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PERFORMANCE OF SOME BREAD WHEAT CULTIVARS UNDER NEW LAND CONDITIONS AT MIDDLE EGYPT

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ABSTRACT

Two field experiments were carried out at El-Minia governorate (Middle Egypt) during 2018/2019 and 2019/2020 to evaluate the performance of 14 bread wheat cultivars namely; Gemmiza 9, Gemmiza 10, Gemmiza 11, Gemmiza 12, Sakha94, Sakha 95, Giza 168, Sids 12, Sids 14, Giza 171, Misr 1, Misr 2, Misr 3, and Shandaweel 1 under newly reclaimed lands. Randomized complete block design with four replications was used. The differences among bread wheat cultivars for all studied traits were significant in both seasons except days to heading in the second season and harvest index in both seasons. The results indicated that Gemmiza 12 recorded the lowest number of days to heading. Shandaweel 1 showed the earliest maturity than the other cultivars. Gemmiza 9 and 10 recorded the tallest plants in first season and Gemmiza 9 and Sakha 95 in the second season. Sids 12 produced the highest number of kernels spike^{-1} (59 kernels) in the first season, while it was (55 kernels) for Sids 12 and Misr 1 in the second season. Misr 3 recorded the highest number of spikes m^{-2}. Giza 171 produced the highest values for 1000- kernel weight in both seasons (48.64 g and 39.01 g, respectively). The highest grain yield was obtained from Misr 3 in both seasons without significant differences among cultivars Gemmiza 10, Gemmiza 11, Sakha 94, Sakha 95, Sids 12, Misr 1, and Misr 2 in the first season and among Misr 2 and Giza 171 without significant differences in the second season. Meanwhile, Misr 3 recorded the highest biological yield in both seasons. Shandaweel 1 recorded the lowest number of grain filling duration (13.0 and 18.0), growing degree days (GDD) at grain filling stage (157.7 and 273.2), and growing degree days (GDD) at maturity stage (1317.8 and 1363.2) in both seasons. Significant and positive correlations were found between grain yield and biological yield, grain filling duration with growing degree days at filling stage and growing degree days at maturity stage, and growing degree days at filling stage with growing degree days at maturity stage. These results indicated the superiority and the suitability of Misr 3 and Misr 2 and high potentiality under the newly reclaimed lands at El-Minia Governorate.

Key words*: **Triticum aestivum, New land, Growing degree day, Yield, Yield components.***

INTRODUCTION

Wheat is the main food and the most strategic cereal crop in Egypt. Wheat grains are used as food for humans, and the straw is used as fodder for animals. Its area amounted to about 1.33 million hectares (3.17 million faddan) in 2019/2020 growing season producing a total of 8.5 million tons with an average of 6.4 ton ha^{-1} (17.85 ardab faddan^{-1}) (Economic Affairs Annual Report 2020). Also, in Egypt, Gharib *et al* (2016) showed that the local production is not sufficient to face the annual requirements, therefore improvement of wheat productivity is the most important way to minimize the gap between production and consumption which can be achieved through paying a great deal of attention to increase the area and productivity per unit area of wheat.

Wheat production in the newly reclaimed lands is below average production of Delta and valley due to some adverse environmental stresses affecting plant growth and productivity such as heat stress, less availability of irrigation water and low soil fertility. Mohammad *et al* (2012) showed that global wheat production must be increased by 40 % by 2020 to meet the rising demand for wheat grain. In order to increase total production, breeders developed new wheat cultivars which were tested for their yield performances in different locations. The success of a new wheat variety depends upon its yield potential and adaptation to environmental conditions in those locations.

During growth and development of a cereal crop, several growth stages are distinguishable in which important physiological processes occur. Influence of temperature on phenology and yield of crop plants can be studied under field condition through accumulated heat units system (Bishnoi *et al* 1995) and (Sikder 2009). Plants have a definite temperature requirement before they attain certain phenological stages. David *et al* (2012) reported that in the near future (2020- 2049) a small to nil increase in heat stress may occur. In the far future (2070- 2099), the frequency of heat stress during grain filling will increase significantly.

Wheat production can be increased by development of high yielding wheat cultivars under different environmental conditions. In that context, selection for grain yield can be effective if sufficient genetic variation is present in the plant material. The grain yield is related to thousand grain weight and number of spikes per unit area. Besides, Milad *et al* (2016) found that grain yield was affected by number of fertile tillers per plant.

El Sayed *et al* (2018) reported that the differences among Egyptian bread wheat cultivars were significant. Misr 2 recorded the highest number of days to heading and maturity, grains/spike and straw yield. Sakha 94 recorded the highest number of spikes/m^2 and straw yield. Misr 1 and Gemmiza 9 recorded the highest grain and straw yields/fed. Giza 171 produced the highest values for 1000- grain weight and Giza 168 recorded the highest values of harvest index.

Thanaa and El-Hussin (2013) found that cultivars differed significantly in number of spikes/m^2 and number of kernels/spike in the first growing season, while highly significant differences were in 1000-kernel weight, grain yield and biological yield in the second season. Sids 13 recorded the highest number of spikes/m², number of kernels per spike and grain yield in the first season. Meanwhile, Gemmiza 11 recorded the highest 1000-kernel weight, grain yield and biological yield in the second season. Ahmed *et al* (2013) stated that cultivar Sids 13 and Misr 1 produced the highest values for grain yield where they recorded 6.03 and 6.29 tons/ha in both seasons.

The optimum temperature for wheat is from 17°C to 23°C with a minimum temperature of 0°C and a maximum of 37°C beyond which growth stop (Porter and Gawith 1999). Any fluctuation in temperature may reduce harvestable yield potentiality (Pressey *et al* 2007). The productivity of wheat is influenced by various abiotic stress such as water stress, salinity or high temperature and/or biotic stresses (diseases, insects etc.) (Abdelaal *et al* 2018). Temperature more than optimum has an effect on shortening the growth period and grain yield may be reduced (Polley 2002). Thus, change in temperature especially in new reclaimed area has direct impacts on crop and tolerance or adaptability of a cultivar to unfavorable climatic condition. This is recognized as a basic rule for development of yield productivity per unit area under newly reclaimed area (Abdel-shafi *et al* 1999 and Tawfelis 2006 a and b).

Therefore, this study was aimed to select better performed bread wheat cultivars that can adapt to newly reclaimed land at El-Minia Governorate condition.

MATERIALS AND METHODS

Two field experiments were carried out in the newly reclaimed sands at El-Minia governorate at east coast of Nile River. These experiments were conducted on 15 Nov. during 2018/2019 and 2019/2020 seasons to evaluate the performance of 14 bread wheat cultivars namely: Gemmiza 9, Gemmiza 10, Gemmiza 11, Gemmiza 12, Sakha 94, Sakha 95, Giza 168, Sids 12, Sids 14, Giza 171, Misr 1, Misr 2, Misr 3, and Shandaweel 1. Pedigree and selection history of these cultivars are presented in Table (1).

Table 1. Name, pedigree and history of the studied Egyptian bread wheat genotypes.

No.	Name	Pedigree and history
1	Gemmiza 9	Ald"S"/Huac"S"//CMH74A.630/5x. CGM4583-5GM-1GM-0GM
2	Gemmiza 10	MAYA74"S"/ON//II60-147/3/BB/GLL/4/CHAT"S"/5/CROW"S" GM5820-3GM-1GM-2GM-0GM
3	Gemmiza 11	B0W"S"/KVZ"S"//7C/SERI82/3/GIZA168/SAKHA61. CGM7892-2GM-1GM-2GM-1GM0GM
4	Gemmiza-12	OTUS/3/SARA/THB//VEE. CCMSS97Y00227S-5Y-010M-010Y-010M-2Y-1M-0Y-0GM
5	Sakha 94	Opata/Rayon//Kauz. CMBW90Y31800-TOPM-3Y-010M-010M-010Y-10M-015Y-0Y-0AB-0S
6	Sakha 95	PASTOR//SITE/MO/3/CHEN/AEGILOPS SQUARROSA (TAUS)//BCN/4/WBLL1. CMSA01Y00158S-040P0Y-040M-030ZTM-040SY-26M-0Y-0SY-0S.
7	Giza 168	MRL/BUC//Seri CM93046-8M-0Y-0M-2Y-0B.
8	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.
9	Sids 14	Bow"S"/Vee"S"//Bow"S"/TSI/3/Bani Sewef 1. SD293-1SD-2SD- 4SD – OSD.
10	Giza 171	Sakha 93 / Gemmiza 9 S.6-1GZ-4GZ-1GZ-2GZ-0S. Gz2003-101-1GZ-4GZ-1GZ-2GZ-0Gz.
11	Misr 1	OASIS/SKAUZ//4*BCN/3/2*PASTOR. CMSS00Y01881T -050M-0304-030M-030WGY-33M- 0Y-0S -0EGY.
12	Misr 2	SKAUZ/BAV92. CMSS96M03611S-1M-0105Y-010M-010SY-8M-0Y-0S- EGY.
13	Misr 3	Rohf 07*2/Kiriti. CGSS 05 B00123T-099T-0PY-099M-099NJ-6WGY-0B-0BGY-0GZ.
14	Shandaweel 1	SITE//MO/4/NAC/TH.AC//3*PVN/3/MIRLO/BUC. CMSS93 B00S 67S-72Y-010M-010Y-010M- 3Y- 0THY -0SH.

A Randomized Complete Blocks Design (RCBD) with four replications was used. The plot area was 4.8 m^2 (6 rows, 4 m long and 20 cm apart). Seeds were drilled at the rate of 450 seeds /m^2. All recommended cultural practices were applied. The selected site was ploughed to a depth of 50 cm, three times with a cultivator followed by planking. Tillage operations were applied in cross directions.

Soil Analysis

Mechanical and chemical soil analysis of the experimental site is presented in Table (2) according to Jackson (1973).

Table 2. Some physical and chemical properties of a representative soil sample of the experimental site.

Soil property	Value
Sand%	92.3
Silt%	2.6
Clay%	5.1
Soil texture	Sandy
Organic matter%	0.25
Total N (%)	0.04
Soluble ions (meq/100g soil (1:5))	
CO_3^-	--
HCO_3^-	0.72
Cl^-	19.34
$SO_4^=$	2.6
Ca^{++}	6.35
Mg^{++}	3.1
Na^+	12.34
K^+	0.6
EC (ds/m)(1:5)	2.47
pH(1:1)	7.97
$CaCO_3$%	35.97

Data of soil analyses presented in Table (2) show that sand represents 92.3% of soil texture indicating that the experimental site is sandy soil which characterized by low holding capacity of irrigation water.

Moreover, the soil fertility is very low where the organic matter is only 0.25%, total nitrogen 0.04% and soluble ions of potassium is 0.6%. However, low value of EC (2.47 ds/m), was detected indicated that type of soil is good for planting wheat. Calcium carbonate percentage was high as it reached 35.97% indicating that the soil type is sandy calcareous soil and pH was high (7.97). These two factors decreases the availability of phosphorus to the plants which affects absorption of other macro-nutrients especially nitrogen uptake leading to unbalanced plant nutrition. These characterizations may help in results interpretation.

Recorded data

I-Growth characteristics

1. **Days to heading.**
2. **Days to maturity.**
3. **Plant height (cm).**

II-Yield and yield components

1. **Number of spikes m^{-2}**.
2. **Number of kernels spike^{-1}.**
3. **1000-kernel weight (g.)**
4. **Biological yield (ton faddan^{-1})** all plant material in each plot (4.8m^2) above soil surface was harvested and weighed on the basis of biological yield plot^{-1}, which converted into biological yield faddan^{-1} in ton.
5. **Grain yield (ardab faddan^{-1})** the grain received from each plot was weighed on the basis of grain yield plot^{-1}, which was converted into grain yield faddan^{-1} in ardab.
6. **Harvest index (%)** was estimated according to Hühn (1990).

$$\textbf{Harvest index} = \frac{\textbf{Grain yield (kg/plot)}}{\textbf{Biological yield (kg/plot)}} \textbf{ X 100}$$

III- Phenological characters

The daily meteorological data were collected and the various measurements of accumulated heat units were calculated according to the following formulae of Rajput *et al (*1980).

$$\textbf{Growing degree days GDD (°C)} = \sum[(T.\ max + T.\ min)/2 - Tb]$$

Where: T. max and T. min are the maximum and minimum daily air temperature, respectively and Tb = Base temperature (5°C) bellow which no development occurs according to Przuij and Mladenove 1999)

1- **Grain filling duration GFD (days):** The period between anthesis to physiological maturity stages.

2- **Growing degree days (GDD, °C) at grain filling stage:** Growing degree days from anthesis to grain filling stage (°C).

3- **Growing degree days (GDD, °C) at maturity stage.** Growing degree days from planting to maturity stage (°C).

Statistical analysis

All data were statistically analyzed according to technique of analysis of variance (ANOVA) for the Randomized Complete Block design as mentioned by Gomez and Gomez (1984) by means of MSTAT-C program (1990) computer software package and least significant differences (L.S.D.) at 5% level of probability were calculated to compare between treatment means and simple correlation coefficients among all studied characters were calculated.

RESULTS AND DISCUSSIONS

Analysis of variance

Results of the present study showed significant ($P \leq 0.05$ or 0.01) differences for all the studied traits in this study in the two seasons except days to heading in second season only and harvest index in the both seasons, where differences were insignificant (Table 3).

I-Growth characteristics

1-Days to heading

Data in Table (4) showed that number of days to heading of the fourteen cultivars ranged from 115.5 to 117.8 days. Gemmiza 12 was the earliest compared to other cultivars in the first season (111.5 days) and in the second season (101.0 days) without significant differences for all cultivars. While, Gemmiza 10 was the latest one (117.8 days) in the first season. Cultivar differences in number of days to heading reflect different genetic makeup of cvs. Several researchers such as Mumtaz *et al* (2015), Hendawy (2017) and Kandil *et al* (2016) observed varietal differences in most growth characters including number of days to heading.

Table 3. Mean squares of the studied traits for fourteen bread wheat cultivars in the two seasons 2018/2019 and 2019/2020.

Season	SOV	df	MS					
			Days to heading	Days to maturity	Plant height (cm)	Spikes m^{-2}	No. kernels/ spike	1000 kernel weight (g)
2018/19	Replication	3	7.19	7.113	29.018	1087.5	0.637	8.388
	Cultivar	13	9.681 **	22.941 **	129.979 **	2055.632 **	54.238 **	64.089 **
	Error	39	3.011	3.805	30.62	584.936	19.791	5.15
2019/20	Replication	3	34.018	4.542	26.786	1644.643	17.923	11.646
	Cultivar	13	8.633	4.661 *	106.593 *	2506.181 *	130.979 **	16.591 *
	Error	39	7.12	2.093	29.029	1116.438	14.756	6.588
Season	SOV	df	MS					
			Biological yield (ton/fad.)	Grain yield (ard./fad.)	Harvest index (%)	Grain filling duration (days)	GDD for Grain filling stage (°C)	GDD for Maturity Stage (°C)
2018/19	Replication	3	1.457	3.497	8.763	13.923	3289.05	1253.44
	Cultivar	13	1.387 *	6.570 *	14.018	18.106 **	2978.15 **	3792.76 **
	Error	39	0.588	2.886	8.697	4.256	734.131	668.805
2019/20	Replication	3	0..203	6.235	16.116	15.929	2586.812	1310.427
	Cultivar	13	1.455 **	10.521 **	11.136	17.170 **	4798.87 **	1168.185 *
	Error	39	0.165	3.236	15.901	4.749	837.317	633.934

*** and ** indicate significant at 0.05 and 0.01 probability levels, respectively.**

Table 4. Means of days to heading, days to maturity and plant height (cm) of fourteen bread wheat cultivars in 2018/2019 and 2019/2020.

Cultivars	days to Heading		days to maturity		Plant height (cm)	
	2018/2019	2019/2020	2018/2019	2019/2020	2018/2019	2019/2020
Gemmiza 9	116.0	105.5	134.8	129.5	91.3	93.8
Gemmiza 10	117.8	104.8	136.8	128.8	77.5	75.0
Gemmiza 11	114.0	104.8	134.0	129.5	91.3	85.0
Gemmiza 12	111.5	101.0	134.3	129.0	81.3	88.8
Sakha 94	114.8	105.0	132.8	128.0	88.8	87.5
Sakha 95	113.5	104.0	132.0	127.5	87.5	93.8
Giza 168	112.8	103.3	132.3	128.0	72.5	90.0
Sids 12	113.3	103.5	133.0	128.3	80.0	85.0
Sids 14	113.8	101.8	138.3	131.0	90.0	91.3
Giza 171	114.8	104.3	132.8	127.8	88.8	85.0
Misr 1	113.3	105.0	131.8	128.5	86.3	81.3
Misr 2	115.5	102.0	136.8	128.0	87.5	88.8
Misr 3	114.3	102.5	134.5	128.0	80.0	92.5
Shandaweel 1	113.0	105.5	129.0	126.5	83.8	90.0
Mean	114.1	103.8	133.8	128.5	84.7	87.7
L.S.D 5%	2.48	NS	2.79	2.07	7.91	7.71

NS= not significant.

2- Days to maturity

Results in Table (4) show that wheat cultivars were different in their maturity data in both seasons. Shandaweel 1 recorded the earliest maturity date by 129.0 and 127.5 days in the first and second seasons, respectively. Meanwhile, the latest maturity was obtained by Sids 14 (138.3 and 131.0 days in the first and second seasons, respectively). This result may reflect the higher temperature effect in second season compared to the first season. Similar results were reported by Tawfelis *et al* (2011) and Moustafa and El-Sawi (2014) who showed that wheat cultivars were affected in heading and maturity dates of wheat by high temperatures.

3- Plant height (cm)

The fourteen cultivars showed significant differences in plant height in both growing seasons (Table 4). Gemmiza 9 and Gemmiza 11 recorded the highest plant height (91.3 cm) while, the shortest plants were obtained from Giza 168 (72.5 cm) in the first season. Furthermore, in the second season the tallest plants were obtained from Gemmiza 9 and Sakha 95 (93.8 cm) while, the shortest plants were obtained from Gemmiza 10 (75.0 cm). These results indicated the genetic differences among the tested cultivars. Results reported by Abdel-Nour, N. and Mahgoub, H. (2011) and Tawfelis *et al* (2011) showed marked differences among the evaluated wheat cultivars growing in Egypt in plant height.

II-Yield and yield components:

1- **Number of spikes m^{-2}**

The results in Table (5) showed that the highest number of spikes m^{-2} was obtained by Misr 3 without significant difference from Misr 2 in the two growing seasons. Moreover, cultivar Misr 3 recorded the highest number of spikes m^{-2} (385) without significant differences compared to Gemmiza 10, Gemmiza 12, Sakha 94, Sakha 95, Sids14, Giza 171, Misr 1, Misr 2 and Shandaweel 1 in the first season. The results support that the variation of number of spikes m^{-2} is largely due to genetic makeup of cultivars. These results are in harmony with those reported by Rahman *et al* (2010) and El- Ashmouny *et al.,* (2011) who reported that different number of spikes per unit area is a result of the ability differences of cultivars to produce fertile tillers.

2-Number of kernels spike^{-1}

Number of kernels per spike ranged from 47.5 to 58.8 kernels in the first season and 40.3 to 55.0 kernels in the second season (Table 5). The maximum number of kernels spike^{-1} was recorded by Sids 12 (58.8 and 55 kernels) in first and second seasons, respectively. On the other hand the minimum number was recorded by Gemmiza 11 (47.5 and 40.3 kernels) in first and second seasons. Variation among genotypes for number of kernels per spike could be referred to their genetic constitutions and the interaction with the prevailing environmental conditions. These findings are in agreement with Bhattarai *et al* (2017) and Bayisa *et al* (2019).

Table 5. Means of number of spikes m-2, number of kernels spike-1 and 1000-kernel weight (g) of fourteen bread wheat cultivars in 2018/2019 and 2019/2020.

Cultivars	No. spikes m^{-2}		No. kernels $spike^{-1}$		1000-kernel weight (g)	
	2018/2019	2019/2020	2018/2019	2019/2020	2018/2019	2019/2020
Gemmiza 9	322.5	277.5	49.5	41.3	47.21	38.28
Gemmiza 10	377.5	325.0	49.5	54.3	38.76	35.60
Gemmiza 11	325.0	310.0	47.5	40.3	45.39	37.68
Gemmiza 12	362.5	305.0	54.3	41.0	35.87	34.77
Sakha 94	370.0	327.5	54.0	44.0	42.75	35.03
Sakha 95	375.0	317.5	56.8	50.0	41.03	36.44
Giza 168	320.0	320.0	52.0	44.3	38.68	35.78
Sids 12	342.5	330.0	58.8	55.0	39.36	36.72
Sids 14	360.0	297.5	57.3	47.8	43.67	37.27
Giza 171	345.0	332.5	50.5	41.5	48.64	39.01
Misr 1	365.0	322.5	51.5	54.8	42.53	36.81
Misr 2	380.0	357.5	58.0	53.3	36.55	31.04
Misr 3	385.0	382.5	49.5	53.0	45.15	33.44
Shandaweel 1	377.5	322.5	55.8	44.5	37.88	35.82
Mean	357.7	323.4	53.2	47.5	41.68	35.98
L.S.D 5%	34.59	47.79	6.363	5.494	3.246	3.671

3-1000-kernel weight (g)

Data in Table (5) for 1000-kernel weight had a significant differences among all cultivars in both seasons and ranged from 35.87 to 48.64g in first season and 31.04 to 39.01g in the second season. The heaviest grains were obtained from Giza 171 (48.64g) without significant differences among Gemmiza 9, Gemmiza 11 and Misr 3 in the first season. While, Giza 171 (39.01g) recorded a significant difference between Misr 2 and Misr 3 only in the second season. El Sayad *et al* (2018) reported that the increase in yield and its attributes may be due to prolonging vegetative growth stage resulting in more tillers formation, leaf numbers and photosynthetic area (leaf area), which resulted in more photosynthetic production and consequently, increased yield attributes (number of spikes m^{-2}, number of grains $spike^{-1}$, 1000-grain weight) and in turn increased grain yield. The results are in harmony with El-Nakhlawy *et al* (2015) and Mumtaz *et al* (2015).

4- Biological yield (ton faddan^{-1}):

The cultivars differed significantly in their biological yields in the two seasons (Table 6). The cultivar Misr 3 produced almost convergent and higher biological yields. Misr 3 produced 7.569 and 6.694 ton faddan^{-1} in first and second seasons, respectively. On the other hand, Gemmiza 9 had the lowest biological yield and recorded 5.447 and 4.799 ton faddan^{-1} in first and second seasons, respectively.

Table 6. Means of grain yield (ardab faddan^{-1}), straw yield (tons faddan^{-1}), and harvest index of fourteen bread wheat cultivars in 2018/2019 and 2019/2020.

Cultivars	Biological yield (tons faddan^{-1})		Grain yield (ardab faddan^{-1})		Harvest Index (%)	
	2018/2019	2019/2020	2018/2019	2019/2020	2018/2019	2019/2020
Gemmiza 9	5.447	4.799	13.27	11.89	36.75	37.22
Gemmiza 10	6.803	5.644	15.90	14.04	35.06	37.36
Gemmiza 11	6.748	1.160	16.70	13.18	37.12	38.12
Gemmiza 12	6.563	4.966	14.58	12.93	33.33	39.04
Sakha 94	6.770	5.272	15.68	14.28	34.77	40.51
Sakha 95	7.438	4.966	16.92	13.35	34.20	40.26
Giza 168	6.059	5.119	14.58	13.52	36.03	39.67
Sids 12	5.775	5.578	15.02	14.44	39.01	38.84
Sids 14	6.464	4.900	14.22	12.31	33.39	37.51
Giza 171	6.464	5.556	13.93	15.90	32.63	43.12
Misr 1	6.716	5.228	16.62	13.87	37.66	39.67
Misr 2	6.694	6.650	16.34	17.17	36.58	38.65
Misr 3	7.569	6.694	17.50	17.27	34.90	38.98
Shandaweel 1	5.906	4.944	14.58	13.75	37.22	41.64
Mean	6.530	5.391	15.42	14.13	35.62	39.33
L.S.D 5%	1.097	0.581	2.43	2.57	NS	NS

NS= not significant.

These results may be due to the lowest number of spikes m^{-2}, which could be reflected on reducing its biological yield. Biomass yield is one of the required traits by agro-pastoral community for their livestock feed during dry season where forage is inadequate. Therefore, identification of higher biomass yield genotypes might fit with the need of agro-pastoral community of study area. These differences between cultivars could be referred to their genetic constitutions and their interaction with the prevailing environmental conditions Moustafa *et al* (1997) and Sadek (2000).

5- Grain yield (ardab faddan^{-1}):

Grain yield is the most important trait in any bread wheat evaluation program. Results in Table (6) show significant differences among cultivars for grain yield (ardab faddan^{-1}). In the first season, Misr 3 (the recent Egyptian bread wheat in Egypt) had the highest grain yield (17.50 ardab faddan^{-1}) without significant differences from Gemmiza 10, Gemmiza 11, Sakha 94, Sakha 95, Sids 12, Misr 1, and Misr 2 while, the lowest grain yield was recorded by Gemmiza 9 (13.27 ardab faddan^{-1}). In addition, in the second season Misr 3 also recorded the highest grain yield (17.27 ardab faddan^{-1}) without significant differences from Giza 171 and Misr 2. These results indicated superiority and the suitability of Misr 3 and Misr 2 under the newly reclaimed lands at El-Minia governorate. The cultivars differences in grain yield may be attributed to genetical factors and environment conditions which affected yield attributes and the highest number of spikes m^{-2} produced by Misr 3 (Table 5). These results are in agreement with those reported by Moustafa *et al* (1997) and Thanaa and El-Hussin (2013).

6- Harvest index (%)

Harvest index (HI) is the ratio of harvested grain to total shoot dry matter, and this can be used as a measure of reproductive efficiency under different regions that influence crop such as extreme temperatures during crop reproductive development. Harvest index ranged from 32.63 to 39.01% in the first season and from 37.22 to 43.11% in the second season. Insignificant differences were detected among studied cultivars for this trait. These results are in harmony with those reported by Moustafa and El-Sawi (2014) in second season and Moustafa (2014) in the first season.

III- Phenological characters-

1- Grain filling duration GFD (days): Analysis of variance for the period between anthesis to physiological maturity stages GFD showed highly significant differences among cultivars in both growing seasons. Shandaweel 1 recorded the lowest (13.0 and 18.0 days) for GFD in the first and second seasons, respectively. On the other hand, the highest GFD was recorded by Sids 14 (21.5 and 26.3 days) in the first and second seasons, respectively (Table 7). The cultivars of relatively low GFD are relatively early maturing and thus well adapted to the region environments. Wheat genotypes that can fill their grain quickly may have an advantage in environments where crop plants be under high-temperature stress during the grain filling periods (Whan *et al* 1996). Grain filling duration under genetic control can be used for indirect yield selection in these cultivars. This result is in agreement with other researcher's findings for wheat (Tewolde *et al* 2006).

Table 7. Growing degree days (GDD °C) at different phenological stages of fourteen bread wheat cultivars at two seasons.

Cultivars	Grain filling duration (days)		GDD for grain filling stage (°C days)		GDD for maturity stage (°C days)	
	2018/2019	2019/2020	2018/2019	2019/2020	2018/2019	2019/2020
Gemmiza 9	15.8	21.0	187.5	320.7	1389.5	1414.3
Gemmiza 10	16.0	21.0	195.5	321.5	1417.8	1400.7
Gemmiza 11	17.0	21.8	207.0	334.5	1381.5	1414.3
Gemmiza 12	19.8	25.0	242.2	373.4	1383.9	1394.7
Sakha 94	15.0	20.0	178.7	303.1	1364.6	1389.2
Sakha 95	15.5	20.5	187.6	309.0	1355.2	1379.3
Giza 168	16.5	21.8	192.6	327.1	1358.7	1388.2
Sids 12	16.8	21.8	204.8	325.2	1368.1	1392.0
Sids 14	21.5	26.3	263.4	420.3	1435.5	1440.8
Giza 171	15.0	20.5	178.5	310.4	1363.3	1384.0
Misr 1	15.5	20.5	184.1	312.1	1348.9	1396.4
Misr 2	18.3	23.0	219.4	344.2	1413.9	1388.4
Misr 3	17.3	22.5	209.9	336.9	1388.6	1387.3
Shandaweel 1	13.0	18.0	157.7	273.2	1317.8	1363.2
Mean	16.3	21.7	200.6	329.4	1377.6	1395.2
L.S.D 5%	2.95	3.12	38.75	41.9	36.99	36.01

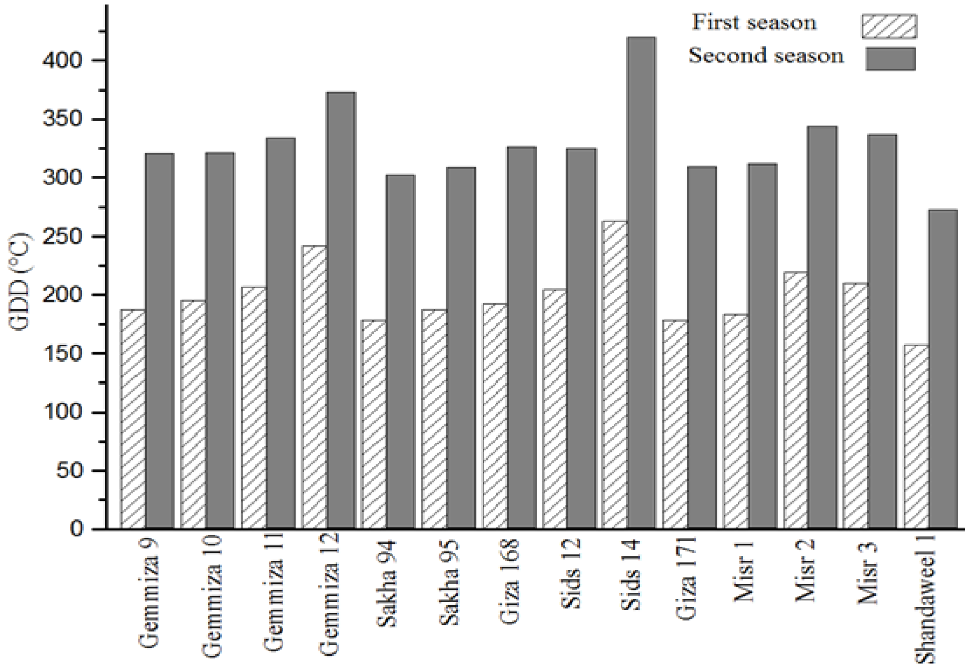

Fig. 1. Growing degree days (GDD °C) at grain filling stage of fourteen wheat cultivars.

2- GDD at grain filling stage: Growing degree days (°C) from anthesis to grain filling stage showed significant differences with cultivars (Table 7). Results in the first season showed that the lowest GDD (157.7) was obtained from Shandaweel 1 without significant differences with Gemmiza 9, Gemmiza 10, Sakha 94, Sakha 95, Giza 168, Giza 171 and Misr 1. Meanwhile, in the second season, Shandaweel 1 had the lowest GDD (273.2) without significant differences with Sakha 94, Sakha 95, Giza 171 and Misr 1. On the other hand, Sids 14 had the highest GDD (263.4 and 420.3) in the first and second seasons, respectively. Data in Fig.1 cleared the requirement of GDD at filling stage in the first season was lower than second season. This result may be due to high temperature in the second season which reduced grain filling stage for all genotypes compared with low temperature in first season. This is supported by results obtained by

(Khan *et al* 2007), who found that wheat adapted to environments characterized by high temperature has been reported to relatively mature early to avoid heat stress at the critical stages of grain filling.

3- Growing degree days (GDD °C) at maturity stage: Growing degree days from planting to maturity stage (°C) were differed significantly among the studied cultivars (Table 7). The lowest number for heat unit GDD was recorded by Shandaweel 1; while, Sids 14 had the highest heat unit GDD in the two seasons. Data in Fig. 2 cleared that the required of GDD were lower in the first season as compared with second season for most studied cultivars. Only Misr 3 had the same heat unit GDD. This means that the influence of temperature on yield for Misr 3 was highly stable in the two seasons. Therefore, Misr 3 may be considered as the best cultivar tolerant to high temperature stress under new reclaimed land in this region.

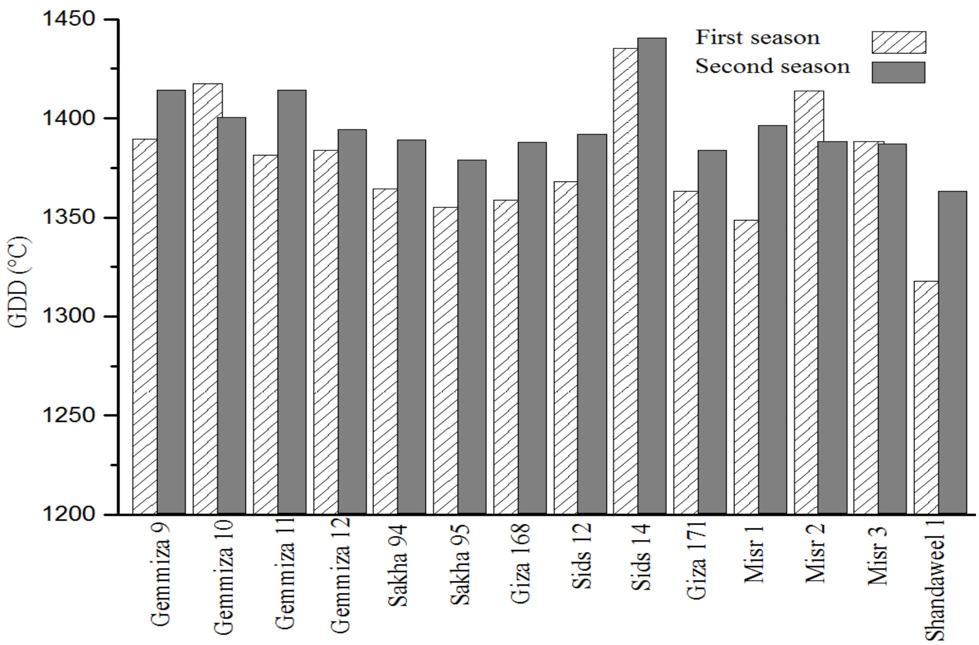

Fig. 2. Growing degree days (GDD °C) at maturity stage of fourteen wheat cultivars.

Simple correlation coefficients:

Correlation coefficients for all studied characters in Table (8, above diagonal) in the first season showed that, days to maturity had a significant and positive correlation with grain filling duration, growing degree days at grain filling stage and growing degree days at maturity stage.

Table 8. Correlation coefficients among days to heading (DH), days to maturity (DM), plant height (PH), spikes per square meter (SM^{-2}), kernels per spike (KS^{-1}), 1000-kernel weight (TKW), grain yield (GY), biological yield (BY), harvest index (HI), grain filling duration (GFD), GDD for grain filling period (GDDF) and GDD at maturity stage(GDDM) in the first season (above diagonal) and in the second season (below diagonal).

	DH	DM	PH	SM^{-2}	KS^{-1}	TKW	GY	BY	HI	GFD	GDDF	GDDM
DH		0.487	0.170	0.122	-0.346	0.276	0.054	0.052	-0.017	-0.183	-0.179	0.488
DM	-0.306		0.134	0.056	-0.011	0.054	-0.004	0.157	-0.301	0.768**	0.768**	0.999**
PH	-0.276	-0.033		-0.052	-0.002	0.554*	-0.062	0.021	-0.110	0.027	0.035	0.115
SM^{-2}	-0.246	-0.514	-0.081		0.339	-0.359	0.508	0.612*	-0.239	-0.016	0.028	0.069
KS^{-1}	-0.130	-0.132	-0.338	0.538*		-0.558*	-0.098	-0.123	0.072	0.241	0.255	-0.017
TKW	-0.489	0.288	-0.097	-0.653*	-0.426		-0.104	0.045	-0.197	-0.141	-0.155	0.047
GY	-0.231	-0.487	-0.095	0.947**	0.438	-0.595*		0.822**	0.152	-0.044	-0.024	-0.001
BY	-0.327	-0.252	-0.121	0.904**	0.556*	-0.686**	0.934**		-0.435	0.139	0.157	0.162
HI	0.227	-0.727**	0.060	0.268	-0.238	0.144	0.323	-0.035		-0.326	-0.323	-0.305
GFD	-0.868**	0.738**	0.179	-0.093	0.023	-0.197	-0.090	0.100	-0.540*		0.995**	0.767**
GDDF	-0.788**	0.813**	0.162	-0.179	0.001	-0.095	-0.178	0.013	-0.559*	0.982**		0.768**
GDDM	-0.219	0.987**	-0.034	-0.498	-0.100	0.321	-0.468	-0.237	-0.718**	0.669**	0.763**	

A significant and positive correlation was detected between plant height and 1000-kenel weight. Spikes per square meter were significantly and positively correlated with biological yield. Number of kernels per spike had a significant and negative correlation with 1000-kenel weight. Positive correlation between grain yield and biological yield was detected**.** Grain filling duration was significantly and positively correlated with growing degree days at grain filling stage and growing degree days at maturity stage.

In the second season Table (8, below diagonal), days to heading had a significant and negative correlation with grain filling duration and growing degree days at grain filling stage. Days to maturity had a significant and negative correlation with harvest index and positive with grain filling duration, growing degree days at grain filling stage and growing degree days at maturity stage. Number of spikes per square meter had a positive and significant correlation with number of kernels per spike, grain yield and biological yield while, it is negatively correlated with 1000-kenel weight. Kernels per spike had a significant and positive correlation with biological yield.1000-kernel weight had a significant and negative correlation with grain yield and biological yield. Grain yield showed a significant and positive correlation with biological yield. These results are in agreement with those reported by Tadesse *et al* (2018). Harvest index showed a significant and negative correlation with grain filling duration, growing degree days at grain filling stage and growing degree days at maturity stage. Grain filling duration had a significant and positive correlation with growing degree days at grain filling stage and growing degree days at maturity stage. A positive and significant correlation was observed between growing degree days at filling stage and growing degree days at maturity stage.

CONCLUSION

It can be concluded from the present investigation that cultivars Misr 3 and Misr 2 showed the best performance by producing highest number of spikes m^{-2} and hence highest grain yield ardab $faddan^{-1}$ under newly reclaimed land at El-Minia Governorate conditions.

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تقييم أداء بعض أصناف قمح الخبز
تحت ظروف الأراضى الجديدة بمنطقة مصر الوسطى

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أقيمت تجربتان حقليتان فى محافظة المنيا (مصر الوسطى) خلال موسمي ٢٠١٩/٢٠١٨ و٢٠٢٠/٢٠١٩م. لتقييم أداء ١٤ صنف من أصناف قمح الخبز (جميزة ٩ ، جميزة ١٠ ، جميزة ١١، جميزة ١٢، سخا ٩٤، سخا ٩٥، جيزة ١٦٨، سدس ١٢، سدس ١٤، جيزة ١٧١، مصر ١، مصر ٢، مصر ٣ و شندويل ١) تحت ظروف الأراضى الجديدة بمحافظة المنيا. وقد أستخدم فى هذه الدراسة تصميم القطاعات الكاملة العشوائية في أربعة مكرارت وأظهرت النتائج أن الإختلافات بين الأصناف كانت معنوية لجميع الصفات محل الدراسة ماعدا صفة عدد الأيام من الزراعة إلى طرد السنابل فى الموسم الثانى وصفة دليل الحصاد فى كلا الموسمين. أظهرت النتائج أن الصنف جميزة ١٢ سجل أقل أيام حتى طرد السنابل وكان الصنف شندويل ١ أبكر الأصناف فى ميعاد النضج مقارنة بباقى الأصناف. وسجلا الصنفين جميزة ٩ وجميزة ١٠ أطول النباتات فى الموسم الأول والصنفين جميزة ٩ وسخا ٩٥ في الموسم الثانى. أعطى الصنف سدس ١٢ أعلى الأصناف لصفة عدد حبوب السنبلة (٥٩ حبة) في الموسم الأول والصنفين سدس ١٢ ومصر ١ (٥٥ حبة) في الموسم الثانى. سجل الصنف مصر٣ تفوق فى صفة عدد السنابل فى المتر المربع فى كلا الموسمين وسجل الصنف جيزة ١٧١ أعلى الأصناف فى صفة وزن ١٠٠٠ حبة مقارنة بباقى الأصناف (٤٨,٦٤ و ٣٩,٠١ جم) فى الموسمين على التوالى.، وسجل الصنف مصر ٣ أعلى محصول للحبوب فى كلا الموسمين دون إختلافات معنوية مع الأصناف جميزة ١٠، جميزة ١١، سخا ٩٤، سخا ٩٥، سدس١٢، مصر١ ومصر ٢ فى الموسم الأول ودون اختلافات معنوية مع الصنفين مصر ٢ وجيزة ١٧١ فى الموسم الثانى. وسجل الصنف مصر ٣ أعلى محصول بيولوجى (٧,٥٦٩ و ٦,٦٩٤ طن للفدان) في كلا الموسميين على التوالى. سجل الصنف شندويل ١ أقل فترة لصفة إمتلاء الحبة (١٣ و ١٨ يوم) وأقل تجمع حرارى لصفة عدد أيام النمو لمرحلة إمتلاء الحبة (١٥٧,٧ و ٢٧٣,٢ وحدة حرارية) وأقل تجمع حرارى لصفة عدد أيام النمو لمرحلة النضج (١٣١٧,٨ و ١٣٦٣,٢ وحدة حرارية) فى كلا الموسمين على التوالى. أظهرت النتائج أن هناك إرتباط معنوى موجب بين محصول الحبوب والمحصول البيولوجى ، كذلك صفة فترة إمتلاء الحبة كانت مرتبطة مع صفتى التجمع الحرارى لفترة إمتلاء الحبة والتجمع الحرارى لفترة النضج وكذلك بين صفة التجمع الحرارى لفترة إمتلاء الحبة وصفة التجمع الحرارى لفترة النضج. وأظهرت الدراسة أن الصنفين مصر ٣ ومصر ٢ أعلى إنتاجاً تحت ظروف الأراضى الجديدة بمصر الوسطى.

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