International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.8, No.12 pp 170-177, 2015

Performance of some Triticale Genotypes in Delta, Egypt

[1]Hozayn M.; [1]Abd El-Salam M.S.;[1]Abd El Lateef E.M.;
[1]Amany A. Baher and [2,3]Abd El-Monem A.A.
[1]Field Crops Research and [2]Botany Departments, National Research Centre,
33 El-Buhouth St., (Former El-Tahrir St.) 12622 Dokki, Giza, Egypt.
[3]Biology Dept., Fac. of Sci., Tabuk Univ., Branch Tayma, Saudi Arabia.

ABSTRACT: Forty triticale genotypes were evaluated for two winter seasons 2012/13 and 2013/14 in clay soil, Kalubia Governorate. The results revealed that the genotypes significantly varied in most studied characters. Regarding days to flowering and maturity, triticale lines flowered after 72.5 to 95 days exhibiting that five triticale lines were earlier than others < 80 days, while only line no. 8 was the latest flowering line > 90 days. The other 34 lines flowered between 70 – 80 days. Similar trend was observed in days to 90% ripening character. The same earlier lines were the earlier in ripening and ranged between 132 – 137 for the lines 1, 37, 38, 39 and 40, while, the latest maturity one was line number 8 >150 days. Other lines matured between 140 – 150 days. Grain yield significantly differed among genotypes, where two lines i.e., (6 and 8) gave the highest grain yield (1.01 and 0.92 kg m^2, respectively), compared the other genotypes and the local check. The same superiority of lines no. 6 and 8 in grain yield was evident for both straw and biological yields than the other lines. Also, the lines no. 3, 4, 5, 7, 9, 10, 21 and 23 gave the best straw and biological yields/m^2. Generally, this study indicate_that, triticale lines could out yield grain, straw and biological yields reveal to this distinct. So, could be successfully promising genotypes which could be employed as possible alternative to wheat under Egyptian condition.
Key words: Triticale, genotypes, yield, correlation, cluster analysis.

INTRODUCTION

Worldwide, global food and feed demands have been projected to double in the 21*st* century, which will further increase the pressure on the use of land, water and nutrients. In Egypt, the government has adopted ambitious strategy to overcome the wheat gap (40%), through increasing the productivity of wheat vertically and horizontally as well as increasing the production of bread by mixing of wheat flour with corn or triticale flour. Triticale is a promising crop used as food material for human and feed for animals throughout the world and could be employed as possible alternative to wheat under Egyptian condition.

Evaluation and adaption of crop genotypes comes in the first order for the most of agriculture scientist in Egypt due to its effective and importance role for improvement crop productivity, especially cereal crops where the Egyptian food gab approximately reached to 40%. So, optimizing production by evaluation and adaptation the imported genotypes under Egyptian conditions is essential. Also, rapid increases in Egypt population demand concomitant increases in food production, particularly of cereals, the main source of nutrients for both humans and animals. Therefore, production increase must come mainly from enhancing the yield potential of new crops like triticale besides expanding the global cultivated area.

Triticale (*X Triticosecale* Wittmack) is a cereal crop developed by human intervention from crosses between wheat and rye. It has high yield potential and is adapted to a wide range of soil types and environments. Triticale is used as food material for human and feed for animals throughout the world because its flour is rich in proteins (average 14-15%) and contains high level of essential amino acids and does not accumulate NO_3 to the critical level of intoxication as a forage crop[1]. Many studies indicate that triticale flour blends of up to 50% with wheat flours produce breads with quality similar to breads made from wheat flours only[2]. Some studies indicate that while the nutritional quality of triticale is considered superior to wheat, the higher ash content, lower milling yields of flour, and inferior loaf volume and texture distract from commercial baking use of triticale[3]. Pena and Amaya[2] indicate that triticale flour blends of up to 50% with wheat flours produce breads with quality similar to breads made from wheat flours only.

The possibility to obtain superior genotypes for various morpho-agronomical traits needs to be explored through field evaluation and characterization of diversity, present among genotypes. Therefore, the aim of this work is to evaluate the performance of some triticale genotypes under Egyptian conditions in order to identify the most promising genotypes adapted to the Egyptian agriculture.

MATERIAL AND METHODS

Forty triticale genotypes were evaluated for two years two winter seasons 2012/13 and 2013/14 in clay soil, Kalubia Governorate. It is located at the North of Cairo (30º 51 N latitude and 32º 20 E longitude). The soil texture of the experimental site was clay and having the following characters: sand 23.91 %, silt 22.27 %, clay 48.82 %, pH 8.42, organic matter 1.68 %, $CaCo_3$ 1.85%, EC 0.67 mmllos/cm^3, and available total N, P and K were 22.00, 16.85 and 228 mg/100 g soil respectively, according to the method described by[4]. The soil was ploughed twice, and divided into plots. During seed preparation, 100 kg/fed calcium super phosphate (15.5% P_2O_5) and 50 kg/fed potassium sulphate (48 % K_2O) were applied.

The materials under study were (local) + 39 genotypes imported from International Center for Agricultural Research in Dry Areas (ICARDA), Allepo, Syria due to International Triticale Yield Nursery, CIMMYT/ICARDA, contribution of the International Maize and Wheat Improvement Center (CIMMYT) (Table 1). Each entry was planted with 6 rows of 2.5 m length with 20 cm between rows with three replications and arranged in Randomized Complete Block Design (RCBD). All recommended agronomic practices for bread wheat were applied for the trial. Sowing date in both cultivation seasons was around mid - November. Nitrogen fertilizer was applied at the rate of 40 kg N/fed as urea (46% N) in two equal doses before the first and second irrigation. Triticale plants were manually harvested on the first week of May in both seasons.

Data recorded.

From the central four rows in each plot, days to 50% heading and to 90% maturity were determined by the count of panicle initiation and wet yellow spikes, respectively compared to the total plants. At harvest stage, one square meter from four central rows in each plot was pulled to determine number of spikes/m^2 as well as plant height, number of spikelets and grains per spike, length and weight of spike, grains weight of spike and 100–grains weight were determined from randomly selected 20 tillers from each plot. As well as the above ground biomass (biological yield) was determined, spikes were threshed to determine grain yield, straw yield was calculated by subtracting grain yield from biological yield, harvest and crop indexes was calculated by dividing grain and straw yield/biological yield, respectively.

Statistical analysis.

Data were analyzed using an ANOVA of randomized complete block design (RCBD) (the analytical package M-STATC v. 3.1.,)[5]. Since the trend was similar in both seasons, Bartlett's test was applied and the combined analysis of the two growing seasons was done. LSD (P = 0.05) was used to compare genotype means. The simple correlation coefficients among all the studied characters and Cluster Analysis were performed using the analytical package SPSS v. 16.1[6].

Table 1. The pedigree of triticale genotype used in the experiment.

No.	Name and pedigree of genotypes
1	Bahteem-1 (Local check)
2	Beagle_ l
3	Eronga 83
4	Fahad_5
5	Pollmer_2.1.1
6	Liron_2/5/dis 85/3/sphd/pvn/ / yogui_6/ 4/
7	Pollmer_ 1.1/3/faras_2//sika 26/hare_337
8	Fahad_8-2* 2/ / ptr/ pnd-t/3/gaur_3/ anoas_2/
9	Ker_6/faras_1/ /bull_2/3/eriz0_11/yogui_3
10	Ardi_ l/topo 1419/ / eriz0_9/ 3/liron_1-1/4/
11	Pollmer_1.2/ / 150.83/ 2* walrus_1/3/fahad_1
12	Rondo/bant_5//anoas_2/3/rhin0_3/bull_1-1
13	1982 Tc3/yogui_1//arrb/3/kissa _3-1/4/lt1/
14	Ardi_l/topo 1419/ /eriz0_9/3/2* kissa_7-1
15	Asn0/3/2 * musx/lynx/ /yogui_ 1/4/2*mor5a
16	Eriz0_12/2* nimir_3//rond0/2*eriz0_11
17	Lira/buc/4/2 *t4466/3/k760/dp/ /x77-387-1/5/
18	Pollmer_4/5/tapir / yogui_l /2* musx/3/
19	Bull_10/manati_1//pollmer_4
20	Dad 3141/3/ardi_l/topo 1419/ /eriz0_9/4/
21	Dahbi_6/3/ardi_1/topo 1419//eriz0_9
22	Susi_2/ 5/tapir/ yogui_l// 2* musx/ 3/ eriz0_7/ 4/
23	T1502_wg/moloc_4/ /rhin0_3/bull_ 1- 1
24	Musx*2/f78117//uron_6/3/tarasca 87_1* 2/4/
25	Pop_wg
26	Prest0//2*tesm0_1/musx 603/4/ ardi_ l/
27	Prest0//2*tesm0_1/musx 603/4/ ardi_ l/.
28	Prest0//2*tesm0_ 1/musx 603/4/giraf/yogui_l//
29	Anoas_s/faras_1//pollmer_4/3/caal
30	Fahad_4/faras_l//caal/3/dagro/ibex/ /civet#2
31	Ker_6/faras_1//bull_ 2/3/pollmer _1.1.1
32	Merino/jlo//reh/3/hare _267/4/ ardi_4/5/ptr/
33	Yogui_3/eriz0_11//0na_2/poss_1-2
34	83 Tr 1-11/3/150.83//2*tesm0_1/musx 603/4/
35	Ardi_l/topo 1419//eriz0_9/4/gaur_1/3/musx/
36	Bull_1-1/kissa_1-1//pollmer_2.1.1
37	Dahbi/3/fahad_s-2*2//ptr/pnd-t
38	Pollmer_3.5.1//eriz0_ 15/fahad_3
39	Tcb163_wg/pollmer_1.1.1//pollmer _2.1.1
40	Yogui_3/eriz0_11/ /ona_2/poss_ 1·2

RESULTS AND DISCUSSION

Yield Components:

The analysis of variance indicated that there is highly significant difference ($P \leq 0.01$) in mean performance of Triticale yield components i.e, days to 50% flowering and 90% maturity; plant height; spike number/m^2; spike length and weight of grain, straw and biological yield as well as HI and CI (Tables 2 and 3). All the test genotypes differ in their mean performance in all the above characters.

Table 2. Analysis of variance (expressed as mean square) for yield components of 40 triticale genotypes grown at Delta region in Egypt. (Combined data over both seasons).

Source of variation	Degree of freedom	Days to50% flowering	Days to 90% maturity	plant height (cm)	spike length (cm)	spike weight (g)	spikes (numbers/m^2)
Years (Y)	1	55.97 ^{ns}	106.67*	27.45^{ns}	16.54**	0.014^{ns}	596.45*
Error	4	8.01	8.02	25.44	0.31	0.006	70.69
Genotype (G)	39	132.15**	146.11**	496.16**	12.83**	1.440**	29922.24**
(Y x G)	39	88.08**	44.27**	126.11**	0.07^{ns}	0.007**	821.28**
Error	156	42.09	10.26	11.31	1.35	0.004	128.97
Total	239						
CV (%)		**7.66**	**2.24**	**3.20**	**15.05**	**7.14**	**4.20**

Table 3. Analysis of variance (expressed as mean square) for yield components of 40 triticale genotypes grown at Delta region in Egypt. (Combined data over both seasons).

Source of variation	Degree of freedom	Yield (kg/m^2)			HI (%)	CI (%)
		Grain	Straw	Biological		
Years (Y)	1	0.133**	1.33^{ns}	0.622^{ns}	344.98^{ns}	689.79^{ns}
Error	4	0.005	0.984	0.863	214.31	591.11
Genotype (G)	39	0.23**	4.70**	6.420**	133.60**	289.32**
(Y x G)	39	0.008**	0.44**	0.471**	24.15**	57.94**
Error	156	0.002	0.055	0.066	9.20	28.74
Total	239					
CV (%)		**12.68**	**13.21**	**11.83**	**15.69**	**21.74**

Days to flowering and maturity:

Significant differences among Triticale lines in days to 50% heading and 90% maturity were recorded in Table 4. Regarding days to 50% heading, results shows that Triticale lines flowered after 72.5 to 95 days. The data show that 5 triticale lines were earlier than others (< 80 days), while only line no. 8 was the latest flowering line (> 90 days). The other 34 lines flowered between 70 – 80 days. Similar trend was observed in days to 90% ripening character. The same earlier lines were the earlier in ripening and ranged between 132 – 137 for the lines 1, 37, 38, 39 and 40, while, the latest maturity one was line no. (8 >150 days). Other lines matured between 140 – 150 days. It seems that, most the earlier maturity triticale lines were shorter than that the other lines and were < 90 days. Also, it is worthy to note that, the latest matured lines possessed the tallest plants. El-Karmany *et al*.[7,8] found variation among genotypes in sandy soils in Egypt. Also, wide variations among tested genotypes were reported by CIMMYT[9].

Spike characters:

From the same Table, it is clear that triticale lines significantly differed in their ability to produce spikes per m^2. The data reveal that 4 categories could be noticed where 2 lines less than 100 spikes per m^2 and 4 lines produced 100 – 199 spikes /m^2. the majority of the tested lines produced 200 – 300 spikes /m^2 (20 lines) and the rest 14 lines produced greater than 300 spike /m^2. The greatest no. of spikes /m^2 was recorded by the line no. 5 while the lowest no. was recorded by the line no. 19.

Significant differences among triticale lines were recorded in spike length (g). The data clearly show that the only 4 lines produced the tallest spikes (1, 2, 3, 8) > 10 cm where as the shortest were no. 17 and 25. The rest of the lines ranged between 6 and 10 cm per spike.

The data of spike weight clearly revealed significant differences in spike weight among the tested lines (Table 4). The greatest weight of spikes were recorded by the lines 6 and 9 >200 g/100 spike followed by the lines no. 1, 3, 7, 8, 9, 11 and 35 > 100 g/100 spikes while, the rest were < 100g/100 spike. It seems that, these criteria related to the competition between triticale plants under the same line (inter – specific competition). Such observation is evident for the lines no. 2 (the lowest spike weight and great spike no.) and the contrast situation with the line no. 19 greater spike weight (220 g/100 spike) and the lowest no. of spikes (83)/m2. Variations among genotypes in spike characters were recorded by El-Kramany *et al*.[7, 8] under sandy soil conditions. They stated significant differences among genotypes for all studied characters.

Table 4. Differences between forty triticale lines in days to 50% flowering and 90% repining, yield and yield components. (Combined data over both seasons).

Trtical lines □	Days to □		Plant height (cm)	Spike length (cm)	Spike weight (g)	Spikes numbers /m^2	Yield (kg/m^2)			HI (%)	CI (%)
	50 % flowering	90 % ripenning					Grain	Straw	Biological		
1	83.33	137.50	84.17	11.17	1.19	314.83	0.653	2.534	3.187	20.48	25.80
2	86.67	141.67	105.33	10.83	0.29	336.83	0.263	2.467	2.730	9.79	11.20
3	89.17	145.83	121.17	10.50	1.74	180.67	0.556	3.191	3.747	15.32	18.21
4	87.50	140.83	90.83	7.83	0.55	337.33	0.460	2.757	3.217	14.26	17.05
5	85.00	138.33	99.83	8.83	0.70	433.00	0.579	2.674	3.253	17.88	21.82
6	88.33	144.17	99.33	7.50	2.31	262.33	1.003	4.133	5.137	19.59	24.42
7	86.67	140.00	108.83	9.33	1.01	384.17	0.708	2.782	3.490	20.34	25.59
8	95.00	151.67	125.17	10.83	1.70	303.50	0.916	3.876	4.792	19.24	23.89
9	92.50	149.17	115.00	9.17	1.27	306.00	0.691	2.849	3.540	19.61	24.43
10	73.48	143.33	107.00	9.50	1.31	310.00	0.726	2.217	2.943	24.88	33.32
11	88.33	142.50	110.17	8.83	0.44	325.83	0.341	2.589	2.930	14.56	17.93
12	86.67	145.00	114.67	7.33	1.57	96.00	0.269	1.021	1.290	21.41	27.48
13	90.00	149.17	115.83	7.67	0.82	175.00	0.288	0.999	1.287	22.48	29.09
14	89.17	149.17	109.33	7.00	0.99	186.00	0.317	0.923	1.240	25.75	35.03
15	88.33	148.33	106.50	7.33	0.97	189.50	0.305	1.239	1.543	19.94	25.05
16	84.17	147.50	110.00	7.33	0.71	286.33	0.363	1.380	1.743	21.00	26.71
17	82.50	145.83	104.50	5.33	0.49	335.50	0.347	1.033	1.380	26.73	37.06
18	84.17	145.83	103.33	6.33	0.46	256.83	0.251	0.969	1.220	21.23	27.13
19	84.17	145.00	103.83	6.33	2.23	83.17	0.271	1.105	1.377	21.31	28.19
20	85.83	144.17	111.50	6.83	0.80	252.17	0.363	1.370	1.733	21.31	27.37
21	84.17	143.33	102.83	7.50	0.83	292.67	0.442	1.425	1.867	24.05	31.94
22	86.67	149.17	102.00	9.33	0.34	306.00	0.231	0.935	1.167	20.54	26.04
23	84.17	145.83	107.67	7.50	1.04	233.17	0.402	1.255	1.657	24.41	32.36
24	86.67	144.17	107.83	8.33	0.97	206.33	0.341	1.309	1.650	20.78	26.40
25	80.00	141.67	113.67	5.33	0.69	294.67	0.376	1.717	2.093	19.17	24.18
26	85.00	140.00	105.00	7.33	0.43	286.67	0.253	0.964	1.217	21.20	27.14
27	86.67	148.33	108.67	7.67	0.67	373.00	0.413	1.534	1.947	21.43	27.52
28	89.17	149.17	105.33	8.67	0.75	286.67	0.363	1.550	1.913	19.13	23.76
29	85.83	139.17	98.09	7.33	0.46	313.67	0.337	1.510	1.847	17.98	22.09
30	81.67	145.00	109.67	6.00	0.46	211.33	0.248	1.077	1.325	18.88	23.54
31	85.00	143.33	97.50	6.67	0.69	206.67	0.220	0.710	0.930	24.65	34.55
32	84.17	148.33	110.17	6.67	0.37	300.33	0.204	0.931	1.135	18.71	23.29
33	82.50	140.83	105.50	7.33	0.65	252.50	0.303	1.191	1.495	20.59	26.18
34	84.17	143.33	108.50	6.67	1.07	209.67	0.389	1.308	1.697	23.33	30.82
35	82.50	143.33	102.17	7.33	0.84	243.33	0.357	1.243	1.600	23.14	30.73
36	84.17	138.33	106.83	7.33	0.80	280.83	0.367	1.431	1.799	20.59	26.15
37	76.67	131.67	83.81	6.42	0.42	297.42	0.206	1.884	2.090	9.83	10.96
38	72.50	135.00	84.17	6.42	0.56	293.58	0.199	1.675	1.874	10.57	11.85
39	74.17	132.50	89.64	6.50	0.47	292.22	0.171	3.531	3.702	4.60	4.82
40	79.17	132.50	103.83	6.67	0.40	278.33	0.170	1.643	1.813	12.66	15.45
Grand Mean	**84.65**	**143.25**	**104.98**	**7.72**	**0.86**	**270.35**	**0.39**	**1.77**	**2.16**	**19.33**	**24.66**
$LSD_{5\%}$	**7.32**	**3.63**	**3.82**	**1.31**	**9.72**	**12.91**	**0.14**	**0.65**	**0.72**	**3.40**	**6.00**
CV (%)	**7.66**	**2.24**	**3.2**	**15.05**	**3.95**	**4.20**	**12.68**	**12.99**	**11.83**	**15.96**	**21.56**

Yield (kg/m^2):

Data presented in Table (4) show significant differences among triticale genotypes in grain yield/m^2. The inspection of the data reveals that, there were two superior lines i.e., (6 and 8) in grain yield (1.01 and 0.92 kg m^2, respectively). Other lines (>100g/m^2) could give reasonable triticale grain yield in such clay soil (Lines no. 3, 4, 5, 7, 9, 10, 21 and 23). The yield of the rest lines ranged between 42.5 – 97.2 g /m^2 indicating poor to medium grain yield.

Similar tendency was observed for both straw and biological yields/m^2. The same superiority of lines no. 6 and 8 in grain yield was evident for both straw and biological yields than the other lines. Also, the lines no. 3, 4, 5, 7, 9, 10, 21 and 23 gave the best straw and biological yields m^{-2} indicating that, triticale lines could out yield grain, straw and biological yields reveal to this distinct.

From the same Table, it can be noticed significant differences among triticale lines in harvest index (HI) and Crop index (CI). Harvest index ranged between 4.6 and 26.7 % for the lines 39 and 17, respectively. It is clear from the data that, more than 50% of the tested lines gave HI % >20% comparable to wheat and barley. The same tendency was evident in CI % for the tested lines. CI % values ranged between 4.8 and 37.1% for the lines 39 and 17. Only 8 lines 2, 3, 4, 11, 37, 38, 39 and 40 reported CI < 20%. The differences among genotypes were reported in many studies either under Egyptian condition[7,8] or abroad[10, 11].

Correlation among tested characters:

The data of the correlation matrix presented in Table (5) clearly show that, grain yield (kg/m^2) was highly significant correlated with days to 50 % flowering, spike length, weight and number/m^2 (P> 0.01) and correlated significantly with plant height and days to 90 % maturity P> 0.05. Straw and biological yields were highly significant correlated with spike length, weight, spike no./m^2 and grain yield /m^2, while, biological yield was also correlated with straw yield/m^2 (P> 0.01%). Simple correlation is considered one of the important statistical tools, simple, faster way for plant breeder for selection of heritability traits affecting in grain yield. Sharma and Rao[12] and Blestsos *et al.*[13] reveled that tillers m^{-2} clear maximum positive direct effect on grain yield followed by grains/spike, biological yield, harvest index and 1000-grain weight thus, they are characters of major importance for grain yield[12, 13] . Milovanovic[14] and Koczowska and Korona[15] stated that grain yield and found that it was significantly correlated with number of spikes/square meter. Ittu *et al.*[11] added that yield improvement resulted from an increase in the number of kernels/spike (0.4 kernels/year), weight of kernels/spike (0.0164 g/year), and test weight (0.337 kg/hl/year). Similar results of correlation matrix among triticale yield and its components were reported by several studies[8, 10, 16].

Table 5: Correlation coefficient matrix of the agronomic characters of 40 triticale genotypes.

	1	2	3	4	5	6	7	8	9	10
1-Dys to 50 % flowering	1									
2- Days to 90 % ripening	0.32**	1								
3- Plant height (cm)	0.27**	0.49**	1							
4- Spike length (cm)	0.19**	0.14*	0.13*	1						
5- Spikes weight (g)	0.17**	0.15*	0.16*	0.41**	1					
6- Spikes numbers/m^2	-0.04	-0.21**	-0.23**	0.23**	0.20**	1				
7- Grain yield (g/m^2)	0.19**	0.16*	0.16*	0.46**	0.93**	0.28**	1			
8- Straw yield (g/m^2)	0.07	-0.12	0.01	0.41**	0.64**	0.36**	0.64**	1		
9- Biol. yield (g/m^2)	0.10	-0.08	0.03	0.44**	0.73**	0.37**	0.74**	0.99**	1	
10- HI (%)	0.14*	0.32**	0.21**	-0.02	0.16*	-0.19**	0.24**	-0.52**	-0.41**	1
11- CI (%)	0.13*	0.29**	0.18**	-0.04	0.13*	-0.19**	0.21**	-0.51**	-0.40**	0.98**

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

Cluster analysis:

Cluster analysis was used as a tool to classify triticale genotypes into groups and sub-groups based on all tested parameters. The dendrogram was constructed on the basis of Euclidean distance matrix (Fig. 1). The genotypes classified into 4 groups and 8 sub-groups. Cluster I, II, III and VII, contained 21, 14, 3 and 2 genotypes respectively. Cluster V was the largest group including 21 genotypes i.e. no. 1, 2, 4, 8-11, 16, 17, 21, 22, 25, 26, 28, 29, 32 and 37- 40 followed by cluster II where contained 14 genotypes (i.e., no.3, 6, 13-16, 18, 20, 23, 24, 30, 31, 33-35). While clusters III and VI came in the last order with 3 genotypes (no., 5, 7, 27) and 2 genotypes (no., 12, 19), respectively. Inter cluster unit data may suggest that these genotypes could be originated from a single colony while, intera the clusters this may reflect the wide diversity among the genotypes under the conditions of the experiment (Table 1). Genotypic variation was recorded by several studies[8, 17- 20].

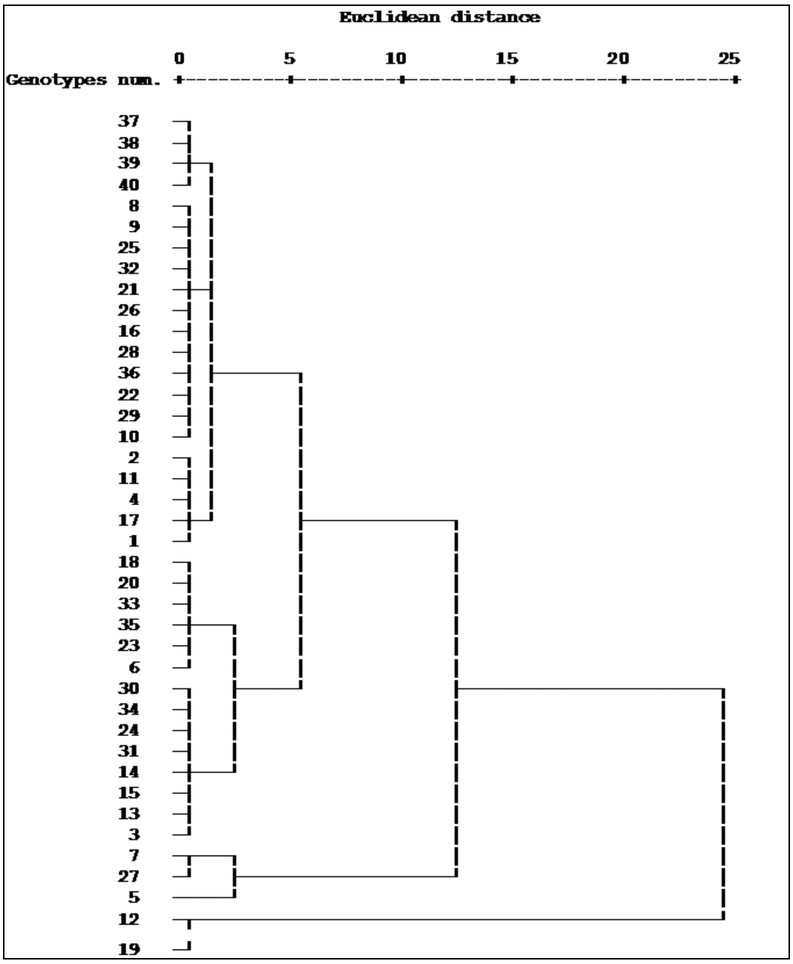

Fig. 1. Dendrogram based squared Euclidean distance for yield and yield components of triticale genotypes (entry no 1-40 as per Table 1).

Conclusion

It could be concluded from this study that some triticale lines could give reasonable triticale grain yield comparable to wheat and barley yields under similar conditions, i.e. lines no. 3, 4, 5, 7, 9, 10, 21 and 23). Meanwhile, other lines (6 and 8) proved to be promising genotypes that could be employed as possible alternative to wheat under Egyptian condition.

ACKNOWLEDGMENT

This work was financially supported by National Research Centre, Giza, Egypt.

REFERENCES

1. Gulmezoglu, N., I. Tolay and A. Askin (2010). Changes in nitrate concentration of triticale forages (x *Triticosecale* Wittmack) at different growth stages by increasing nitrogen rates. Journal of Food, Agriculture and Environment, 8(2), 449-453.
2. Pena R.J. and Amaya A. (1993). Milling and bread making properties of wheat triticale grain blends. J. Sci. Food Agric., 60, 483-487.
3. Stallknecht G.F., Gilbertson K.M. and Ranney J.E. (1996). Alternative wheat cereals as food grains: Einkorn, emmer, spelt, kamut, and triticale. In: Janick J. (ed.): Progress in New Crops. ASHS Press, Alexandria, 156–170.
4. Chapman, H.D. and R.F. Pratt (1978). Methods analysis for soil, plant and water. Univ. of California Div. Agric. Sci., 16-38.
5. MSTAT-C, 1988. MSTAT-C, a microcomputer program for the design, arrangement and analysis of agronomic research. Michigan State University, East Lansing.
6. SPSS (Statistical Package for Social Sciences), 2007. SPSS (Computer based software package) v. 16. SPSS Inc., New York.
7. El-Kramany M.F., Mirvat E. Gobarah and M.S. Zeidan (2005). Comparative Performance of Some Triticale (X *Triticosecale* Wittmack) Genotypes in Sandy Soil. Egypt J. Agron., 27(1), 1-10.
8. El-Kramany M.F, Ibrahim, O.M, El Habbasha S.F. and Ashour N.I. (2009). Screening of 40 Triticale (X *Triticosecale wittmack*) Genotypes under Sandy Soil Conditions. J. Applied Sci. Res., 5(1), 33-39.
9. CIMMYT, 1997. Triticale. 50-71. In CIMMYT report on wheat improvement. International Maize and Wheat Improvement Center, Mexico City.
10. Elisabeth Thiemt (2006). Triticale with improved nitrogen-use efficiency for organic farming. State Plant Breeding Institute, University of Hohenheim, D-70593 Stuttgart, Germany.
11. Ittu G., Sãulescu N.N. and Mariana I. (2001). Genetic progress in Fundulea triticale breeding program.Turda, 3350, str. Agriculturii 27 Jud Cluj, Romania.
12. Sharma S.C. and S.R.G. Rao (1989). Genetic variability association among metric traits and path coefficient analysis in triticale (X *Triticosecale Wittmack*). Ann. Agric. Res., 10(2), 145.
13. Blestsos E., D. Gogas and T. Adamidis (1997). Dry hay and grain production of two new barley and two triticale cultivars. Rachis, 16(1-2), 27.
14. Milovanovic M. (1993). Investigation of yield and technology traits of grain of the intergenus hybrids triricale (X *Triticosecale* Wittmack). Review of Research Work, Faculty of Agriculture Belgrade, 38(2), 71.
15. Koczowska I. and A. Korona (1994). Variability and correlation of selected traits in spring triticale. Zeszyty Naukowe Akademii Rolniczej WSzczecinie, Rolnictwo,Poland, 58, 67-72.
16. Arzani A., S. Ansari and S.A. Mirmohammadi (2006). Variation of morphological and agronomic characters in triticale. 6th international triticale symposium, September 2006.
17. Hozayn M., M.S. Zeidan, Abd El-Lateef E.M and M.S. Abd El-Salam (2007). Performance of some mungbean (*Vigna radiata* L. Wilczek) genotypes under late sowing condition in Egypt. Res. J. Agric. Biol. Sci., 3(6), 972-978.
18. Hozayn M., S.F. El-Habbasha, E.M. Abd El-Lateef, A.A. Abd El-Monem (2013). Genetic variability in 16 exotic mungbean genotypes for late sowing under Egyptian conditions. J. Applied Sci. Res., 9(1), 643-651.
19. Hozayn M., Korayem A. M., El-Hashash E. F., Abd El-Monem A.A., Abd El-Lateef E.M., Hassanein M. S. and Elwa, T.A (2014). Evaluation of ten exotic sugar beet varieties under different locations in Egypt. Middle East J. Agric. Res., 3(4), 1145-1154.
20. Ramazan D., O. Kacar, N. Coplu and N. Azkan (2009). Characteristics of new breeding lines of triticale. African J. Agric. Res., 4 (2), 133-138.

*****