3031

International Journal of Recent Scientific Research

RESEARCH ARTICLE

EVALUATION THE EFFECT OF PLANTING DATE ON COLD TOLERANCE IN BARLEY GENOTYPES

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ARTICLE INFO

Article History:

Received 18th, September, 2013
Received in revised form 28th, September, 2013
Accepted 14th, October, 2013
Published online 28th October, 2013

Key words:
Barley, Cold tolerance, Grain yield, multi variety analysis.

ABSTRACT

In order to evaluate cold tolerance of twenty barley genotypes under field conditions an experiment was carried out with Randomized Complete Blocks Design at 3 sowing dates (October 6, November 5 and December 5) during 2011 - 2012 seasons. Also, another experiment was done on the same genotypes based on Completely Randomized Design with 5 replications under greenhouse conditions. Results analysis of variance showed that significant differences between sowing dates for traits of plant height, spike per m^2, grain per spike, 1000 KW and grain yield. First sowing date at October had higher spike per m^2, 1000 KW, grain yield and total dry matter. There were significant differences, for total dry matter and ion leakage at 4 and 6 leaves stage. The highest and lowest ion leakages were observed at Redut/OK84817 (37.30µds/m^2) and Legia/CWB117-5-9-5 (21.44µds/m^2) genotypes, respectively. Traits of 1000 KW, total dry matter had positive significant correlations with grain yield $r = 0.62^{**}$ and $r = 0.74^{**}$, respectively. It seems that these traits could be used an indirect criteria for cold tolerance evaluation. At regression analysis with stepwise method 1000-kernel weight and harvest index remained at final model. Cluster analysis with all traits showed that genotypes of 12, 16, 4, 3, 17, 8, 15, 7, 14, 20, 11 and 9 were superior genotypes. At principal component analysis four first components showed 80.9% from total variation. First component was important at improving grain yield and third components named as a grain yield components.

INTRODUCTION

Cold (freezing temperatures) is among the major environmental factors such as toxicity, pest and etc. limiting crop productivity worldwide. The reproductive structures (flower spikes) are the most cold-sensitive parts of barley, and sporadic frost events in the order of -2 ° C to -5 ° C during flowering can damage the grain, or cause floret sterility and complete loss of grain set and it can be cause to threaten the sustainability of agricultural industry. Developing crops which can tolerate environmental stresses, and can also maintain productivity, is a critical requirement for sustainable agriculture in this era (Jenkes *et al*., 2005). Therefore, finding ways to nourish both people and the planet with environmentally sustainable methods and to cope with climate change is very vital (Shameer *et al*., 2009). Risk factors including weather were always effective on grain yield of cereals in many areas. Low temperatures in winter climate was the effective limiting factors mentioned in the temperate regions and thus the occurrence of cold temperature in some year's and biota impressed growth of winter crops like wheat and due to yield was decreased (Hossein et al. 1993). It seems that soft cold period across the winter was necessary for stable cold tolerance in plant. Increasing of temperature over 10 ° C in winter is reducing resistance to cold. At the other hand, if the plant exposed again under low temperatures, plant can maintain the tolerate ability against freezing. Despite this plant loses his winter resistant when we saw increase in temperature in late winter (Choie et al. 2002). Cold hardiness of plants is greatest in late fall-early winter so low temperature damage is unlikely at this time. But cold hardiness gradually decreases as spring approaches in order to allow plants to "deharden" and resume growth. Survival will be a function of fall hardening and the degree and duration of cold temperatures. To evaluate cold tolerance of plants under field conditions researchers sowing plants at field condition in autumn and observe winter survival (Guy et al. 1992). Fowler and Gasta (1981) believe that the winter survival of plants relatively good field test for evaluated cold tolerance of plants and according to this factor for measurement of cold tolerance suggested LT 50 index. Reports indicate that the cold stress effect of economic losses rate on the country's crops, far more than devastating losses to other atmospheric phenomena, and sometimes even more than the damage of pests and diseases (Baker et al., 2004).

MATERIAL AND METHOD

Study in both greenhouse and field condition during the year 2011 – 2012 in Agricultural and Natural Resources Research Center of West Azerbaijan were occurred.

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The greenhouse experiment was conducted in a completely randomized design with 5 replication and 20 genotype of barley (Table 1) were sown in 15 wooden boxes (52 × 32 and a height of 13 cm) containing a mixture of garden soil and the leaves soil. Inside each box 15 plants of barley genotypes were sown in a row. 10 and 14 hours of light and dark photoperiod were apply, 20° C for day and 10° C for night and 65% - 70 % relative humidity as the same of field experiment environment were apply. After 24 hours the temperature reduces until -25° C periodically with reduce 2° C per hours (Habibi et al., 2012). In two, four and six-leaf stage (approximately 20, 40 and 60 days after planting), five boxes transfer to the laboratory refrigerator at 20 ° C under controlled lighting conditions (10 hours light and 14 hours of darkness and100 lux light intensity) were transferred. With the loss of five degrees of temperature from - 5 ° C and apply cold stress for two days a box frequently, picked up of refrigerator and measured a treat such as LT 50 (50 dead plant), ion leakage, dry matter per plant and to ensure the heading used a light camera microscope (Olympus XSB 211) equipped to photographed terminal sprouting characteristics with a magnification of 100. To measure the dry weight per plant ten plants were randomly harvested from each box and dried for 24 h at oven in 72 ° C. To measure ion leakage, ten 2 cm leaf discs distilled in water and kept at 20 ° C for 24 hours were used (Jenkins et al., 1974).

Field evaluation

Field experiment was design split plot conditions based on Randomized Complete Blocks with three replications and 20 cultivars and three sowing date (6th October, 5th November and 5th December) at years 2011. Land preparation operations including plowing with moldboard, Hunk and grinding the field were leveling using labor force. Barley genotype Planted in six rows with a density of 400 plants/m^2. Planting distance was 20 cm between rows and 3 meter length for each row.

Table 1 Pedigree or origin of springs and winter type wheat genotypes

No	type	Root
1	Spring	(WA2196-68/NY6005-18, F1//Scotia I)
2	Spring	Makouee/3/Roho/Mazurka//ICB-103020
3	winter	Michailo/K-096M3
4	Spring	Michailo/Dobrinya
5	Spring	Antares/Ky63-1294//Marageh/4/Roho//Alger/Ceres 362-1-1/3/CWB117-77-9-7
6	Spring	ICB-100149/(L.BIRAN/Una827//Gloria ‘S’/Com ‘S’)
7	winter	Radikal/3/Walfajre/Scotia//Beecher.Sel
8	winter	Janees/CWB117-5-9-5
9	winter	K-247/2401-13//Vavilon/3/Radical/Ppervenets// Radical
10	Spring	K-247/2401-13//Vavilon/3/Radical/Ppervenets// Radical
11	winter	Robur/WA2196-68//K-281/Skorokhod
12	Spring	Mal1-4-3094-2//YEA 422-1/YEA 455-25
13	Spring	Alpha/Durra//SLB47-81
14	Spring	Legia/3/Torsh/9cr.279-07/Bgs
15	winter	Legia/CWB 117-5-9-5
16	Spring	Plasisaut//MD45-286-13/OWB73173-2H.OH/3/
17	winter	Honahoh/Batal-U1
18	Spring	Redut/OK84817
19	winter	(7^{th} EBYTC85-5) Bereke-54
20	winter	Makouee (Star)

Fertilizer recommendations applied based of soil analysis results to the amount of 100 kg ha^{-1} of nitrogen fertilizer on the row to three sowing date, stem elongation and heading were applied. Before planting Phosphorus fertilizer was applied in 70 kg ha^{-1}. Field weeds were controlled by herbicide 2-4-D in tillering stage. Traits of Plant height at maturity, spike number per square meter, kernels per ear, grain yield, 1000 kernel weight, total dry matter per plot were measured.

DISCUSSION

Significant differences between the characteristics such as ion leakage, leaf dry matter per plant at 4 and 6 leaf growth stage were observed in lab condition ($P< 0.05$) (Table 2).

Ion leakage

Genotypes 18 and 17, respectively, with 37 and 33 micΩ had the maximum amount of ion leakage and genotypes 15 with 21 micΩ ion leakage were showed at the lowest value (Figure 1). Under cold stress, cell wall degradation and the intracellular contents leak out of the cell and the electrical conductivity of the solution increases. Yamada et al (2004) in an experiment on the grass under cold stress for measurement of ion leakage were observed that the sensitive genotypes had highly ion leakage. Habibi et all (2011 -b) show that the lowest ion leakage (high membrane stability) obtains from winter type of wheat cultivar and genotype and assumed that minimal damage to cell membranes due to cold stress and it has been the most resistant varieties

Dry matter per plant at different growth stages

Genotypes no 16 with 291 mg dry matter /plant in four-leaf stage had the highest rate and statistically in the same range with genotype 10 to with 274 mg dry matter/plant. Genotype no 2 with 128 mg dry matter /plant of had a minimum allocation to the plant (Figure 2). Coventry and Reeves, (2003) showed that plant dry matter in spring and winter wheat in the four-leaf stage observed that winter wheat varieties had a less dry matter in compared with spring wheat varieties. In the six-leaf stage genotype 16 with 240 mg dry matter/plant had the highest dry matter and genotypes 8 and 10 with 206 mg dry matter/plant had no significant difference. In contrast, genotype no 19 with 121 mg produced the lowest dry matter per plant (Figure 3).

Apex growth

By examining the response of winter barley to temperature changes for vernalization, it was found that a inter action beet when the reaction of temperature and the response to day length. Not vernalization plants had very fast reaction to low temperatures, in compared with high temperatures. Taking pictures were performed for all genotypes at two, four and six-leaf stage. In two and four-leaf stage of growth genotypes with different types were in the vegetative stage and in six-leaf stage genotypes number 2, 4, 5, 6, 7, 10, 12, 13, 14, 16, 17 and 18 with spring type Enter reproductive phase and genotype 1, 3, 8, 9, 11, 15, 19 and 20 with winter type were still in vegetative stage. Genotype 1 that was showed the vegetative growth in all three developmental stages (2, 4 and 6-leaf stage of growth) had less growth of the terminal bud. In the six-leaf stage spring type genotypes showed evolution of spike and were sensitive to cold stress. These genotype terminal buds in 6-leaf stages developed and pass to reproductive phase and shoots were appeared, but it did not happen in the winter genotype (Figure 4).

Table 2 Mean-square complex in barley genotypes traits under cold stress in field conditions

		Ms			
Source of Variation	df	Ion leakage	2 Leaf stage dry matter	4 Leaf stage dry matter	6 Leaf stage dry matter
Genotype	19	71.492 **	3620.496 ^{ns}	8568.326 **	3863.14 *
Error	80	37.98	4435.16	3062.45	1935.72
CV %		21.96	18.36	16.73	20.43

Ns, * and **: Non significant, Significant at the 5 and 1% levels of probability,

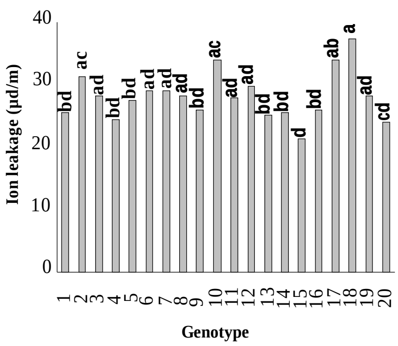

Figure 1 – barley variety and genotype ion leakage under cold stress in vitro condition

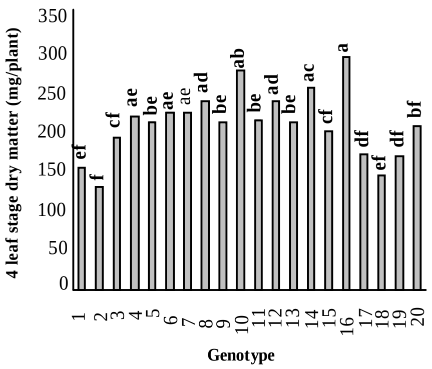

Figure 2 - barley variety leaf dry matter in 4 leaf stage under cold stress in vitro condition

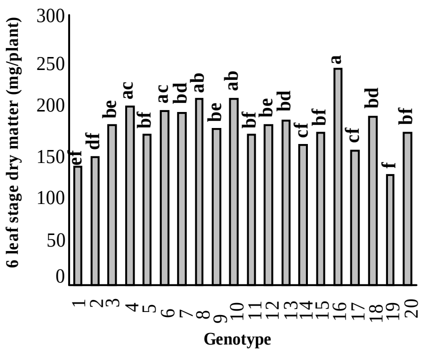

Figure 3 - barley variety leaf dry matter in 6 leaf stage under cold stress in vitro condition

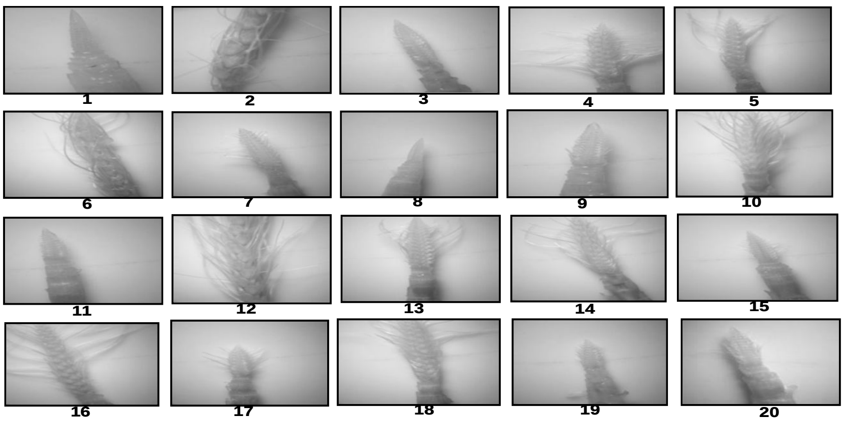

Figure 4 – 20 Barley variety and genotype apex macroscopic picture in 6 leaf stage under cold stress in vitro condition

Table 3 Probit analyze for 20 barley genotype under cold stress to determining LT $_{50}$ in 6 leaf stage growth period

Genotype	a	b	Z=a+b logx$_i$	LT$_{50}$ (°C)	Genotype	a	b	Z=a+b logx$_i$	LT$_{50}$ (°C)
1	-27.02	46.70	1.64	-38	11	-41.08	62.31	1.64	-30
2	-45.03	67.35	1.41	-25	12	-25.82	54.58	1.38	-24
3	-44.19	71.08	1.32	-21	13	-12.17	42.34	1.46	-29
4	-73.75	96.10	1.28	-19	14	-33.08	58.11	1.42	-27
5	-99.46	90.06	1.29	-20	15	-49.11	72.50	1.36	-23
6	-33.99	54.45	1.54	-35	16	-28.82	54.58	1.38	-24
7	-33.25	58.25	1.42	-26	17	-52.19	76.76	1.33	-21
8	-33.98	54.44	1.53	-35	18	-55.38	85.61	1.23	-17
9	-44.19	71.08	1.32	-21	19	-38.03	59.56	1.47	-30
10	-41.15	74.39	1.25	-18	20	-47.99	70.00	1.39	-25

Table 4 Mean-square complex in barley genotypes traits under cold stress in field conditions

		Ms					
Source of variation	df	Plant high	Spike(m^2)	Grain / spike	1000 KW	Grain yield	Total dry matter
Sowing date	2	723.01 ^{ns}	6747892.42 **	752.26 ^{ns}	552.42 *	502650.20**	18276953.88 **
Replication × sowing date	6	568.50	78926.77	247.84	92.85	20123.18	2341.00
Genotype	19	540.56 **	150380.98 **	342.31 **	101.52 **	13127.10 *	147375.32*
Genotype × sowing date	38	96.57 *	54143.13 **	37.74 ^{ns}	23.80 *	18892.66 **	93676.11 ^{ns}
Error	114	59.87	24567.80	31.49	13.53	7488.11	77151.19
CV %		20.00	16.50	9.18	14.07	22.22	17.06

Ns, * and **: Non significant, Significant at the 5 and 1% levels of probability,

Table 5 Mean treat of barley genotypes under three cold stress level on farm condition

Genotype	Plant high (cm)			Spike (m^2)			1000 KW (g)			Grain yield (g/m^2)		
	first	second	third	first	second	third	first	second	third	first	second	third
1	57 tu	74 ir	56 u	778 hk	836 ji	428 o	37 mv	37 mv	35 qw	520 oq	582 jq	499 pq
2	58 su	72 kr	64 qu	1236 ad	1098 bf	477 mo	39 hs	36 ns	29 w	507 pq	675 bl	489 q
3	80 do	73 kr	70 ns	1329 ad	894 fj	425 o	41 ep	34 sw	35 ov	801 ac	519 pq	507 pq
4	76 hq	88 ah	79 do	1087 bg	766 hk	296 o	43 ck	37 lv	42 dm	729 ai	599 hq	536 lq
5	89 ah	76 hp	79 eo	1392 a	1256 ac	501 lo	50 ab	41 eo	48 ac	836 a	516 pq	607 gq
6	66 pu	83 bl	74 ir	1389 a	904 fj	417 o	37 mv	41 vw	35 pv	633 cn	529 hq	518 pq
7	97 a	93 ac	88 ah	876 fj	717 jn	372 o	41 eo	36 mv	43 cl	742 aj	506 pq	570 kq
8	93 ab	88 ah	80 do	706 jn	738 il	368 o	45 ah	41 fp	42 en	664 cn	535 mq	603 gq
9	82 cm	84 bk	69 ot	912 fj	748 il	400 o	40 fq	33 tw	31vw	725 ai	492 q	506 pq
10	75 ir	82 cm	77 gp	1369 a	844 gj	420 o	46 af	38 ju	36 mv	820 a	518 oq	546 lq
11	90 af	82 cn	70 ms	758 hk	890 fj	378 o	41 ep	33 uw	34 rw	773 ae	489 q	537 lq
12	80 do	89 ag	78 ep	1208 ad	729 jm	382 o	45 ag	37 mv	44 bi	827 a	606 gq	624 fq
13	74 ir	84 bk	78 ep	1385 a	1182 ae	526 ko	47 ae	39 it	50 ab	718 aj	547 lq	578 jq
14	89 af	81 do	78 ep	1112 bf	732 jl	393 o	48 ad	42 cm	37 mv	807 ab	511 pq	512 pq
15	79 eo	86 aj	82 cn	926 fj	988 di	465 no	41 ep	40 fr	38 ju	752 af	539 lq	537 lq
16	95 ab	85 ak	80 do	1005 ch	736 il	385 o	41 ep	40 fr	40 gr	737 ah	555 lq	590 iq
17	63 ru	78 ep	71 lr	950 ej	814 hj	394 o	45 ah	38 ku	41 ep	671 bm	564 lq	607 gq
18	83 bl	83 ai	90 af	842 gj	730 jm	386 o	39 gs	36 mv	38 iu	655 do	778 ad	527 kq
19	73 jr	73 fp	69 ot	1294 ab	866 fj	466 no	44 cj	36 mv	40 fr	821 a	662 cn	531 nq
20	90 ae	90 ad	83 bl	773 hk	836 gj	384 o	50 a	37 mv	38 ku	520 oq	571 ko	708 ak

Value with the same superscript letters are non significantly different at P <0.01.

Table 6 Range and standard deviation of grain yield, total dry matter and dry matter of single plant at the six-leaf stage of barley genotypes

genotype	Grain yield (g/m^2)		Total dry matter (g/m^2)		6 leaf stage dry matter (mg/plant)		genotype	Grain yield (g/m^2)		Total dry matter (g/m^2)		6 leaf stage dry matter (mg/plant)	
		Standard deviation (sd)		Standard deviation (sd)		Standard deviation (sd)			Standard deviation (sd)		Standard deviation (sd)		Standard deviation (sd)
1	83	43	706	1835	20	11	**11**	284	146	1166	2951	66	33
2	186	102	913	2550	44	22	**12**	220	122	920	2697	64	35
3	294	166	1536	3282	17	9	**13**	170	90	1096	3303	26	13
4	193	98	1163	3303	20	11	**14**	295	170	1313	2994	97	49
5	320	165	1763	3139	43	97	**15**	215	123	1040	3197	70	54
6	145	80	783	2901	55	27	**16**	182	96	1486	3472	82	41
7	236	122	973	3302	41	21	**17**	107	53	863	2724	20	11
8	129	68	1116	3031	52	26	**18**	205	103	750	2896	43	24
9	233	130	1133	3000	62	31	**19**	290	145	1463	3557	44	26
10	301	166	1126	3221	90	48	**20**	137	68	760	2897	35	20

Table 7 Independent Mean analyze of barley genotypes under field conditions

Growth type	Spike (m^2)	Grain / spike	1000 KW (g)	Grain yield (g/m^2)
Winter type	759 a	34 a	38 b	425 a
Spring type	737 b	33 b	40 a	419 b

Value with the same superscript letters are non significantly different at P <0.01.

Table 8 Regression coefficients associated with yield traits in barley genotypes

The remaining parameters in the model	Standard Regression coefficients	Non Standard Regression coefficients	Non Standard deviation	P
1000 KW (g)	0.80	9.89	1.18	0.00
Total dry matter (g/m^2)	-0.22	-2.99	-1.24	0.03
The origin width	----	456.74	70.26	0.00

R^2 = 0.86

Table 9 Discrimination analysis to determine where the graph cuts in cluster analysis of all traits in barley genotypes

Group number	Wilcox lambda (λ)	χ^2	P (probability)
2	0.13	25.24	0.008
4	0.46	8.81	0.41

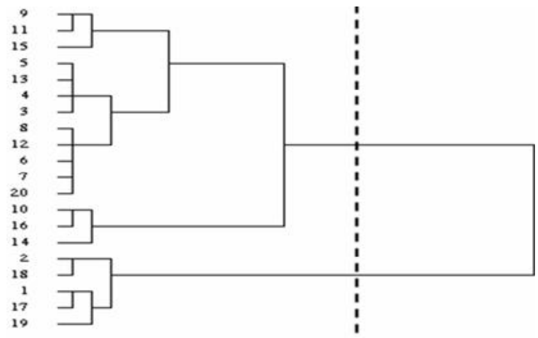

Figure 4 - cluster analysis Dendrogram based on standard data with Ward's method for all barley genotypes

Table 10 Group Means and deviation percentage from total mean in the barley genotypes

cluster	genotype		Grain / spike	1000 Kw (g)	Spike (m^2)	Grain yield (g/m^2)	Plant high (cm)	Total dry matter (g/m^2)
1	3,4,5,6,7,8,9, 10,11,14,15, 16,20 and 12	Mean	36.44	39.86	706.17	553.80	81.66	1243.64
		Deviation from total mean (%)	7.13	-0.5	-9.31	-0.098	2.30	-1.33
2	1,2,17,18, and 19	Mean	28.35	40.54	947.85	551.61	75.54	1292.60
		Deviation from total mean (%)	-16.65	1.18	21.72	0.22	-5.36	3.10
		Total mean	34.01	40.07	778.67	554.34	79.82	1260.43

Table 11 Eigenvalues, Percentage variance and cumulative variance for principle component

Principle component (PC)	Eigenvalues	Percentage variance	Cumulative variance
1	2.89	26.33	26.34
2	2.42	21.99	48.34
3	2.20	20.02	68.37
4	1.38	12.60	80.97

Table 12 Eigenvectors of the main components for traits measured in barley genotypes

Treats	PC 1	PC 2	PC 3	PC 4
Grain / spike	-0.41	0.59	0.86	-0.12
1000 KW (g)	0.77	0.13	-0.29	0.21
Spike(m^2)	0.10	-0.02	-0.90	0.40
Grain yield (g/m^2)	0.93	0.05	0.01	0.18
Plant high (cm)	0.59	0.35	0.49	0.42
Total dry matter (g/m^2)	0.77	0.28	-0.26	0.11

In plant delay transition from vegetative growth to reproductive phase was very important for tolerant to cold stress and thus genotypes that were in the vegetative stage are more tolerant to cold stress. The genotypes were entered Reproductive stage of grown were not proffer in cold regions. Mahfozi, et al (2006) in a study of spring wheat cultivars under cold stress demonstrated that spring type like Koh dasht needed to vernalization not require, and this necessity just delays plant developmental stage. They concluded that the transition from the vegetative to the reproductive phase, a key measure in reducing the expression of freezing resistance in cereals grown under thermal stress. In addition, Gardner and Barnett (1990) pointed out that the changes of vernalization necessity, provides an opportunity to select tolerant cultivars to cold stress.

The temperature required to kill 50% of plants (LT50)

Probit analysis showed that average lethal temperature in winter type genotypes (LT50 = - 28° C) is more than the spring type (LT50 = -23° C) and indicates that most of the genotypes with winter type had more ability to tolerant the low temperature. Between the winter type barley, genotype no 1 (winter type) with temperature – 38° C most tolerant genotypes and genotype no 18 (spring type) with -17° C, temperature is susceptible genotype to cold stress. Lethal temperatures required for the loss of fifty percent of the plants were within the two genotypes (Table 3). Spring type barley that in the six-leaf stage that were enter reproductive phase in compare the winter type were susceptible to cold stress. It seems that in cold tolerance of varieties, types and developmental, stages vernalization requirement and day length were importance. Tolerance to low temperatures of winter cereal depends on known physiological processes at low temperature. Mortality rate of plants under cold stress in the early stages of growth were more than the other stage on plant growth (Brule babel and Fowler., 1998).

Several biochemical and physiological changes were occured during cold stress, such as changes in enzyme activity, accumulation of compatible solutions, changes in membrane stability and the induction of specific genes (Cattivelli and Bartels., 1992). These changes in the winter types were more severe than type spring. However cold tolerance exclusively locused with gene location numbered Sh1, Sh2 and Sh3 that could control the type of growth. And Genetic analysis in barley has shown that this trait is linked to a large number of gene loci (Koller et al., 1991).

A field experiment

Results of analysis of variance showed significant differences between the three cold stress on Spike/m^2, 1000 KW, Grain yield and Total dry matter treatments($P<0.01$) (Table 4). Genotypes 3, 5, 10, 12, 14 and 19 had more than 800 gr/m^2 grain yield in first planting date (6th October). Additionally genotype number 9 and 11 in the second planting date (5th November), and genotype 1 and 2 in the third planting date (5th November) have had less than 500 gr /m^2 grain yield (Table 5). The decrease in grain yield with delayed sowing date could be due to reduce in tillering; no storage of assimilate in leaf that cause reduces over wintering in cereals. According to these test results, Habibi, et al (2012) reported significant interactions between planting date and cultivar for grain yield in various type of wheat. Among the genotypes, number 1 (winter type) were showed the lowest range and standard deviation (Table 6) for grain yield, dry matter and total dry matter in the six-leaf stage and had a minimum 50LT(-38 ° C), further more these genotype had been relatively low ion leakage(membrane stability) and appears to be high cold tolerance. Genotype umber 5, 10 and 14 with spring type showed the high range and standard deviation , LT 50 among -18 to -27 ° C and 33 micΩ ion leakage specified as stress- sensitive genotypes further more genotype number 18 with LT50 = -17 ° C and highest ion leakage had above average yield potential. It is possible, that genotypes with spring type show high performance of grain yield but due to greater range and standard deviation were not identified as tolerant genotype. At the other hand winter type genotype with low grain yield potential due to lower range and standard deviation are presented as tolerant. In the second and third sowing date seed 1000 KW reduction rate were greater than the first planting date. With delays in planting date, reduced 1000 KW and just in genotypes 5 and 13 in third planting date is 1000KW greater than the second sowing date. Grain weight change in genotypes number 1 and 16 under three planting dates were less than the other one (Table 6). In the second and third sowing date seed 1000 KW reduction rate were greater than the first planting date. Habibi, et al (2011 – a) reported that Concurrency of the grain filling period and high temperature were cause reduce the 1000 KW and in there report the second and third sowing date grain filling period coincides with the June heat and the grain were wrinkle. Genotypes 5, 6, 10 and 13, in first sowing date with more than 1369 spike/m^2 had the highest value and genotypes in the third sowing date had the lowest number of spikes spike/m^2 (Table 6). Jakesno, et al (1996) reported the importance of traits considered based on understanding the interaction of genotype and environment for plant selection. Genotype number Seven in first planting date with 97 cm and genotype number 1 with 56 cm in the third planting date, had the highest and lowest plant high respectively (Table 6). Habibi, et al (2011-b) stated that suitable sowing date due to located crop in good conditions and because of the suitable sowing date plant height was in terms of the optimal.

Independent analyze

The winter Type genotypes in compared with the spring type had high yield. And it's Due to the increased in number of grains/spike and spike/m^2 (Table 7). But winter type in compared with spring type has had the lower 1000KW.

Multiple Regression Analysis

In order to determine the most effective traits on grain yield of barley genotyp using a multiple regression analysis were better explain these relationships (Table 8). In this method 1000 KW and total dry matter had higher correlation with grain yield and remained in model. Correction coefficient were (R^2 = 0.86), indicates good justified of yield by traits.

Cluster analyze

20 genotypes of barley Grouped based on measured treats with standard data (Figure 4), and for the determining cutting location of chart discriminate analyze were done. By this way achieved two groups (Table 9). Genotypes 9, 11, 15, 5, 13, 4, 3, 8, 12, 6, 7, 20, 10, 16 and 14 in the first group and genotype 2, 18, 1, 17 and 19 in the second group. The first group of genotypes had lower grain yield, total dry weight, number of spikes/m^2 and 1000KW than total mean of data (Table 10). These results were consistent with the growth of apex at the end of 6 leaf stages, and according to apex growth result genotypes number 2, 4, 5, 6, 7, 10, 12, 13, 14, 16, 17 and 18 with spring type were interred in reproductive phase and thus they were sensitive to cold stress. Genotype number 1, 3, 8, 9, 11, 15, 19 and 20 with winter type were still in the vegetative stage and more tolerant to cold stress because when the reproductive organ appear the sensitivity to cold were grow up. At the other hand Genotype 4, 7, 12, 14, 15 and 20 probably as intermediate type and they are presented for further research.

Principle component analyze

For reduce the number of data and make better decisions from the calculated results principal component analyze was used in this experiment, the first four principal components explained 80 percent of the total variation (Table 12). According to importance of the first principal component it was useful to select the tolerant genotype. The base for Selection was greater factor coefficients in principal component. The first component was explain the 26.34 percent of the variation, yield with 0.93, total dry matter and 1000 KW with 0.77 respectively had the higher coefficient of selection (**Eigenvectors**) (Table 12), This factor can be named as a yield factor (Table 12). The fourth component, explain 12% of the total variation with load factor (**Eigenvectors**) 0.42 for the plant height. The second and third components, explain 21 and 20 percent of the total variation respectively, grain number/spike treat with select coefficients (**Eigenvectors**) of 0.86 for PC3 and 0.59 for PC2 has the highest value And they can be named as yield components factor (Table 12).

CONCLUSION

Morphophysiologic traits of barley genotypes with different growth types have been effected planting date. 15^{th} October had the highest amount of grain yield and its components between other sowing dates. In the four-and six-leaf growth stages, spring type barley genotype had higher dry matter per plant than winter types. Spring type barley in compared the winter types were faster inters the reproductive phase and has a shorter growth period. But winter type barley has had more grain yield than spring type and it were due to increase of ears per square meter and kernels per ear. At the other hand barleys genotype with spring type had higher 1000 KW than the winter type. A high positive and significant correlation coefficient for total dry matter with grain yield in the regression analyze was because of the number of fertile tillers that increase total dry matter and finally the grain yield. The result of the present study identified , however , early , freezing tolerant and above average yielding cultivar can serve as genetic source to improve tolerance to low temperature in short cycle genetic background and . Grain yield obtained from the first cold stress level, consequently the period of first cold stress level planting time and growth conditions on the first cold stress treatment level was suitable for tillering that the variety have enough time to tiller and due to their tolerance to cold stress.

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