Egypt. J. Plant Breed. 23(1):1– 10 (2019)

WHICH WHEAT SPECIES IS THE MOST HIGH YIELD POTENTIAL UNDER SANDY SOIL CONDITIONS IN MIDDLE EGYPT?

Sh. R. M. El-Areed

Beni-Suef University, Faculty of Agriculture, Agronomy Department

ABSTRACT

G×E interaction is a big challenge for breeders and producers, so cultivar choice is a major factor for increasing production which lead the farmers to high profit. The present study was carried out in Middle Egypt (El-Minia Governorate) under sandy soil conditions in two growing seasons (2015/2016 and 2016/2017). The study is aimed to a) to identify the pest wheat species under sandy soil conditions b) to determine the best bread wheat cultivar under sandy soil conditions in Middle Egypt c) to determine the best durum wheat cultivar under sandy soil conditions in Middle Egypt. Twelve bread wheat cultivars and six durum wheat cultivars are used in this study using RCBD (randomized complete block design) in three replications. Yield and yield components and other characters are recorded and analysed via GEN-STAT programme version 2014. The results indicated that bread wheat productivity is higher than durum wheat under sandy soil conditions. Besides bread wheat cultivars MISR 2 and MISR1 are the most high yielding cultivars among both bread and durum wheat cultivars. In addition durum wheat cultivar BANI SUEF 5 has the most high yielding potential among durum wheat cultivars.

Key words: ***Bread wheat, Durum wheat, Sandy soil, Middle Egypt*.**

INRODUCTION

Wheat is the most important staple crop in the world being used for human food and livestock feed. Wheat is both the most important grain and the single largest crop by area in Egypt. Egypt has not reached to self-sufficiency of wheat production until now (production is 8.7 million ton and domestic consumption is 18.6 million ton) according to FAO Country Cereal Balance Sheet 2015. According to OECD/FAO (2016), outlook 2016–2025. The self-sufficiency is 43% in 2017 and will be 42% in 2025. The Egyptian Government is the world˚s single largest importer of wheat, the tender documents have become increasingly complex in recent years (Wheat Egypt sector review by FAO/EBRD Cooperation 2015, FAO INVESTMENT CENTER). Most of agricultural expansion in Egypt is in the desert land which resides in the arid zone that characterized by shortage of water and unfavourable soil properties and nutrients deficiencies are the most constrains facing any agricultural project proposed (Eissa 2014). The major wheat species grown throughout the world is *Triticum aestivum*, a hexaploid species usually called "common "or" bread" wheat. However, the total world production includes about 35–40 mt of *T. turgidum* var. *durum*, a tetraploid species (Shewry and Hey 2015). Bread wheat is very important for manufacturing different types of bread products, durum wheat (*Triticum durum*) is known for its high yield potential and adaptation to relatively dry environments (Varughese *et al* 1997). The importance of durum wheat is attributed to multiple usages for human consumption in bread, macaroni industry and its high protein and gluten contents (Rachon *et al* 2002 and Makowska 2008). Durum wheat has received far less attention than bread wheat and barley (Royo *et al* 2007). Both species (bread and durum wheat) are planted in Egypt. In both bread and durum wheat, grain yield is assessed by three components, namely; the number of spikes per unit area, the number of kernels per spike and kernel weight. (Guinta *et al* 1993) and (Zhong-hu, and Rajaram 1994).

In this current stage, we have to give great attention in Egypt to increase the productivity of wheat especially in the new reclaimed land particularly the Egyptian government try to increase the cultivated area in the new reclaimed lands. Thus, cultivar choice is a major factor for obtaining high production because of G×E interaction which is a big challenge for wheat breeders and producer. The present study aimed to a) identify the best wheat species under sandy soil conditions b) determine the best bread wheat cultivar under sandy soil conditions in Middle Egypt c) determine the best durum wheat cultivar under sandy soil conditions in Middle Egypt.

MATERIALS AND METHODS

The present study was carried out in Middle Egypt at El-Minia Governorate under a sandy soil condition in two growing seasons 2015/2016 and 2016/2017. Table (1) shows the physical and chemical characters of experimental site soil. Eighteen wheat cultivars were used in this study (12 bread wheat cultivars and 6 durum wheat cultivars). Table (2) shows cultivar names, pedigree, species and origin.

Table 1. Physical and chemical characters of experimental site soil.

<table>
<tr><th>Soil Character</th><th>Value</th><th>Soil Character</th><th>Value</th></tr>
<tr><td>Texture grade</td><td>Loamy sand</td><td>pH (1:2.5)</td><td>8.11</td></tr>
<tr><td>Fine sand%</td><td>77.4</td><td>CEC cmol kg^{-1}</td><td>4.71</td></tr>
<tr><td>Coarse sand%</td><td>9.4</td><td>Potassium mg kg^{-1}</td><td>0.28%</td></tr>
<tr><td>Silt%</td><td>7.3</td><td>$CaCO_3$%</td><td>11.22</td></tr>
<tr><td>Clay%</td><td>6.3</td><td>N%</td><td>0.18</td></tr>
<tr><td>EC ds m^{-1} at 25C^0</td><td>0.93</td><td rowspan="2">Phosphorus mg kg^{-1}</td><td rowspan="2">0.04%</td></tr>
<tr><td>Organic matter(%)</td><td>0.20</td></tr>
</table>

Table 2. Name, pedigree and origin of 18 Egyptian wheat cultivars under study.

SN	Cultivar name	Pedigree & origin	Species
1	SIDS 1	HD2172/Pavon “S”//1158.57/Maya 74”S” Sd46-4Sd-2Sd-1Sd-0Sd	Bread wheat
2	SIDS 12	BUC//7C/ALD/5/MAYA74/ON//1160.147/3/BB/GLL/4/CHAT"S"/6/MAYA/VUL//CMH74A.630/4*SX SD7096-4SD-1SD-1SD-0SD	Bread wheat
3	SIDS 13	Kauz “s” // Tsi / Snb”s” ICW94-0375-4AP-2AP-030AP-0APS-3AP-0APA-050AP-0AP-0SD	Bread wheat
4	SAKHA 93	Sakha 92TR 810328 S 8871-1S-2S-1S-0S	Bread wheat
5	SAKHA 94	Opata/Rayon//Kauz CMBW90Y3180-0TOPM-3Y-010M-010M-010Y-10M-015Y-0Y-0AP-0S	Bread wheat
6	SHANDAWEEL 1	Site / Mo /4/ Nac / Th.Ac // 3* Pvn /3/ Mirlo / Buc CMSS93B00567S-72Y-010M-010Y-010M-3Y-0M-0THY-0SH	Bread wheat
7	GEMMEIZA 9	Ald”S”/Huac”S”//CMH74A.630/5x CGM4583-5GM-1GM-0GM.	Bread wheat
8	GEMMEIZA 11	Maya 74 “S”/On//1160-147/3/Bb/4/Chat”S” /5/ctow	Bread wheat
9	GEMMEIZA 12	Bow “s”/ Kvz “s”//7C/Seri 82 /3/ Giza 168 / Sakha61 GM 7892-2GM-1GM-2GM-1GM-0GM	Bread wheat
10	GIZA 168	MIL/BUC//Seri CM93046-8M-0Y-0M-2Y-0B	Bread wheat
11	MISR 1	OASIS / SKAUZ // 4*BCN /3/ 2*PASTOR CMSS00Y01881T-050M-030Y-030M-030WGY-33M-0Y-0S	Bread wheat
12	MISR 2	SKAUZ / BAV92 CMSS96M03611S-1M-010SY-010M-010SY-8M-0Y-0S	Bread wheat
13	BANI SUEF 1	Jo”S” / AA//g “S”	Durum wheat
14	BANI SUEF 3	Corm”S”/Rufo”S” CD4893-10y-1M-1Y-0M	Bread wheat
15	BANI SUEF 4	RoK”S”/Mexi 75/a/”S”//Ruff”S”/FG”S”/3/Mexi 75 SDD1462-2sd-1sd-0sd	Durum wheat
16	BANI SUEF 5	Dipperz / bushen3 CDSS92B128-1M-0Y-0M-0Y-3B-0Y-0SD	Durum wheat
17	BANI SUEF6	Boomer-21/Busca-3 CDSS95Y001185-8Y-0M-0Y-0B-1Y-0B-0SD	Durum wheat
18	SOHAG 3	CBC509CHILE//SOOTY_9/RASCON_37/9/USDA595/3/D67.3/RABI//CRA/4/ALO/5/HUI/YAV_1/6/ARDENTE/7/HUI/YAV79/8/POD_9 and CDSS02Y01233T-0TOPB-0Y-0M-26Y-0Y-0SD	Durum wheat

The seed are planted by drill method with six rows, 3m long, 20 cm apart between the rows (planted area = 3.6m^2), four enter rows are harvested without border to overcome border effect (harvested area = 2.4m^2). All recommended package is applied.

Regarding the experimental design and statistical analysis, RCBD (Randomized Complete Block Design) is used with three replications, combined analysis of the two seasons is computed using Genstat program version (2104).

RESULTS AND DISCUSION

Analysis of variance for all studied traits are analysed by Gnstat program, version (2014) and all data are presented in Table (3). Mean performance of all studied traits for all studied wheat cultivars are shown in Table (4).

Table 3. Analysis of variance of studied traits for 18 wheat cultivars

SOV	df	Mean of square (MS)							
		Grain yield kg./plot	No. of spikes/ m^2	No. of kernels/ spike	1000-kernel weight	No. of spikelets/ spike	Spike length	Plant height	Biological yield kg/plot
Rep.	2	0.2169	18016	10.9	47.07	0.791	0.7857	177.85	4.5716
Cultivars	17	0.1964**	32821**	149.3	153.51**	12.347**	3.9829**	62.35**	0.6503*
Error	28	0.02413	10811	104.4	36.53	1.408	0.6312	20.2	0.3016

***, ** = significant and highly significant effect affected by wheat genotypes**

Grain yield

According to Pfeiffer (2001) durum wheat attended to consistently out yield bread wheat in the highest yielding conditions. In this study, the bread wheat cultivars were higher than durum wheat cultivars under sandy soil conditions. The data in Table (3) show that highly significant differences were shown by studied wheat cultivars for grain yield. Table (4) and figure (1) show that the average of grain yield for bread wheat cultivars (1.1 kg/plot) is higher than durum wheat cultivars (0.7kg./plot). These results are in harmony with those of Hatun *et al* (2015) and Fischer and Maurer (1978). The highest values are obtained by bread wheat cultivars MISR 1, MISR 2, SIDS 13 and SAHKA 94 (1.5, 1.4, 1.2 kg plot^{-1} , respectively). By contrast, the lowest values are obtained by durum wheat cultivars BANI SUEF 4, BANI SUEF 6, BANI SUEF 1 and SOHAG 3 (O.5, 0.6. 0.7 kg plot^{-1}, respectively).

Table 4. Mean performance of studied traits for 18 Egyptian wheat cultivars under sandy soil conditions at Middle Egypt

Cultivar name	Species	Grain yield kg/plot	No. of spikes/ m^2	No. of kernels/ spike	1000-kernels weight (g)	No. of spikelets /spike	Spike length (cm)	Plant height (cm)	Biological yield Kg/plot
SIDS 1	Bread	1.0	284	34.5	41.8	19.9	9.5	75.0	3.1
SIDS 12	Bread	1.1	383	43.8	28.5	17.9	8.5	73.0	3.0
SIDS 13	Bread	1.2	262	38.0	51.3	16.1	6.2	70.0	3.5
SAKHA 93	Bread	1.0	263	28.3	42.0	18.3	8.7	70.0	3.0
SAKHA 94	Bread	1.2	343	36.2	38.7	16.3	7.7	83.0	3.3
SHANDAWEEL 1	Bread	1.1	400	34.9	35.2	15.4	7.2	73.0	3.3
GEMMEIZA 9	Bread	0.9	264	25.8	42.5	16.1	7.5	73.0	3.1
GEMMEIZA 11	Bread	0.8	311	26.3	43.4	19.4	9.2	83.0	2.5
GEMMEIZA 12	Bread	0.9	464	29.9	33.3	14.7	6.9	78.0	2.3
GIZA 168	Bread	0.9	495	24.9	24.1	19.1	9.2	75.0	2.9
MISR1	Bread	1.4	428	36.9	40.0	16.2	7.6	80.0	3.1
MISR 2	Bread	1.5	475	37.7	40.0	17.1	8.0	83.0	3.8
Mean of BWC		1.1	364.3	33.1	38.4	17.2	8.0	76.3	3.1
BANI SUEF 1	Durum	0.7	126	41.5	53.3	15.0	6.5	73.0	2.3
BANI SUEF 3	Durum	0.8	289	27.2	40.7	13.1	5.9	78.0	2.8
BANI SUEF4	Durum	0.5	214	27.8	45.5	14.7	6.5	83.0	1.9
BANI SUEF 5	Durum	0.9	196	50.8	39.2	16.1	6.9	82.0	2.9
BANI SUEF 6	Durum	0.6	211	31.6	39.7	13.1	6.0	77.0	2.6
SOHAG 3	Durum	0.7	310	29.6	47.7	14.3	6.4	77.0	2.4
Mean of DWC		0.7	224.3	34.8	44.3	14.4	6.4	78.3	2.5
CV		11.4	10	2.3	4	1.3	2.8	4.1	17.5
LSD at 1%		0.3505	238.3	22.76	13.571	2.643	1.77	10.0	1.2234
LSD at 5%		0.2598	175.6	16.96	10.078	1.969	1.318	7.5	0.9112

BWC = Bread Wheat Cultivars, DWC= Durum Wheat Cultivars

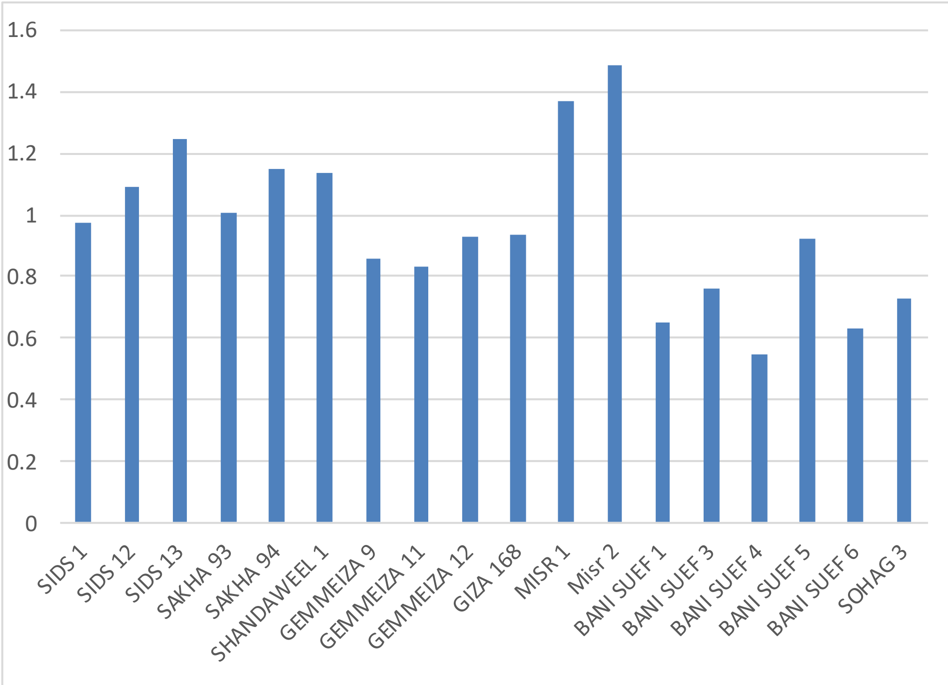

Fig.1. Performance of grain yield kg/plot (2.4m^2) for 18 Egyptian wheat cultivars under sandy soil conditions at Middle Egypt

Number of spikes per m^2

The tillering is one of the first earliest developmental processes during the early growth stage of cereal plant depend on accessibility of water and minerals (Simane *et al* 1993), tillering may be one of the important factors in determining a cultivars' yield (Connor *et al* 1992) Highly significant difference were observed for number of spikes per ^{2} due to different cultivars (Table 3). The mean performance of number of spikes per m^2 is illustrated in Table (4), the overall mean of bread wheat cultivars (364 spikes per m^2) was higher than that of durum wheat cultivars (224 spikes per m^2). The lowest value of number of spikes per m^2 was from durum wheat cultivar BANI SUEF 1 and BANI SUEF 5 (126, 196 tillers per m^2) and the highest values obtained by bread wheat was for cultivar GIZA 186 and GEMMEIZA 12 (495, 464 tillers per m^2, respectively). These results agreed with that of Moaydi *et al.* (2009) who found that the G5 durum genotype produced the lowest value for all the tillering traits in D2 treatment (water limitation from one-leaf to floral initiation stage) while cultivar Chamran (bread wheat cultivar) exhibited the highest value.

1000-kernel weight

Highly significant differences were observed by 1000-kernel weight due to different wheat cultivars (Table 3). Data presented in Table (4) indicated that the average of 1000-kernel weight of durum wheat cultivars (44.3 g) is higher than that of bread wheat cultivars (34.4 g). These results are in harmony with Martia and Slafer (2014) and Moayedi *et al* (2010). Bahrani, A. and Hagh Too (2010) who found that remobilization efficiency of plant nitrogen to grain differed between cultivars over the range of different nitrogen levels and durum wheat was more efficient than bread wheat in nitrogen remobilization efficiency. Consequently, grain protein percentage in durum wheat increased. Results of Branlard *et al* (2001) and Cox *et al* (1990) explain the previously reported facts in this study.

Durum wheat cultivar BANI SUEF 1 gave the highest (53.3g) while the bread wheat cultivar SIDS 12 gave the lowest value (28.5g).

Number of grains per spike and spikelets per spike

There is no significant differences for number of grains per spike but the data showed highly significant differences for number of spikelets per spike (Table 3) The results in Table 4 show that the average of durum wheat cultivars is higher than bread wheat cultivars. These results disagree with Martia and Slafer (2014), BANI SUEF 5 gave the highest value while GIZA 168 and GEMMEIZA 9 gave the lowest values (50.8, 24.9 and 25.8 respectively). Regarding the number of spikelets per spike the average bread wheat cultivars (17.2) is higher than durum wheat cultivars (14.4) despite of the durum wheat cultivars gave the highest value of number of grains per spike, may be due to different fertility level in the flowers, boron (B) deficiency limits reproductive growth more than vegetative growth in cereals such as wheat (Huang *et al* 1996) found that the lower was floret fertility and the number of grains set in a whole ear affected by boron deficiency. According to the presented results we can say that the number of floret fertility in durum wheat is higher than bread wheat. The question is why the number of fertility florets in durum wheat is higher than bread wheat? For answering the question we can refer to (Connor *et al* 1992) who found that durum wheat cultivars were higher in the uptake of boron than bread wheat. In addition, Turan *et al* (2018) found that B toxicity symptoms strongly appeared in durum wheat compared to bread wheat.

Spike length and plant height

Highly significant differences were obtained for spike length and plant height due to different wheat cultivars (Table 3). The presented results in Table 4 indicated that the average of spike length of bread wheat (8 cm) was higher than durum wheat cultivars (6.4 cm) while the average of plant height of durum wheat cultivars (78.3 cm) was higher than bread wheat cultivars (76.3 cm). genetic gains in bread wheat yield have been widely associated with decreasing plant height (Berger and Planchon 1990) which associated to the presence of the dwarfing genes Rht-B1 and Rht-D1,

Biological yield

The effect of wheat cultivars is significant on biological yield trait (Table 3), The presented data in Table (4) illustrate that the biological yield of bread wheat cultivars (3.1 kg/plot) was higher than durum wheat cultivars (2.5kg./plot). These results are in harmony with Marti and Slafer (2014) who found that the Bread wheat cultivars were more efficient than durum wheat under low-yielding conditions. Table (2) indicated that the present study is implemented under low-yielding conditions, MISR 1 (bread wheat cultivar) gave the highest value (3.8kg./plot) while BANI SUEF 4 (durum wheat) gave the lowest value (1.9kg./plot).

Conclusion

The bread wheat is the most yielder wheat species regarding yield potential in the present study compared to durum wheat under sandy soil condition in Middle Egypt. The best bread wheat cultivars are MISR 1 and MISR 2. While the best durum wheat cultivar is BANI SUEF 5. Wheat breeders have to give more efforts for improving durum wheat productivity under sandy soil conditions.

REFERRENCE

Bahrani, A. and M. Hagh Joo (2010). Flag leaf role in N accumulation and remobilization as affected by nitrogen in a bread and durum wheat cultivars. American-Eurasian J. Agric. & Environ. Sci. 8 (6): 728-735.

Berger, M. and C. Planchon (1990) Physiological factors determining yield in bread wheat- effects of introducing dwarfism genes. Euphytica 51:33–39 **Branlard, G., M. Dardevet and R. Saccomano, 2001.** Genetic diversity of wheat storage proteins and bread wheat quality. Euphytica 119(1/2): 59-67.

Connor, D. J., S.Theiveyanathan and G.M.Rimmington, (1992). Development, growth, water-use and yield of a spring and a winter wheat in response to time of sowing. J. Agric. Res.43:493-516 .

Eissa, M. A. (2014). Improving yield of drip-Irrigated wheat under sandy calcareous soils. World Applied Sciences Journal 30 (7): 818-826.

FAO/EBRD Cooperation (2015). Egypt wheat sector review, FAO investment centre, http://www.fao.org/3/a-i4898e.pdf

Fisher, R.A. and R. Maurer (1978). Drought resistance in spring wheat cultivars. I. Grain yield responses. Austr. J. Agric. Res. 29(5): 897 – 912.

Genstat (2014). Genstat developed by VSN International Ltd, in collaboration with practising statisticians at Rothamsted and other organisations in Britain, Australia, New Zealand and The Netherlands. http://cdn.vsni.co.uk/downloads/genstat/release15/doc/IntroGuide.pdf

Guinta, F., R. Motzo and M. Deidda (1993). Effect of drought on yield and yield components of durum wheat and triticale in a Mediterranean environment. Field Crops Res., 33: 399-409.

Hatun, B., S. Aykanat, T. Şimşek ans S. Eker (2015). Nitrogen-Use efficiencies of bread and durum wheat cultivars grown in cukurova region. International Journal of Agriculture and Wildlife Science (IJAWS)1(1): 15 - 22

Huang, L., J.Plant, R.W.Bell, B.Dell and K.Deane (1996) Effects of boron deficiency and low temperature on wheat sterility. In Sterility in Wheat in Sub-tropical Asia: Extent, Causes and Solutions. Australian Centre for International Agricultural Research, Canberra, pp. 91-102.

Makowska, A., W. Obuchowski, H. Sulewska, W. Koziara and H. Paschke (2008). Effect of nitrogen fertilization of durum wheat varieties on some characteristics important for pasta production. Acta Sci. Pol., Technol. Aliment. 7(1): 29-39.

Marti, J. and C.A.Slafer (2014). Bread and durum wheat yields under wide range of environmental conditions. Field Crops Research 156: 258-271.

Moayedi,A.A., A. N. Boyce and S. S. Barakbah (2010). The Performance of durum and bread wheat genotypes associated with yield and yield component under different water deficit conditions. Austr. J. of Basic and Appl. Sci., 4(1): 106-113, ISSN 1991-8178.

Moayedi, A.A., A.N.Boyce, S.S.Barakbah and M.Ghodsi (2009). Tillering behaviours of promising durum wheat genotypes and bread wheat cultivars under different water deficit conditions, Middle Eastern and Russian J. of Plant Science and Biotechnology, Global Science Books.

Pfeiffer, W.H., K. D. Sayre, M. P. Reynolds and T. S. Payne (2001). Increasing yield potential and yield stability in durum wheat. Wheat Program, International Maize and Wheat Improvement Center (CIMMYT) 06600 Mexico, D. F., Mexico pp. 569-577

Rachon, L., K. Szweed-Urbas and Z. Segit (2002). Plonowanie nowych linii pszenicy twardej w zale_nosci od poziomu nawo_enia azotem i ochrony roslin (Yield of new durum wheat (*Triticum durum* Desf.) lines depending on nitrogen fertilization and plant protection levels). Ann. Univ. Mariae Curie-Sklodowska Sect. E, 57: 71-76 (in Polish).

Royo,C., F.Alvaro, V.Martos, A.Ramdani, J.Isadro, D.Villegase and F. G.M. Luis (2007). Genetic changes in durum wheat yield components and associated traits in Italian and Spanish varieties during the 20th century. Euphytica 155: 259–270

OECD/FAO (2016), OECD-FAO Agricultural Outlook 2016-2025, OECD Publishing, Paris. http://dx.doi.org/10.1787/agr_outlook-2016-en

Shewry, P.R. and S.J.Hey (2015). The contribution of wheat to human diet and health. Food Energy Secure. 4(3): 178-202ee

Simane, B, P. C. Struik, M. M. Nachit and J. M. Peacock (1993). Ontogenetic analysis of yield components and yield stability of durum wheat in water-limited environments. Euphytica 71: 211-219

Turan, T.A., S. Taban, G.B.Kayin and N.Taban (2018). Effect of boron application on calcium and boron concentrations in cell wall of durum (Triticum durum) and bread (*Triticum aestivum*) wheat. J. of plant nutrition. 41(11) : 1351-1357.

Varughese, G., W.H. Pfeiffer and R.J. Peantilde (1997). A reappraisal triticale. Consultative Group on International Agriculture Research. CGIAR 4 (2) April, 1997

Zhong-hu, H. and S. Rajaram (1994). Differential responses of bread wheat characters to high temperature. Euphytica. 72: 197-203.

أى أنواع القمح هى الأكثر إنتاجية تحت ظروف الأراضى الرملية فى مصر الوسطى؟

شريف رجب محمد العريض

جامعة بنى سويف – كلية الزراعة البيئية والحيوية والتصنيع الغذائى – قسم المحاصيل

يعتبر التفاعل بين التركيب الوراثى والبيئة من أكبر التحديات التى تواجه مربى النبات والمنتج، لذلك كان إختيار الصنف أحد العوامل الرئيسية لزيادة الإنتاج وبالتالى زيادة الربح. اجريت هذة الدراسة تحت ظروف الأراضى الرملية بمنطقة مصر الوسطى (محافظة المنيا) فى خلال موسمين متتاليين ٢٠١٦/٢٠١٥ و٢٠١٧/٢٠١٦ بهدف أ) تحديد نواع القمح الأكثر إنتاجية تحت ظروف الأراضى الرملية بمنطقة مصر الوسطى، ب) تحديد أفضل أصناف قمح الخبز، ج) تحديد أفضل أصناف قمح المكرونة. وتم إستخدام عدد ١٢ صنف من قمح الخبز وعدد ٦ إصناف من قمح المكرونة وتمت الزراعة بإستخدام تصميم القطاعات الكاملة العشوائية فى ثلاث مكررات. وأوضحت النتائج أن أفضل الأنواع التى يمكن زراعتها تحت ظروف الأراضى الرملية بمنطقة مصر الوسطى هى قمح الخبز، كما أوضحت النتائج أن أفضل الأصناف بالنسبة لقمح الخبز هى مصر ٢ ومصر ١ على التوالى كما أن أفضل الأصناف بالنسبة لقمح المكرونة هو الصنف بنى سويف ٥ .

المجلة المصرية لتربية النبات ٢٣(١) : ١- ١٠ (٢٠١٩)