Response of Growth and Agronomic Characters of Some Triticale and Barley Genotypes for Different Seeding Rates

M.T. Mohammad[*], C. H. Mohammed[**]

* Faculty of Agricultural Sciences. University of Sulaimani, Sulaimani, Kurdistan region, Iraq, email: drmohammadt@gmail.com

** Halabja Agricultural Technical College, Sulaimani Polytechnic University, Sulaimani, Kurdistan region, Iraq, email: Nsozyar@yahoo.com

Abstract:

Two experiments were carried out during winter season of 2010-2011 at two different locations Halabja and Qlyasan research station in order to study the response of some triticale (Roaeda, Eronga-95 and Clossbied) and barley (IPA 99, Bip 999 and NS 313) genotypes under four different seeding rates (80, 120, 160, 200 kg/ha), and their interactions on some growth and agronomic characters. Using Split Plot Design in which main plots in RCBD with three replications. The results showed significant differences among genotypes for all agronomic characters at both locations and their average with the exception of flag leaf area and flag leaf dry weight during Qlyasan location. The statistical analysis revealed non significant effects of seeding rates on growth and agronomic characters at both locations and their average with the exception of number of days from seeding to physiological maturity, which was highly significant at both locations with their average. There were no significant differences due to the effect of interaction between genotypes and seed rates on growth and agronomic characters at both locations and their average.

Keywords: Genotypes; barley; triticale; hybrid; breeding; seeding rates; agronomic.

I. Introduction

Cereals are members of the grass family cultivated primarily for their starchy seeds, for human food and livestock feed, as well as for other uses, cereals are worldwide the most important cultivated crops and account for the main source of energy and protein in human and domesticated animal diets [1].

Triticale (*X Triticosecale* Wittmack), a human-made crop, is a hybrid of small grain produced by hybridization between wheat and rye, this hybrid were subjected to chromosomes doubling to overcome the sterility, the triticale hybrids are all amphiploid [2]. Triticale is mainly used as animal feed, as forage and for human consumption [3]. [4] reported that Europe served as the main producer and breeder of this crop and it is often considered an alternative to wheat in unfavorable growing conditions and in low input systems. The evolution of triticale as a commercial crop was slow until the mid-1980s, since then triticale production has increased at an average rate of 150 000 tones/year, reaching nearly 11 million tons in 2002 [5]. In 2005, according to the (FAO), 13.5 million tons

from 3 million hectare were harvested and sown in 28 countries across the world [6].

Triticale has been proven to contain higher levels of proteins, Vitamin B and essential amino acids such as lysine and methionine when compared to oats, barley, rye and corn [7]. Triticale also has secondary advantages, such as its high production of straw, which is of direct interest to livestock farmers, for a yield equivalent to wheat or barley, it produces a 30% larger volume of straw [8]. The optimum population was higher under higher yielding conditions and varied between about 80 and 190 plants/m^2 for grain yield levels ranging from 2.1 to 6.9 t/ha, this corresponds to optimum seed rates from 30 to 150 kg/ha depending upon seed size and expected field establishment [9].

Yield and yield components evaluation of different barley (*Hordeum vulgare* L.) genotypes with objective determination of the best plant density and nitrogen fertilizer rate is necessary for obtaining maximum quality and quantity yield and yield components [10].

Barley is typically sown and a plant density of 100-150 plants/m^2 densities of less than 80 plants/m^2 can result in reduced yield, and above 150 plants/m^2 can lead to a reduction in seed weight, according to FAOSTAT, worldwide yields averaged 2.4 tons/ha in 2007, crop density for barley at the time of planting varies from 180 to 200 plants/m^2 [11]. The yield or biomass of barley can dramatically respond to even a small change in plant density [12]. The aims of the present study were to:

1- Assess the performance of some triticale and barley genotypes to four seeding rates at the two locations.
2- Study some growth and agronomic characters of the genotypes at both locations.

II. Materials and Methods

This investigation was conducted at two different locations Qlyasan research station (Lat 35˚ 34′ 30″ N; Long 45˚ 21′ 43″ E, 765 meter above sea level) located 2 km north west of Sulaimani and Halabja research field of Technical College of Agriculture (Lat 35˚ 11′ 43″ N; 45˚ 58′ 36″ E, 690 meter above sea level) located 84 km south east of Sulaimani, during the winter season of (2010-2011). Three genotypes of triticale (Roaeda, Eronga-95 and clossbied), and three genotypes of barley (IPA 99, Bip 999 and NS 313) were used in this study to evaluate some growth and agronomic characters under four different seed rates under rainfed conditions.

The four different seed rates were: 80, 120, 160 and 200 kg/ha. Each of the two experiments were laid out using Split Plot Design with three replicates [13]. The main plots were consisted of genotypes in which arranged with RCBD, whereas the sub-plots were consisted of four different seed rates, and each main plot contained four sub plots with two rows of 3 m long, with the distance of 0.25 m between rows, and 1.0 m between replications. The lands of the experiments at both locations were prepared by plowing the field twice. Seeds were drilled on 21 and 25 December for locations, Qlyasan and Halabja respectively. All cultural practices were conducted whenever were necessary. All treatments were harvested at full maturity on 1st and 5th June for barley, and 7th and 9th June for triticale at both locations Qlyasan and Halabja respectively. Table (I and II) show Agro-meteorological data of both locations Qlyasan and Halabja during the season of (2010-2011).

Studied growth and agronomic characters included: plant height (cm), No. of days from seeding to 50% anthesis, No. of

days from seeding to physiological maturity, No. of days from 50% anthesis to physiological maturity, flag leaf area (cm^2), flag leaf dry weight (g), No. of fertile tillers/plant.

Statistical Analysis: The experiments were conducted according to Split Plot Design within three replications; all data were statistically analyzed at 5% significant level for both locations according to the methods of analysis of variance (ANOVA), combined analysis of variance for the average of both locations was conducted and least significant differences (LSD) at 5% significant level were used to compare between mean characters [13].

Table.I: Meteorological data of Halabja location during growing season of 2010 – 2011 in Sulaimani

	Air temperature(˚C)			Humidity (%)			Precipitation
Months	Avg.	Max.	Min.	Avg.	Max.	Min.	(mm)
Jan.	10.3	14.3	6.2	55.3	63.5	47	147.8
Feb.	10	14	5.6	58.7	66.3	51.2	61.8
Mar.	15.1	19.9	10.2	50.4	58.7	42	58.5
Apr.	17.3	23	11.9	51.3	60	42.3	173.3
May.	24.2	30.5	17.9	37.4	44.8	30	33.9
Jun.	32.8	40.1	25.4	24.8	23.6	26.1	2.5
Total							624

Table.II: Meteorological data of Qlyasan location during growing season of 2010 – 2011 in Sulaimani.

Months	Air temperature (˚C)			Humidity (%)			Wind speed m/s	Precipitation (mm)	Pressure (mb)
	Avg.	Max.	Min.	Avg.	Max.	Min.			
Jan.	6.6	10.7	2.5	71.2	86.1	56.3	1.0	146.3	6.7
Feb.	8.0	12.2	3.8	65.9	82.9	48.9	1.0	44.6	6.8
Mar.	12.7	17.9	7.5	54.0	69.5	38.5	1.7	60.7	7.5
Apr.	17.2	22.2	12.2	57.1	74.3	39.9	1.2	214.8	10.4
May.	22.9	28.5	17.2	47.6	63.3	31.9	1.2	37.3	12.4
Jun.	30.0	36.4	23.7	27.1	39.1	15.1	1.9	3.7	10.4
Total								567.9	

III. Results and Discussion

A. *Effect of genotypes on growth and agronomic characters:*

1. Plant height (cm):

Data represented in (Table III, IV, V and VI) showed significant differences among genotypes for the character plant height at Halabja location and highly significant differences at Qlyasan location and the

average of both locations. The results of genotypes present in (Table VI) showed that Roaeda triticale variety exceeded all other genotypes in plant height reached 114.50 and 109.43 cm at Halabja location and the average of both locations respectively, whereas the highest value of plant height at Qlyasan location was 105.78 cm recorded by Clossbied triticale variety, (Table VI) showed that the lowest values for plant height were 74.23, 71.08, and 72.65 cm recorded by the NS 313 barley genotype for both locations and their average respectively. These results were in agreement with [14 and 15].

2. No. of days from seeding to 50% anthesis:

Data in (Table III, IV, V and VI) confirmed the presence of highly significant differences among genotypes for the characternumber of days from seeding to 50% anthesis for both locations and their average. As shown in (Table VI) IPA 99 barley genotype was the earliest in reaching 50% anthesis with 113.42 days at Halabja location, while the BIP 999 barley genotype was the earliest in reaching 50% anthesis with 118.50 and 116.13 days at Qlyasan location and their average respectively. Regarding the same table it was shown that NS 313 barley genotype was the latest in reaching 50% anthesis among all genotypes with 126.00, 130.33 and 128.17 days for both locations and their average respectively. Previous works reported that post anthesis reduced grain filling rate resulted in the time-span of each development phase depends on genotypes [16].

3. No. of days from seeding to physiological maturity:

Highly significant differences were found among genotypes in number of days from seeding to physiological maturity at both locations and their average (Table III, IV, V and VI). Within genotypes the BIP 999 barley genotype was the earliest in reaching physiological maturity with 152.08 days at Halabja location, while the IPA 99 barley genotype was the earliest in reaching physiological maturity with 156.92 and 154.71 days at Qlyasan location and their average respectively. Moreover, the Eronga-95 triticale genotype was the latest in reaching physiological maturity with 164.42 days at Halabja location, while the Roaeda triticale genotype was the latest with 169.25 and 166.63 days in reaching physiological maturity at Qlyasan location and their average respectively. Previous researches showed that starch deposition begins 1-2 weeks after anthesis and this process is also influenced by genotype [16].

4. No. of days from 50% anthesis to physiological maturity:

Data in (Table III, IV, V and VI) indicated the presence of highly significant differences among genotypes in the number of days from 50% anthesis to physiological maturity at both locations and their average. The maximum value of days from 50% anthesis to physiological maturity was exhibited by the Eronga-95 triticale variety with 48.67 days at Halabja location, while at Qlyasan location and their average; Roaeda triticale variety exceeded all genotypes with 47.58 and 47.83 days respectively. Moreover, the NS 313 barley genotype showed the minimum value of required days from 50% anthesis to physiological maturity with 32.33, 35.67 and 34.00 days for both locations and their average respectively. This result is agreed with [16].

5. Flag leaf area (cm^2):

Data represented in (Table III, IV, V and VI) showed highly significant differences among genotypes for the character Flag leaf area at Halabja location and their average, while it was not significant at Qlyasan location. The results of genotypes in (Table VI) showed that the Eronga-95 triticale genotype exceeded all other genotypes in flag leaf area with 26.36, 18.22 and 22.29 cm^2 for both locations and their average respectively, while the minimum values of flag leaf area were 11.03 and 12.51 cm^2 at Halabja location and their average recorded by IPA 99 barley genotype.

6. Flag leaf dry weight (g):

Table III, IV, V and VI) indicated the presence of highly significant differences among genotypes for the character flag leaf dry weight at Halabja location and their average, while it was not significant at Qlyasan location. The maximum value of flag leaf dry weight at Halabja location was 0.325 gm exhibited by Eronga-95 triticale genotype whereas the minimum value was 0.145 gm exhibited by the genotype barley IPA 99, but at Qlyasan location and their average the maximum values of flag leaf dry weight were 0.301 and 0.306 gm shown by the Clossbied triticale genotype respectively. Moreover the minimum values of the same character were 0.150 and 0.166 gm showed by the barley NS 313 and IPA 99 genotype respectively. Similar results were reported by [17].

7. No. of fertile tillers/plant:

Data in (Table III, IV, V and VI) revealed the presence of highly significant differences among genotypes for the character number of fertile tillers/plant at Halabja location and their average, while it was only significant at Qlyasan location. (Table VI) showed that the maximum number of fertile tillers/plant were 5.30 and 4.68 exhibited by the BIP 999 barley genotype at Halabja location and their average respectively, whereas the maximum number of fertile tillers/plant at Qlyasan location was 4.08 exhibited by IPA 99 barley genotype, concerning the same table the minimum numbers of fertile tillers/plant were 2.91, 2.44 and 2.76 recorded by the barley NS 313 at Halabja location, triticale Clossbied at Qlyasan location and triticale Roaeda for the average of both locations respectively. Similar results were previously reported by [18, 19 and 20], where showed that varieties produced variation in number of tillers/plant.

Table.III: Mean squares of variance analysis for all characters of six genotypes of barley and triticale at Halabja location.

S.O.V Characters	Replicate	Genotypes	Er (a)	Seed rates	Genotypes x Seed rates	Er (b)
d.f	2	5	10	3	15	36
P.H(cm)	542.499	2786.76*	494.77	75.235$^{n.s}$	290.077$^{n.s}$	154.979
DS*50*A	1.722	249.76**	1.822	0.259$^{n.s}$	0.726$^{n.s}$	0.509
DSPM	0.888	404.91**	2.589	27.755**	0.077$^{n.s}$	0.176
D*50*PM	10.014	524.98**	3.247	0.606$^{n.s}$	0.262$^{n.s}$	0.486
FLA (cm^2)	96.529	415.27**	16.529	9.430$^{n.s}$	11.997$^{n.s}$	9.129
FLDW(g)	0.033	0.060**	0.010	0.016$^{n.s}$	0.010$^{n.s}$	0.009
NFT	5.511	11.458**	1.531	0.825$^{n.s}$	0.640$^{n.s}$	1.044

n.s: Non Significant * : Significant ** : Highly Significant

Table.IV: Mean squares of variance analysis for all characters of six genotypes of barley and triticale at Qlyasan location.

S.O.V Characters	Replicate	Genotypes	Er (a)	Seed rates	Genotypes x Seed rates	Er (b)
d.f	2	5	10	3	15	36
P.H(cm)	169.691	2663.76**	390.833	62.996$^{n.s}$	190.351$^{n.s}$	243.677
DS*50*A	5.791	203.958**	12.125	1.125$^{n.s}$	0.781$^{n.s}$	0.810
DSPM	2.042	371.43**	1.225	32.777**	0.211$^{n.s}$	0.306
D*50*PM	5.792	309.36**	12.125	1.125$^{n.s}$	0.781$^{n.s}$	0.810
FLA (cm^2)	147.811	103.61$^{n.s}$	79.648	13.863$^{n.s}$	9.470$^{n.s}$	15.948
FLDW(g)	0.031	0.039$^{n.s}$	0.013	0.004$^{n.s}$	0.004$^{n.s}$	0.004$^{n.s}$
NFT	1.699	7.120*	1.413	0.383$^{n.s}$	0.629$^{n.s}$	0.753

n.s: Non Significant * : Significant ** : Highly Significant

Table.V: Mean squares of variance analysis of growth and agronomic characters for barley and triticale at the average of both locations.

S.O.V	d.f	Plant height (cm)	Days from seeding to 50% anthesis	Days from seeding to P.M	Days from 50% anthesis to P.M	Flag leaf area(cm^2)	Flag leaf dry weight (g)	No. of fertile tiller/ plant	Grain yield(t/ha)	Biological yield(t/ha)	Harvest index
Locations	1	1690.58 $^{n.s}$	1196.01**	1018.67**	4.694 $^{n.s}$	443.14 $^{n.s}$	0.007 $^{n.s}$	12.461 $^{n.s}$	7.254 $^{n.s}$	54.023 $^{n.s}$	0.018 $^{n.s}$
Replicate/ Locations	4	356.195	3.757	1.466	7.903	122.170	0.032	3.605	3.978	17.534	0.022
Genotypes	5	5366.95**	446.060**	766.040**	799.861**	426.44**	0.092**	17.000**	1.434 $^{n.s}$	5.412 $^{n.s}$	0.015 $^{n.s}$
Genotypes x Locations	5	83.570 $^{n.s}$	7.657 $^{n.s}$	10.307**	34.478**	92.442 $^{n.s}$	0.007 $^{n.s}$	1.577 $^{n.s}$	1.275 $^{n.s}$	3.278 $^{n.s}$	0.026 $^{n.s}$
Er(a) x Locations	20	442.802	6.974	1.907	7.686	48.088	0.012	1.472	2.040	11.624	0.017
Seed rates	3	64.432 $^{n.s}$	1.137 $^{n.s}$	60.414**	1.463 $^{n.s}$	15.772 $^{n.s}$	0.016 $^{n.s}$	0.374 $^{n.s}$	2.476**	11.794*	0.025 **
Seed rates x Locations	3	73.799 $^{n.s}$	0.248 $^{n.s}$	0.118 $^{n.s}$	0.269 $^{n.s}$	7.521 $^{n.s}$	0.004 $^{n.s}$	0.833 $^{n.s}$	0.544 $^{n.s}$	2.114 $^{n.s}$	0.010 $^{n.s}$
Genotype x Seed rates	15	210.419 $^{n.s}$	0.920 $^{n.s}$	0.114 $^{n.s}$	0.591 $^{n.s}$	10.277 $^{n.s}$	0.003 $^{n.s}$	0.721 $^{n.s}$	0.448 $^{n.s}$	3.306 $^{n.s}$	0.004 $^{n.s}$
Genotype x Seed rates x Locations	15	270.010 $^{n.s}$	0.587 $^{n.s}$	0.174 $^{n.s}$	0.452 $^{n.s}$	11.191 $^{n.s}$	0.011 $^{n.s}$	0.548 $^{n.s}$	0.427 $^{n.s}$	3.465 $^{n.s}$	0.004 $^{n.s}$
Er(b)/ Locations	72	199.328	0.660	0.241	0.648	12.539	0.006	0.899	0.369	4.512	0.005

n.s: Non Significant *: Significant **: Highly Significant

Table.VI: Effect of genotypes on some growth and agronomic characters at both locations and their average.

Genotypes	Plant Height (cm)	No. of days from Seeding to 50% Anthesis	No.of days from Seeding to Physiological Maturity	No.of days from 50% Anthesis to Physiological Maturity	Flag leaf area(cm^2)	Flag leaf dry weight(g)	No.of fertile tillers/plant
			Halabja location				
Roaeda	114.50	116.92	164.00	48.08	17.49	0.224	2.94
Eronga-95	102.64	116.67	164.42	48.67	26.36	0.325	3.39
Clossbied	110.13	116.92	163.67	48.08	23.45	0.310	3.22
IPA 99	85.53	113.42	152.50	40.83	11.03	0.145	4.53
BIP 999	96.19	113.75	152.08	38.92	13.58	0.200	5.3
NS 313	74.23	126.00	157.42	32.33	15.74	0.192	2.91
LSD(0.05)	20.232*	1.227**	1.463**	1.639**	3.697**	0.091**	1.125**
			Qlyasan location				
Roaeda	104.35	122.42	169.25	47.58	12.56	0.220	2.58
Eronga-95	99.52	122.75	168.00	46.25	18.22	0.269	2.47
Clossbied	105.78	124.25	169.00	46.75	17.90	0.301	2.44
IPA 99	76.56	120.00	156.92	38.00	13.99	0.187	4.08
BIP 999	84.83	118.50	158.00	40.50	12.65	0.184	4.05
NS 313	71.08	130.33	164.83	35.67	11.28	0.150	3.14
LSD(0.05)	17.981**	3.167**	1.006**	3.167**	N.S	N.S	1.081*
			Average of both locations				
Roaeda	109.43	119.67	166.63	47.83	15.02	0.222	2.76
Eronga-95	101.08	119.71	166.21	47.46	22.29	0.297	2.93
Clossbied	107.95	120.58	166.33	47.42	20.68	0.306	2.83
IPA 99	81.05	116.71	154.71	39.42	12.51	0.166	4.30
BIP 999	90.51	116.13	155.04	39.71	13.12	0.192	4.68
NS 313	72.65	128.17	161.13	34.00	13.51	0.171	3.03
LSD(0.05)	12.671**	1.59**	0.831**	1.669**	4.175**	0.065**	0.73**

n.s: Non Significant * : Significant ** : Highly Significant

B. Effect of Seed Rates on growth and agronomic characters:

Table III, IV, V and VII showed no significant effect of seed rates on almost all agronomic characters at both locations and their average with the exception of the character number of days from seeding to physiological maturity. These results disagreed with previous researchers [21].

Number of days from seeding to physiological maturity:

Data in (Table III, IV, V and VII) confirmed the presence of highly significant differences for number of days from seeding to physiological maturity under different seed rates at both locations and their average. Data in the same table showed that seed rate 200 Kg/ha recorded minimum days from seeding to physiological maturity with 157.61, 162.78 and 160.19 days for both locations and their average respectively. While the maximum value of number of days from seeding to physiological maturity produced by seed rate 80 Kg/ha with values 160.50, 165.94 and 163.22 for both locations and their average respectively.

C. Effect of interaction between genotypes and seed rates:

Data in (Table III, IV and V) confirmed the presence of non significant effect of interaction between genotypes and

seed rates on growth and agronomic characters at both locations and their average. These results were differed with previous studies by [10 and 22].

D. Effect of locations on some growth and agronomic characters:

Data in (Table V and VIII) revealed the presence of non significant effect of locations on some agronomic characters, such as plant height, number of days from 50% anthesis to physiological maturity, flag leaf area, flag leaf dry weight and number of fertile tiller/plant, while the effect of locations were highly significant on number of days from seeding to 50% anthesis and number of days from seeding to physiological maturity. Results in (Table VII) confirmed that, the environmental condition at Qlyasan location affected through increasing in number of days from seeding to 50% anthesis and number of days from seeding to physiological maturity from (117.278 to123.042) and from (159.014 to164.333) days respectively. The increasing in number of days from seeding to 50% anthesis and from seeding to physiological maturity may be due to unsuitability of the environmental factors of Qlyasan location, such as temperature, relative humidity and amount of precipitation and its distribution during the growing season (Table I and II).

IV. Conclusions:

The presence of significant differences among genotypes for most characters at both locations, confirmed the existence of high variability among these genotypes.

Recommendations:

1. The conducting further works on these genotypes especially Eronga-95 triticale variety and NS 313 barley variety at different environmental conditions, and using breeding program to ensure selecting certain genotypes to produce high yield with good quality, and survival at the climatically conditions prevailing in Sulaimani region.
2. Using 200 kg/ha seed rate showed an excellent grain yield for both triticale and barley varieties therefore we recommend this amount to be used at both locations Halabja and Qlyasan.

Table.VII: Effect of seed rates on some growth and agronomic characters at both locations and their average.

Seed rates	Plant Height (cm)	No. of days from Seeding to 50% Anthesis	No.of days from Seeding to Physiological Maturity	No.of days from 50% Anthesis to Physiological Maturity	Flag leaf area(cm^2)	Flag leaf dry weight (g)	No.of fertile tillers/plant
			Halabja location				
80kg/ha.	97.35	117.44	160.5	42.61	17.11	0.206	3.98
120kg/ha.	99.91	117.28	159.44	42.78	18.55	0.273	3.78
160kg/ha.	96.54	117.22	158.5	42.83	17.56	0.233	3.63
200kg/ha.	95.02	117.17	157.61	43.06	18.54	0.218	3.48
LSD(0.05)	N.S	N.S	0.283**	N.S	N.S	N.S	N.S
			Qlyasan location				
80kg/ha.	88.33	123.39	165.94	42.11	14.73	0.208	3.09
120kg/ha.	91.5	122.83	164.78	42.67	15.4	0.238	3.14
160kg/ha.	89.26	123.06	163.83	42.44	13.31	0.203	2.96
200kg/ha.	92.32	122.89	162.78	42.61	14.29	0.225	3.31
LSD (0.05)	N.S	N.S	0.373**	N.S	N.S	N.S	N.S
			Average of both locations				
80kg/ha.	92.83	120.42	163.22	42.36	15.92	0.207	3.53
120kg/ha.	95.7	120.06	162.11	42.72	16.98	0.256	3.46
160kg/ha.	92.9	120.14	161.17	42.64	15.43	0.218	3.29
200kg/ha.	93.67	120.03	160.19	42.83	16.42	0.221	3.39
LSD(0.05)	N.S	N.S	0.23**	N.S	N.S	N.S	N.S

n.s: Non Significant * : Significant ** : Highly Significant

Table.VIII: Effect of locations on some growth and agronomic characters.

Locations	Plant Height (cm)	No. of days from Seeding to 50% Anthesis	No.of days from Seeding to Physiological Maturity	No.of days from 50% Anthesis to Physiological Maturity	Flag leaf area(cm^2)	Flag leaf dry weight(gm)	No.of fertile tiller/plant
Halabja	97.204	117.278	159.014	42.819	17.942	0.233	3.714
Qlyasan	90.351	123.042	164.333	42.458	14.433	0.219	3.126
LSD(0.05)	N.S	0.897**	0.560**	N.S	N.S	N.S	N.S

n.s: Non Significant * : Significant ** : Highly Significant

References

[1] S. Rajaram, "Yield Stability and Avoiding Genetic Vulnerability in Bread Wheat" Wheat Breeding at CIMMYT: *Wheat Special Report* 29, pp. 11-15. Mexico, DF, CIMMYT, (1995).
[2] J. C. Marcelo, "Handbook of Plant Breeding-Cereals" J. Springer Science, 3, pp. 267, (2009).
[3] A. Badea, F. Eudes, D. Salmon, S. Tuvesson, A. Vrolijk, C. T. Larsson, V. Caig, E. Huttner, A. Kilian, and A. Laroche, "Development and Assessment of Dart Markers in Triticale" Theory Applied Genetics, 122, pp. 1547-1560, (2011).
[4] R. Dogan, O. Kacar, N. Coplu, and N. Azkan, "Characteristics of New Breeding Lines of Triticale" African J. of Agric. Res. 4, pp. 133-138, (2009).
[5] FAO, FAOSTAT, "FAO Statistical Databases" Agriculture FAO Statistics. Division, http://faostat.fao.org/site/567/defult. (2003).
[6] Anonymous. "Government of Pakistan, Ministry of Food Agriculture and Livestock" Islamabad. pp. 55, Year Book. (2005-2006).
[7] M. Mergoum, P. K. Singh, R. J. Pena, D. R. Lozano, A. J. Cooper, K. V. Salmon, D. F. and G. Macpherson, "Triticale a New Crop With Old Challenges" Hand Book of Plant Breeding, 1(3), pp. 1-21, (2009).
[8] W. Reed, B. Media SAS, "Hardy rye-wheat crosses steps into the future" pp. 10-75, (2004).
[9] M. W. Juliet, K. Olson, and D. Obert, "Production Guidelines for CHARLES, a New Two-Rowed Winter Malt Barley" Univ. of Idaho, pp. 208-334, (2010).
[10] R. B. Hamid, T. S. Zeinalabedin and A. M. Seyed, "Agronomic Factors on Selected Hulles Barley Genotypes" J. of Agron. 4(4), pp. 333-339, (2005).
[11] FAO, "Investment Centre Division, Viale delle Terme di Caracalla" Rome Italy, FAOSTAT, "Food and Agriculture Organization of the United Nations" (2009).
[12] S. R. Radosevich, "Methods to Study Crop and Weed Interactions/ Weed Management in Agro Ecosystems" pp. 121-144, (1988).
[13] F. M. H. Al-Mohamad, and M. A. Al-Yonis, "Agricultural Experimentation Design And Analysis" Bagdad University, Ministry of Higher Education and Scientific Research, (In Arabic), (2000).
[14] T. Yagbasanlar, I. Genc, A. C. Ulger, Y. Kirtok, and N. Topal, "A Comparative Study on The Yield And Yield Components of Triticale, Wheat and Barley in Cukurova" J. Fac. Agric. 3(2), pp. 1-13, (1988).
[15] Z. Mut, I. Sezer, and A. Gulumser, "A research on Yield, Yield Components And Some Quality Characteristics of Triticale, Wheat, Barley and Rye" J. of the Fac. of Agric. Ondokuz Mayıs Univ. 19, pp. 1-8, (2004).
[16] M. P. Reynolds, B. Skovmand, R. M. Trethwan, R. P. Singh, M. Vanginkel, "Applying Physiological Strategies to Wheat Breeding" CIMMYT, Mexico, Can. J. of Plant Sci. 91, pp. 125-135. (2000).
[17] M. R. D. Vipin, M. M. Singh, and S. S. Verma, "Dry Matter Accumulation at Pre And Post Anthesis And Yield of Wheat (*Triticum aestivum*) as Affected by Temperature Stress and Genotypes" Ind. J. of Agron, 48, pp. 277-281, (2003).
[18] C. Royo, and F. Tribo, "Triticale And Barley For Grain And For Dual-Purpose in a Mediterranean-Type Environment" Aust. J. of Agric. Res .48 (4): 411 - 422. 1997.
[19] T. Taşyurek, S. Gokmen, V. Temirkaynak, and M. A. Sakin, "A Study on Yield And Yield Components of Wheat, Barley And Triticale in Sivas-Şarkışla Ecological Conditions" Cereal Symposium, pp. 616-620, Konya, Turkey, (1999).

[20] L. Gobez, W. Mazengia, and L. Hidoto, "Effect of Varieties And Seeding Rates on Grain Yield of Triticale (*Triticosecale Wittmack*) in Different Agro-Ecologies of Southern Ethiopia" African Crop Sci. Conference Proceedings, 8, pp. 41-44. (2007).

[21] F. G. Abreu, and A. M. Ferreira, "Description of Development, Light Interception And Growth of Sufflower at Two Sowing Dates And Two Densities" Portugal, Elsevier Sci. pp. 369-383. (2001).

[22] H. J. Hammadi, and A. K. Saleh, "Effect of Seeding Rates on Grain Yield And Yield Components of Barley" Iraqi J. of Agric. Sci, 33(1), pp. 18-28, (2002).