Egypt J. Agron. **Vol. 27**, No. 1, pp. 1- 10 (2005)

Comparative Performance of some Triticale *(X Triticosecale* Wittmack*)* Genotypes in Sandy Soil

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TWO FILED experiments were conducted during the two winter seasons of 2001/2002 and 2002/2003.

The trial implemented in a private farm at Al - Nagah Village, South Al - Tahrir Province, AL.Behaira Governorate, Egypt. Grains of 50 genotypes imported from International Center for Agricultural Research in the Dry Areas (ICARDA) Aleppo, Syria due to (ITYN 98/1999) CIMMYT/ICARDA and a local check.

Results showed significant differences among genotypes for all the studied characters. The group of genotypes no. 1, 2, 7, 13, 14, 15, 18 and 23 were short plants, early flowering and mature. Genotype no. 39 came in the first order in spike length, no. 34 the first in spikes/m^2, but no. 32 was the best in grain and biological yields/fed. Genotype no. 25 came the first in harvest index, no. 11 have the highest grain protein%.

Regarding correlation coefficient seed yield/fed. appears to have highly significant correlation coefficient with each of plant height; no. of spikes/m^2; biological yield ; harvest index and protein% also, it has significant correlation at 0.05 with days to 50% flowering and spike length.

Keywords: Triticale *(X Triticosecale* Wittmack*)*, Genotypes, Correlation, Yield.

Triticale *(X Triticosecale* Wittmack*)* is an intergeneric hybrid of wheat *(Triticum aestivum)* and rye *(Secale cereale)*. The high productivity of wheat in addition to the high protein and lysine contents as well as resistance to disease of rye are the distinctive traits of triticale (Villegare *et al.*, 1970 and Moinuddin & Afridi, 1997). Further, triticale is adaptable to unfavorable environments and has been claimed as the future staple food for mankind (Zillinisky & Borlang, 1971 and Bletsos *et al.*, 1997) which contributes more than 6 million tons per year to global cereal production South Africa and Brazil are among the major triticale producers 1.595 and 0.590 million hectars, France 0.300, Australia 0.160, Poland 0.100 and USA 0.060 million hectare, but others are planting small areas between 3 and 16 thousand hectares; Algeria, Kenya, Mexico, Morocco and Tunisia. Triticale is grown on more than 2.4 million hectares worldwide, tritical is successfully grown in almost all environments where it parental (Wheat - rye) species are grown, tritical appears to be an ideal low input crop for nonextractive, sustainable agriculture and organic farming (Varughese *et al.*, 1997).

Triticale, derived from wheat x rye hybrids, is becoming an important grain and forage crop in many areas of the world (CIMMYT, 1997). Recent work at CIMMYT has indicated that the better adapted triticale strains continue to maintain yield superiority over wheat and barley checks (Sapra & Bishnoi, 1979). Most triticale production is utilized as a feed grain, forage, or both in animal feeding, including poultry, mongastrics and ruminants. Triticale serves as a substitute for other cereal grains or as a partial substitute for protein sources such as soybean meals.

Improvement in triticale production through selection is an important criterion as its productivity is low under sandy soil. Selections procedure is more difficult for a trait when the heritability is low or is not easily and precisely measurable. Indirect selection in such a situation is more effective and study of correlation among different economic traits is very essential for an effective selection program. The calculation of simple correlation to detect the relative importance in the method mostly used for finding the nature and degree of the relationships between yield and characters which are believed to have direct or indirect effect on traits, trait heritabilities, and correlations among these traits suggest high projected genetic gains for agronomic components associated with grain yield.

Hence, it is essential for a plant breeder to consider the correlation between yield and its contributing traits in segregating generations. Warrant special attention in future breeding efforts.

The presents study was directed to detect the effect of some characters on the yield, aiming to improve the productivity of triticale cultivars.

Material and Methods

Two field experiments were carried out in a private farm at Al Nagah village, Al Tahadi sector, South Al Tahrir provience, Al Behaira Governorate, Egypt for the two winter seasons of 2001/2002 and 2002/2003.

The material under study imported from International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria due to International Triticale Yield Nursery (ITYN 99/2000) CIMMYT/ICARDA.**Contribution of the International Maize and Wheat Improvement Center (CIMMYT) 50 genotypes of triticale grains were tested in complete randomized block design in three replicates, number 1 was local check from trial region farmers. The first International Triticale Yield Nursery (ITYN) was distributed during 1969-1970 season in CIMMYT.

The experimental soil was analyzed according to the method described by Chapman & Pratt 1978. Soil texture was sandy with the following characteristics: sand 94%, pH 8.3, calcium carbonate 3.3%, organic matter 0.45% EC 0.70 m mhos/cm^3, total N 3.2 mg/100g and p 1.7 mg/100g, respectively.

The field ploughed twice and ridged. The plot included 10 rows 3.5 meter long and 0.3 m apart with total area 10.5m^2. Grains were sown in the first week of November in both seasons.

Irrigation took place immediately after sowing according to the sprinkler irrigation (zoon system). Nitrogen was added at the rate of 60 kg N/fed. as ammonium nitrate (33.5%) N in three portions before sowing, tillering stage and heading stage. 15 kg P_2O_5/fed. as super phosphate during seed bed preparation.

Days to 50% flowering determined by count the flowering plants and compare to total plants of two central rows in each plot. Days to 90% maturity determined by count the wet yellow spikes and compare to total plants in the two central rows in each plot. Ten plants harvested from the two central rows and the following traits were determined: plant height, spike length and grains protein%. 1 m^2 harvested to determine number of spikes / m^2. The whole plot harvested to then weight whole above ground (biological yield) then split grains to determined (grain yield). Harvest index calculated by divided grains yield /biological yield.

The obtained results were statistically analyzed using the analysis of variance of complete randomized block design according to (Snedecor & Cochran, 1982). Combined analysis of the two seasons was made and the treatment means were compared by LSD test at the level of 5% probability. The genotypic correlation coefficient among all the studied characters were computed using covariance analysis (Steel & Torrie, 1980).

Results and Discussion

Table 1 shows the combined analysis of the two seasons 2001/2002 and 2002/2003. Data presented in Table 1 show significant differences between genotypes for all the studied characters.

Days to 50% flowering

Genotypes differed in flowering from 71 days to 88.5 days (Table 2) from sowing to 50% flowering. It can be classified to three groups early (71-76 days), medium (77-82 days), late 83-88.5 days. The shortest period recorded by genotypes number 18, 19, 20, 21, 22 and 23 it can be concluded that these group was the early flowering under the trial condition at south Al - Tahrir province.

TABLE 1. Comparative performance of 50 Triticale genotypes .

Lines	50% flowering	90% maturity	Plant height	Spike length (cm)	Spikes /m2	Grain yield/ fed.	Biological yield ton/fed	Harvest index	Grain protein %
Check	76.50	131.50	60.83	3.75	320.00	287.33	1.32	0.22	9.99
2	76.50	130.00	63.50	4.33	208.00	162.67	1.11	0.15	9.49
3	77.50	133.00	94.67	6.50	128.00	151.50	2.28	0.07	8.93
4	77.50	133.00	91.33	7.50	128.00	144.00	2.56	0.06	9.11
5	86.00	150.00	94.00	7.50	128.00	145.00	2.58	0.06	9.05
6	77.50	151.50	70.83	4.17	112.00	130.33	1.47	0.09	8.35
7	76.50	131.50	70.83	4.33	208.00	224.00	1.78	0.13	8.32
8	77.50	151.50	85.00	5.33	192.17	388.83	3.56	0.11	8.09
9	82.50	151.50	83.17	6.33	224.17	224.00	4.85	0.05	8.74
10	75.00	151.50	81.83	6.17	239.83	256.00	2.88	0.09	9.13
11	77.50	133.00	83.67	9.50	64.50	205.17	1.61	0.13	12.88
12	74.00	131.50	75.17	5.83	304.00	372.83	3.45	0.11	8.83
13	74.00	135.83	71.00	4.33	272.17	242.00	1.77	0.14	8.84
14	74.00	136.00	73.50	6.00	192.50	189.50	2.86	0.07	10.49
15	74.00	133.33	72.17	6.33	144.33	235.83	1.93	0.12	9.27
16	79.00	147.00	81.17	5.00	144.00	164.83	2.33	0.07	6.91
17	71.50	133.00	76.67	6.50	224.17	314.50	2.86	0.11	8.31
18	71.00	134.50	74.83	4.17	192.00	234.17	3.68	0.06	8.29
19	71.00	133.00	78.33	4.00	144.17	261.00	2.12	0.12	8.72
20	71.00	136.00	79.00	4.17	207.83	209.17	2.51	0.08	8.90
21	71.00	136.00	76.17	6.33	64.67	240.67	1.37	0.18	8.14
22	71.00	133.00	78.50	6.50	192.50	261.67	2.53	0.10	10.79
23	71.00	133.00	69.17	2.67	272.50	176.00	0.73	0.24	8.03
24	82.50	147.00	97.67	5.83	208.33	256.50	1.64	0.22	8.28
25	75.00	140.00	92.33	4.33	528.17	543.83	1.77	0.30	8.05
26	75.00	140.00	97.17	6.17	320.00	397.83	2.37	0.17	10.34
27	75.00	140.00	92.50	4.50	462.17	460.17	2.46	0.16	8.34
28	82.50	147.00	95.67	4.00	512.17	302.00	1.80	0.17	8.90
29	74.00	143.00	99.00	4.50	703.83	809.83	3.54	0.23	7.83
30	74.00	140.00	105.83	9.17	512.00	735.83	4.32	0.17	8.75
31	75.00	140.00	77.00	4.50	351.83	532.00	3.69	0.14	8.07
32	75.00	141.50	95.33	6.17	672.00	1652.83	8.35	0.24	10.68
33	75.00	140.00	82.17	4.50	784.00	899.00	4.68	0.23	12.61
34	74.00	141.50	96.17	4.50	880.00	593.00	3.73	0.16	12.72
35	87.50	147.00	94.33	4.25	800.50	900.17	3.56	0.25	10.32
36	80.00	132.67	80.50	3.83	832.00	913.00	4.02	0.24	10.39
37	80.00	133.00	93.17	5.50	832.17	775.67	3.54	0.22	11.40
38	80.00	147.00	57.50	3.00	816.00	501.67	3.46	0.15	7.67
39	80.00	147.00	96.33	10.00	448.17	1207.33	4.79	0.26	10.57
40	87.50	147.00	95.00	7.50	448.33	890.00	3.91	0.23	10.45
41	76.50	133.00	90.00	9.33	496.67	1196.67	4.53	0.26	9.66
42	76.50	130.00	91.67	9.00	624.00	694.17	4.26	0.16	10.89
43	76.50	130.00	89.33	4.83	544.17	382.00	2.83	0.14	12.50
44	86.00	150.00	81.17	4.50	752.00	916.00	4.11	0.22	10.81
45	84.00	150.00	88.67	8.50	480.00	575.67	3.28	0.18	10.11
46	71.15	150.00	82.00	6.00	510.83	782.50	3.25	0.24	12.43
47	84.00	153.00	86.67	7.67	384.00	727.50	3.43	0.21	11.55
48	84.00	153.00	54.88	4.83	848.50	998.67	4.29	0.23	10.89
49	88.50	130.00	73.00	6.50	304.17	480.00	3.33	0.14	10.32
50	88.50	130.00	107.00	9.33	448.00	1087.17	4.50	0.24	11.76
LSD 5%	5.857	0.197	7.534	1.561	7.867	130.2	0.299	0.007	0.19

Days to 90% maturity

Data presented in Tables 1-3 clear that genotypes under study show wide range in maturity period. It can be divided into three groups early mature (130-137 days) medium 138-145 days and late mature (146-153 days) from sowing. It can be concluded that there were two genotypes no. 22 and 23 early flowering (71 days) and early mature (133 days) thus, these two genotypes were the best for growing under south Al Tahrir condition as early mature genotypes.

TABLE 2. Group of genotypes flowering date.

Genotypes / Groups	Genotypes number	Total
Early flowering (71-76 days)	1-2-7-10-12-13-14-15-17-18-19-20-21-22-23-25-26-27-29-30-31-32-33-34-41-42-43-46.	28
Medium (77-82 days)	3-4-6-8-9-11-16-24-28-36-37-38-39	13
Late flowering (83-88 days)	5-35-40-44-45-47-48-49-5	9

TABLE 3. Groups of genotypes maturity date.

Genotypes / Groups	Genotypes number	Total
Early flowering (130-137 days)	1-2-3-4-7-11-12-13-14-15-17-18-19-20-21-22-23-36-37-41-42-43-49-50	24
Medium (138-145 days)	25-26-27-29-30-31-32-33-34	9
Late flowering (146-153 days)	5-6-8-9-10-16-24-28-35-39-40-44-45-46-47-48	17

Plant height:

Tables 1- 4 clear that plant height of triticale genotypes ranged widely from 54.8 to 107 cm. It can be classified genotypes to short group (54-74 cm) contains 12 genotypes, medium (75-95 cm) contains 31 genotypes and tall group (>96 cm) contains 7 genotypes. We can deduce from tables 2, 3 and 4 that genotypes number 1, 2, 7, 13, 14, 15, 18 and 23 were short plants, early flowering and mature also, it can be more promissing in land use, fertilizers and irrigation.

TABLE 4. Groups of genotypes height.

Genotypes / Groups	Genotypes number	Total
Short (54-74 cm)	1-2-6-7-13-14-15-18-23-38-48-49	12
Medium (75-95 cm)	3-4-5-8-9-10-11-12-16-17-19-20-21-22-25-27-28-31-32-33-35-36-37-40-41-42-43-44-45-46-47	31
Tall (>96 cm)	24-26-29-30-34-39-50	7

Spike length

Data presented in Table 1 show great differences between genotypes in spike length 2.67 to 10 cm. The tallest spike produced by plants of genotype 39 followed by no. 11, 41, 50 and 30. Although genotype 41 recorded the third order in spike length it was early flowering and early mature, it can be concluded that genotype no. 41 was early and long spike.

Number of spikes/m^2

Table 1 clears significant differences between genotypes in number of spikes/m^2. Wide range was observed (64-880) spiks/m^2. The greatest spikes number obtained by genotype 34 followed by no. 48, 36, 37 and 38.

Grain yield/fed.

Data allocated in Table 1 show significant differences between grain yield of all tested genotypes. There were very wide range from 130 to 1652 kg/fed. Four genotypes produced grain yield greater than 1000 kg/fed. Most of the distinct genotypes were early or medium flowering and mature, tall or medium in plant height, spike length and also have greater than 440 spiks/m^2, the obtained result was in accordance with those obtained by (Pandini *et al.*, 1997) in Brazil who reported tendency of distinct varieties to reductions in height, flowering and maturity, on the other hand, Bobodzhanov *et al.* (1990) in Russia reported that the short varieties had higher values of dry matter resulting in a higher grain yield.

Biological yield/fed.

The results of research reported in Table 1 show clearly significant differences between genotypes in biological yield/fed. The value ranged from 0.73 up to 8.35 ton/fed. Genotype no. 32 recorded the superiority either for biological yield or grain yield followed by no. 9, 39, 41 and 50. It is the same result obtained in grain yield, thus, it can be concluded that the distinct genotypes have superiority in grain and biological yields.

Harvest index

Data presented in Table 1 clear that there were significant differences between genotypes in harvest index. The value ranged from 0.05 to 0.30. The highest harvest index recorded by genotype no. 25, no. 39 and 41 came in the second order, no. 35 came in the third order. It can be concluded that no. 32, 39 and 41 have superiority in grain, biological yields and harvest index and can be educe that this genotypes were promising varieties under south Al Tahrir province.

Protein % in grains

Table 1 shows that there were significant differences between genotypes in grain protein %, protein content in grains. The value ranged from 6.91 to 12.88%. Genotype no.11 came in the first order, no.34 in the second order,33 in the third order followed by 46.

Correlation coefficient

Table 5 shows the correlation coefficient among the studied characters in the 50 tested genotypes during the two growing seasons of 2001/2002 and 2002/2003.Significant and positive correlation coefficient were obtained between the following characters:

1. Days to 50% flowering with days to 90% maturity, protein% at 5% and 1% and with grain yield / fed.
2. Days to 90% maturity with biological yield/fed.
3. Plant height with spike length, grain yield/fed protein% and biological yield/ fed at 0.05 and 0.01.
4. Spike length with protein% at 0.05, 0.01 grain and biological yields/fed.
5. Number of spikes/m^2 with grain, biological yields/fed protein% and harvest index at 0.05 and 0.01.
6. Grain yield/fed with biological yield, harvest index and protein% at 0.05 and 0.01.
7. Biological yield with harvest index and protein% at 0.05 and 0.01.
8. Harvest index with protein% at 0.05 and 0.01.

TABLE 5. Correlation coefficient among the studied characters of 50 triticale genotypes (combined of 2001/2002 and 2002/2003 seasons).

	2	3	4	5	6	7	8	9
Days to 50% flowering (1)	0.267**	0.140	0.164	0.187	0.209*	0.158	0.154	0.215*
Days to 90% maturity (2)		0.091	-0.012	0.188	0.179	0.211*	0.088	-0.088
Plant height (3)			0.409**	0.162	0.317**	0.286**	0.186	0.214*
Spike length (4)				-0.131	0.216*	0.256*	0.026	0.331**
No. of spikes / m^2 (5)					0.699**	0.548**	0.622**	0.458**
Grain yield /fed. (6)						0.748**	0.700**	0.411**
Biological yield/fed. (7)							0.228*	0.340**
Harvest index (8)								0.328**
Protein% (9)								

* Significant at 0.05 ** Significant at 0.01 R 0.05 = 0.205 R 0.01 = 0.257

Regarding correlation coefficient, data in Table 5 clear that grain yield/fed., appears to have highly significant correlation coefficient with each of plant height, no. of spikes/m^2, biological yield protein% and harvest index, also it has significant correlation at 0.05 with days to 50% flowering and spike length. The same trend was extant in biological yield except with days to 50% flowering that failed to reach the significant level but it has significant correlation at 0.05 with days to 90% maturity, these results were in accordance with those obtained by (An-Xing Dong *et al.*, 1995) in China who reported highly significant positive correlation between grain yield with plant height, number and length of spike. (Milovanovic, 1993) stated that grain yield was significantly correlated with the number of spikes/m^2. Also, (Rozbicki & Madry, 1998) found that number of spikes/m^2 made the largest contribution to grain yield. (Sharma & Rao, 1989) in India stated that tillers/m^2 exhibited maximum positive direct effect on grain yield followed by biological yield and harvest index.

These results may be detect the effect of some genotipic characters on grain yield/fed, the data may help the plant breeder to select the favorable genotype to grow under trial conditions, to improve the exotic and commercial cultivars. Suggesting that selection pressure applied for increasing traits will eventually increase grain yield of triticale, therefore, allowing the breeder to select plant types adapted to the environment of cultivation.

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(*Received* 14/3/2004;
accepted 19/3/2005)

مقارنة كفاءة بعض التراكيب الوراثية من التريتيكال فى الأرض الرملية

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أجريت تجربة حقلية خلال الموسم الشتوى لعامى ٢٠٠١/٢٠٠٢، ٢٠٠٢/٢٠٠٣ نفذت التجربة بمزرعة خاصة بقرية النجاح – جنوب مديرية التحرير – محافظة البحيرة – مصر واستخدم فى التجربة ٥٠ تركيب وراثى مستوردة من المركز الدولى لبحوث الزراعة فى المناطق الجافة – حلب – سوريا منهم سلالة محلية استخدمت كمقارنة.

أوضحت النتائج وجود فروق معنوية بين التراكيب الوراثية فى كل الصفات المدروسة وأمكن تحديد مجموعة من التراكيب الوراثية تحمل أرقام ١-٢-٧-١٣-١٤-١٥-١٨-٢٣ أعطت نباتات قصيرة ومبكرة فى كل من التزهير والنضج. بالنسبة لصفة طول السنبلة جاء فى المركز الأول التركيب الوراثى رقم ٣٩ أما التركيب الوراثى رقم ٣٤ فقد جاء فى المركز الأول لعدد السنابل/ م٢ بينما التركيب الوراثى رقم ٣٢ فكان الأفضل فى محصول الحبوب والمحصول البيولوجى. أما التركيب الوراثى رقم ٢٥ فقد سجل أعلى دليل حصاد بينما سجل التركيب الوراثى رقم ١١ أعلى نسبة مئوية للبروتين فى الحبوب.

أظهر تحليل الارتباط أن صفة محصول الحبوب للفدان ترتبط ارتباطا موجباً عالى المعنوية مع صفات ارتفاع النبات – عدد السنابل للمتر المربع – المحصول البيولوجى – دليل الحصاد و النسبة المئوية للبروتين فى الحبوب وكذلك ارتباطا معنوياً مع صفتى عدد الأيام حتى ٥٠٪ تزهير وطول السنبلة.