J. of Plant Production, Mansoura Univ., Vol. 13 (6):265-272, 2022

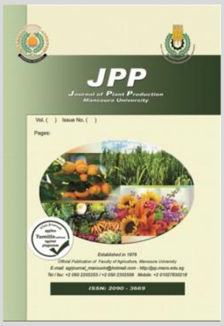
Journal of Plant Production

Journal homepage & Available online at: www.jpp.journals.ekb.eg

Evaluate of The Bread Wheat Productivity for Egyptian Recent Genotypes Under Normal and Salt-Affected Soils in Northern Delta Conditions, Egypt

Genedy M. S.[1*] and Nevein L. Eryan[2]

[1] Wheat Research Department, Field Crops Research Institute, ARC, Egypt.
[2] Grop Physiological Research Department, Field Crops Research Institute, ARC, Egypt.



ABSTRACT

Most of the crop salt tolerance studies are often conducted in a glasshouse and are limited under field conditions. Therefore, a field experiment was conducted under normal and salt-affected soil conditions during 2018/2019 and 2019/2020 seasons at Experimental Farm of Sakha Agricultural Research Station, Agricultural Research Center, Giza, Egypt, to authenticate the performance of physiological and agronomical characters of some Egyptian wheat genotypes. Each soil type was done in separate experiment. Every experiment of soil type was carried out in randomized complete blocks design with three replications, where each experiment incorporated eighteen wheat genotypes. Combined analysis was done between soil types and seasons. Cultivating wheat genotypes under normal soil conditions significantly increased all studied physiological and agronomical characters of wheat and gave the highest values in both seasons and its combined. Sakha95 cultivar exceeded followed by Misr3 cultivar over the other studied wheat genotypes in chlorophyll a, b, total chlorophyll contents, number of spikes/m^2, 1000-grain weight and grain yield/fed and recorded the highest values of these characters as combined over both seasons. It could notable that cultivating wheat Sakha95 cultivar under normal soil conditions produced the highest physiological and agronomical characters. Under salt-affected soil, Misr1 then Shandaweel1 cultivars produced the highest values of characteristics. Besides, the highest salinity susceptibility index of investigated wheat genotypes was Sakha95 cultivar, followed by Sids13 cultivar then Sids14 cultivar, Misr3 cultivar, Sids12 and (SPL2018)#3 promising line according to stress susceptibility index (SSI) results under the environmental conditions of Sakha district, Kafr El-Sheikh Governorate, Egypt.

Keywords: Wheat, normal soil, salt-affected soils, genotypes, physiological and agronomical characters.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the majority commonly grown crop in Egypt and all over the world as the most important source of food and energy for human nutrition, due to its exclusive protein uniqueness (Abedi *et al.*, 2010), which formulate into different types of food like; bread, macaroni, biscuit and sweets. Although wheat is expensive as a livestock feed.

Wheat is a strategic crop that has a major impact on national economies around the world (Yadav *et al.*, 2018). In Egypt, wheat is the principal winter cereal crop, which the whole cultivated area reached about 3.261 million feddan and the total production exceeded 9.000 million tons with an average of 18.10 ardab/fed in 2019/2020 season (FAO, 2022), however wheat production is not enough for local consumption. For that reason, enormous efforts have been exerted to increase wheat production, among them maximizing yield per unit area by cultivating promising genotype especially under salt-affected soil conditions with the purpose of assemble the incessant demand and reduce the gap between the production and the consumption.

Salinity is a foremost restraint to crop production in the arid and semiarid areas of the world, where low precipitation, high surface evaporation, irrigation with saline water, rising water tables, and poor irrigation practices increase the level of soluble salts (Hollington, 1998). Soil salinity causes many adverse effects on plant growth by creating osmotic stress, ion toxicity, and nutritional imbalance or a combination of these factors (Ashraf, 2004). All these factors adversely affect the plant growth, physiological and biochemical metabolism (Munns, 2002). Salt accumulation in root zone causes the development of osmotic stress and disrupts cell ion homeostasis by inducing both the inhibition in the uptake of essential nutrients such as K^+, Ca^{++} and NO_3^- and the accumulation of toxic levels of Na^+ and Cl^-, thereby causing nutritional imbalance in plants (Paranychianakis and Chartzoulakis, 2005). Salt accumulation in the soil can also negatively affect plant growth by reducing nutrient availability in the soil and decreasing uptake of essential nutrients (Grattan and Grieve, 1999). (Singh *et al.*, 2018) stated that increasing salinity significantly increased soil pH, electrical conductivity (EC) and sodium adsorption ratio (SAR). Wheat yield parameters of different cultivars were affected more at higher salinity levels than lower. (Seleiman *et al.*, 2022) revealed that wheat productivity is adversely affected by salt stress, which is associated with a reduction in germination, growth, altered reproductive behavior and enzymatic activity, disrupted photosynthesis, hormonal imbalance, oxidative stress and yield reductions.

From the several strategies to increase wheat production in the salt-affected areas, the development of tolerant plant

[*] **Corresponding author.**
E-mail address: mogenedy82@gmail.com
DOI: 10.21608/jpp.2022.143037.1125

materials using available genetic resources has been a relatively effective and low-cost means to face the salinity challenging (Ragab and Kheir, 2019). In general, wheat is stated to be moderately tolerant to salinity (Asif *et al*., 2020). In this respect, the latest breeding efforts have achieved a few salt-tolerant cultivated wheats, for example the genotypes KLR1-4 and KLR 19 (in India), LU-26S and SARC-1 (in Pakistan) and Sakha 8 (in Egypt) (Munns *et al*., 2006). Unfortunately, the former cultivars have not been extensively accepted by farmers because of other agronomic limitations. It is necessary, subsequently to continue breeding for improved salinity tolerance of wheat.

Chosen the high yielding ability wheat cultivars undoubtedly is very important to raise productivity per unit area. Thus, many researchers in Egypt and around the world among them, (Abdelsalam and Kandil, 2016; Kandil et al., 2016, Baqir and Al-Naqeeb, 2018, El-Sayed et al., 2018, Gomaa et al., 2018, Hassanein et al., 2018, Khan et al., 2019 and Iwanska et al., 2020) concluded that there are significant differences among wheat cultivars in growth, yield and its components by reason of the differences in genetic structure and their interaction with environmental conditions established during growing season. Increasing salinity level decreased physiological and agronomical characters of wheat genotypes (Munns, 2005; Munns and Tester, 2008; Singh et al., 2018 and Ebaid et al., 2019).

Thus, this research was proposed to study performance of some wheat genotypes under normal and salt-affected soils conditions in Sakha district, Kafr El-Sheikh Governorate, Egypt.

MATERIALS AND METHODS

Under field conditions of Experimental Farm of Sakha Agricultural Research Station, Agricultural Research Center, Giza, Egypt, two experiment were conducted during winter seasons of 2018/2019 and 2019/2020 to verify the performance of some wheat genotypes under normal and salt-affected soil conditions on some physiological and agronomical characters.

Each soil type (normal soil and salt-affected soil) was done in separate experiment. Soil samples were taken at random from each soil type (normal soil and salt-affected soil) at a depth of 0-30 cm and 30-60 cm from soil surface before soil preparation to measure the physical and chemical soil properties by method described by (Page, 1982) and its results are shown in Table 1.

Table 1. Some physical and chemical soil properties of each soil type during the two growing seasons of 2018/2019 and 2019/2020.

Soil state	Sample depth (cm)	Soil structure	pH	EC ds/m	Cation meq/L				Anion meq/L		
					Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
	2018/2019 season										
Normal soil	0 - 30	Clayey	8.6	2.3	6.6	4.9	8.0	0.3	2.3	10.0	43.3
	30 - 60	Clayey	8.7	2.1	10.6	6.1	12.4	0.3	2.5	12.5	48.7
	2019/2020 season										
	0 - 30	Clayey	7.9	1.5	3.2	2.3	8.4	0.3	2.5	4.8	7.2
	30 - 60	Clayey	8.1	2.0	5.6	3.9	10.3	0.3	3.0	8.1	9.1
	2018/2019 season										
Salt-affected soil	0 - 30	Clayey	8.7	9.1	60.4	56.3	67.5	1.5	3.0	120.0	95.6
	30 - 60	Clayey	8.9	10.4	77.1	59.9	78.2	1.6	3.0	70.0	102.0
	2019/2020 season										
	0 - 30	Clayey	8.7	8.7	20.1	10.2	40.6	0.3	3.0	25.9	42.6
	30 - 60	Clayey	8.8	9.3	24.9	16.9	44.2	0.5	4.0	34.6	45.6

Every experiment of soil type was carried out in a randomized complete blocks design (RCBD) with three replications. Where, each experiment incorporated eighteen wheat genotypes. The serial number, genotype name, pedigree and selection history of the eighteen wheat genotypes were presented in Table 2. The studied wheat genotypes were obtained from Wheat Research Section, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt.

Table 2. Genotype name, pedigree and selection history of studied wheat genotype in both growing seasons.

Genotype name	Pedigree	Selection history
Misr 1	OASIS/SKAUZ//4*BCN/3/2*PASTOR	CMSS00Y01881T-050M-030Y-030M-030WGY-33M-0Y-0S.
Misr 2	SKAUZ/BAV92	CMSS96M03611S-1M-010SY-010M-010SY-8M-0Y-0S.
Misr 3	ATTILA*2/PBW65*2/KACHU	CMSS06Y00582T-099TOPM-099Y-099ZTM-099Y-099M-10WGY-0B-0EGY.
Sakha 93	SAKHA92/TR810328	S.8871-1S-2S-1S-0S.
Sakha 94	OPATA/RAYON//KAUZ	CMBW90Y3180-0TOPM-3Y-010M-010M-010Y-10M-015Y-0Y-0AP-0S.
Sakha 95	PASTOR // SITE / MO /3/ CHEN / AEGILOPS SQUARROSA (TAUS) // BCN /4/ WBLL1.	CMSA01Y00158S-040POY-040M-030ZTM-040SY-26M-0Y-0SY-0S.
Giza 168	MRL/BUC//SERI	CM93046-8M-0Y-0M-2Y-0B-0SH.
Giza 171	SAKHA 93/GEMMEIZA 9	GZ 2003-101-1GZ-4GZ-1GZ-2GZ-0GZ.
Gemmeiza 9	ALD "S" / HUAC // CMH 74A. 630 / SX	GM 4583-5GM-1GM-0GM.
Gemmeiza 11	BOW"S"/KVZ"S"//7C/SER182 /3/GIZA168/SAKHA 61	GM7892-2GM-1GM-2GM-1GM-0GM.
Gemmeiza 12	OTUS /3/ SARA / THB // VEE	CMSS97Y00227S-5Y-010M-010Y-010M-2Y-1M-0Y-0GM.
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.
Sids 13	KAUZ"S"//TSI/SNB"S"	ICW94-0375-4AP-2AP-030AP-0APS-3AP-0APS-050AP-0AP-0SD.
Sids 14	BOW "S" / VEE"S" // BOW"S" / TSI/3/ BANI SEWEF 1	SD293-1SD-2SD-4SD-0SD.
Shandaweel 1	SITE/MO/4/NAC/TH.AC//3*PVN/3/MIRLO/BUC	CMSS93B00567S-72Y-010M-010Y-010M-3Y-0M-0HTY-0SH.
(SPL2018) # 1	SIDS1/ATTILA//GOUMRIA-17	S.16498-042S-013S-21S-0S
(SPL2018) # 2	MILAN/KAUZ//BABAX/3/BAV92/4/WHEAR//2*PRL/2*PASTOR	S. 16814 -020S -06S-10S-1S -0S.
(SPL2018) # 3	MILAN/KAUZ//BABAX/3/BAV92/4/WHEAR//2*PRL/2*PASTOR	CMSS08B00600S-099M-099NJ-099NJ-14WGY-0B-0S.

The genotypes were arranged in a randomized complete block design (RCBD) with three replicates in each soil state. The area of the experimental unite was 4.2 m^2 (3.5×1.2 m) including 6 rows with 20 cm spaced. The irrigation, fertilizer, weed control, fungicides were applied at proper time with all recommended practices.

Studied characters:

A- Physiological characters:

At heading stage, flag leaves samples were randomly taken from each plot to determined Chlorophyll a and b as well as the total chlorophyll (mg/l) were estimated by using the Spectro-photometric method according to (Moran, 1982).

Proline content (mg/g fresh weight,) was according to (Bates *et al*., 1973). Its absorbance was measured at 520 nm (nanometer) in a spectrophotometer. The content of proline was calculated in mg/g FW (Fresh weight).

Measurement of relative water content (RWC): was estimated according to (Ritchie and Nguyen, 1990): Leaf discs were punched from the center of the leaf. Fresh weight (FW) was taken and floated for 4 hours in distilled water and weighted again to obtain turgid weight (TW). For dry weight (DW) determination, the discs were oven dried at 85c for according to the following equation:

$$\mathbf{RWC\ (\%) = (FW - DW) / (TW - DW) \times 100}$$

B- The agronomic characters:

1- Plant height at harvest (cm) was measured as plant length from the soil surface to the top of the main spike excluding awns as average of ten plants.
2- Number of spikes/m^2: Number of fertile spikes per square meter.
3- Number of grains/spike: Number of grains per spike for ten randomly selected spikes and their average was reported.
4- 1000-grain weight (g) was measured as weight of the grains of each individual plant randomly taken.
5- Grain yield (ardab/fed) was estimated by weighing the grains obtained from the whole plot right after harvesting and then converted to ardab/feddan (one ardab=150 kg).

To evaluate the salinity tolerance of investigated wheat genotypes the stress susceptibility index (SSI) was determined based in grain yield for them. According to the (Fischer and Maurer, 1978) method the SSI was calculated as differences in the results obtained for stress (salt-affected soil) and non-stress (normal soil) conditions by using the following equations:

$$\mathbf{SSI = (1 - MGY_S/MSY_P)/SI}$$

Where;

SI = salinity Stress Intensity = 1 - MY_S/MY_P
MGY_s is grain yield of each genotype under salt-affected soil.
MGY_p is grain yield of each genotype under normal soil.
MY_s is mean (MGY_S) of all genotypes under salt-affected soil.
MY_p is mean (MGY_p) of all genotypes under normal soil.

Statistical analysis:

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the randomized complete blocks design (RCBD) with three replications to each experiment (soil types), combined analysis was done between soil types and seasons after doing homogeneity test error mean squares between soil types and seasons as published by (Gomez and Gomez, 1984) by means of "MSTAT-C" Computer Software Package. Means of the treatments were compared using least significant of difference (LSD) method at 5 % level of probability as described by (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

1. Effect of soil types:

Most of the crop salt tolerance studies are often conducted in a glasshouse and are limited under field conditions. For that reason, this research was conducted under field conditions to study the effect of normal and salt-affected soils on physiological and agronomical characters of some wheat genotypes during 2018/2019 and 2019/2020 seasons. The both studied soil types (normal and salt-affected soils) significantly affected physiological characters (chlorophyll a, b and total chlorophyll (mg/l), proline content (mg/g fresh weight) and relative water content (%) and agronomical characters (plant height at harvest (cm), number of spikes/m^2, number of grains/spike, 1000-grain weight (g) and grain yield (ardab/fed) in the two growing seasons and its combined as shown from the obtained results in Tables 3 and 4.

From the obtained results from this research, it could be observed that cultivating wheat genotypes under normal soil conditions (salinity level ranged from 1.5-2.3 ds/m as EC parameter as shown in Table 1) significantly increased all studied physiological and agronomical characters of wheat and gave the highest values in both growing seasons and its combined. However, cultivating wheat genotypes under salt-affected soil conditions (salinity level ranged from 8.7-10.4 ds/m as EC parameter) was accompanied with the lowest values of all studied physiological and agronomical characters of wheat in the two growing seasons and it's combined. It was respectable to point out that cultivating wheat genotypes under salt-affected soil conditions caused increases in proline content in flag leaf summed of 38.46 % and decreases amounted with 38.63 % in chlorophyll a content, 34.06 % in chlorophyll b content, 37.55 % in total chlorophyll, 7.43 % in relative water content percentage, 16.93 % in plant height, 45.66 % in number of spikes/m^2, 19.14 % in number of grains/spike, 27.46 % in 1000-grain weight and 34.26 % in grain yield/fed as compared with cultivating wheat genotypes under normal soil conditions as combined over both seasons of 2018/2019 and 2019/2020.

These decreases in physiological and agronomical characters of wheat due to cultivating wheat genotypes under salt-affected soil conditions as compared with cultivating wheat genotypes under normal soil conditions may be due to increase soil salinity increased soil pH, electrical conductivity (EC) and sodium adsorption ratio and causes many adverse effects on plant growth by creating osmotic stress, ion toxicity and nutritional imbalance or a combination of these factors. In addition, salt accumulation in the soil can also negatively affect plant growth by reducing nutrient availability in the soil and decreasing uptake of essential nutrients. Furthermore, salt stress associated with a reduction in germination, growth, altered reproductive behavior and enzymatic activity, disrupted photosynthesis, hormonal imbalance, oxidative stress and yield reductions (Ashraf, 2004). These conclusions are in good fulfillment with those announcements by (Grattan and Grieve, 1999, Singh *et al.,* 2018 and Seleiman *et al.,* 2022).

2. Wheat genotypes performance:

As publicized from data in Tables 3 and 4, there were significant differences among the eighteen wheat genotypes *i.e.* Misr 1, Misr 2, Misr 3, Sakha 93, Sakha 94, Sakha 95, Giza 168, Giza 171, Gemmeiza 9, Gemmeiza 11, Gemmeiza 12, Sids 12, Sids 13, Sids 14 and Shandaweel 1 cultivars as well as (SPL2018) # 1, (SPL2018) # 2 and (SPL2018)# 3 lines in physiological characters [chlorophyll a, b and total chlorophyll (mg/l), proline content (mg/g fresh weight) and relative water content (percentage)] and agronomical characters [plant height (cm), number of spikes/m^2, number of grains/spike, 1000-grain weight (g) and grain yield (ardab/fed)] in the two growing seasons and its combined.

The attained results from this research showed that Sakha 95 cultivar exceeded the other studied wheat genotypes in chlorophyll a, b, total chlorophyll contents (mg/l), number of spikes/m^2, 1000-grain weight (g) and grain yield (ardab/fed), which recorded the highest values of these characters as combined over both seasons of 2018/2019 and 2019/2020.

Table 3. Chlorophyll a, b, total chlorophyll and proline content in wheat flag leaf and relative water content percentage as affected by soil types and some wheat genotypes as well as their interactions during 2018/2019 and 2019/2020 seasons and its combined.

Wheat physiological characters	Chlorophyll a (mg/l)			Chlorophyll b (mg/l)			Total chlorophyll (mg/l)			Proline content (mg/g fresh weight)			Relative Water Content (%)		
	2018 /19	2019 /20	Com-bined	2018 /19	2019 /20	Com-bined	2018 /19	2019 /20	Com-bined	2018 /19	2019 /20	Com-bined	2018 /19	2019 /20	Com-bined
A. Soil type:															
Normal soil	10.47	11.17	10.82	2.97	3.49	3.23	13.45	14.67	14.06	0.213	0.229	0.221	78.89	79.99	79.44
Salt-affected soil	6.39	6.9	6.64	2.01	2.24	2.13	8.41	9.15	8.78	0.289	0.323	0.306	72.84	74.24	73.54
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
B. Wheat genotype:															
Misr 1	9.83	10.39	10.11	3.39	4.05	3.72	13.23	14.45	13.84	0.284	0.335	0.309	80.29	81.49	80.89
Misr 2	8.63	9.03	8.83	2.38	2.74	2.56	11.02	11.77	11.39	0.254	0.264	0.259	75.90	77.28	76.59
Misr 3	9.65	10.55	10.10	3.41	4.15	3.78	13.06	14.71	13.89	0.272	0.332	0.302	78.18	79.26	78.72
Sakha 93	7.90	8.53	8.21	2.00	2.32	2.16	9.90	10.85	10.38	0.245	0.255	0.25	75.18	76.65	75.91
Sakha 94	8.86	9.26	9.06	2.65	2.92	2.78	11.51	12.18	11.84	0.255	0.27	0.263	76.32	77.45	76.88
Sakha 95	9.79	10.90	10.35	3.65	4.33	3.99	13.44	15.24	14.34	0.272	0.312	0.292	79.42	80.65	80.03
Giza 168	7.62	8.18	7.90	1.95	2.13	2.04	9.57	10.31	9.94	0.254	0.263	0.259	74.83	76.22	75.53
Giza 171	8.31	9.04	8.67	2.06	2.37	2.21	10.37	11.42	10.89	0.258	0.287	0.272	74.40	74.98	74.69
Gemmeiza 9	7.23	7.79	7.51	1.83	1.90	1.87	9.06	9.69	9.38	0.233	0.235	0.234	73.13	74.55	73.84
Gemmeiza 11	7.05	7.31	7.18	1.71	1.81	1.76	8.76	9.12	8.94	0.226	0.228	0.227	74.51	75.56	75.03
Gemmeiza 12	8.06	8.53	8.29	2.63	3.20	2.92	10.69	11.73	11.21	0.242	0.251	0.247	75.72	76.79	76.25
Sids 12	7.68	8.09	7.89	2.09	2.24	2.16	9.77	10.34	10.06	0.214	0.237	0.225	73.55	74.89	74.22
Sids 13	8.70	8.98	8.84	2.56	2.83	2.69	11.27	11.81	11.54	0.244	0.267	0.255	74.44	75.81	75.13
Sids 14	9.47	10.02	9.75	2.98	3.70	3.34	12.46	13.72	13.09	0.272	0.291	0.281	76.73	78.53	77.63
Shandaweel 1	9.14	9.73	9.43	3.08	3.15	3.11	12.23	12.88	12.55	0.288	0.323	0.306	80.18	81.45	80.81
(SPL2018) # 1	7.31	8.19	7.75	1.77	2.21	1.99	9.08	10.40	9.74	0.228	0.267	0.247	73.08	74.27	73.68
(SPL2018) # 2	7.86	8.74	8.30	2.09	2.73	2.41	9.96	11.48	10.72	0.235	0.27	0.252	74.40	75.51	74.96
(SPL2018) # 3	8.65	9.39	9.02	2.67	2.87	2.77	11.33	12.26	11.80	0.24	0.279	0.26	75.34	76.77	76.06
LSD at (5%)	0.14	0.18	0.12	0.18	0.19	0.13	0.21	0.25	0.18	0.009	0.012	0.007	0.60	0.65	0.51
C. Interaction (F. test):															
A × B	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 4. Plant height at harvest, number of spikes/m^2, number of grains/spike, 1000-grain weight and grain yield/fed as affected by soil types and some wheat genotypes as well as their interactions during 2018/2019 and 2019/2020 seasons and its combined.

Wheat agronomic characters	Plant height at harvest (cm)			Number of spikes/m^2			Number of grains/spike			1000-grain weight (g)			Grain yield (ardab/fed)		
	2018 /19	2019 /20	Com-bined	2018 /19	2019 /20	Com-bined	2018 /19	2019 /20	Com-bined	2018/ 19	2019 /20	Com-bined	2018 /19	2019 /20	Com-bined
A. Soil type:															
Normal soil	106.8	111.7	109.3	476.1	508.8	492.5	52.7	54.03	53.3	45.82	47.76	46.79	16.98	21.2	19.09
Salt-affected soil	89.1	92.5	90.8	247.8	287.5	267.6	41.98	44.31	43.1	32.12	35.76	33.94	11.77	13.33	12.55
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
B. Wheat genotype:															
Misr 1	96.60	102.50	99.50	408.00	443.50	425.70	49.05	50.78	49.92	39.43	42.46	40.94	15.86	19.93	17.90
Misr 2	102.50	105.00	103.70	343.60	341.00	342.30	44.61	46.30	45.45	34.63	35.36	35	12.28	13.56	12.92
Misr 3	104.10	106.60	105.40	418.50	466.00	442.20	51.70	52.95	52.32	45.47	47.12	46.3	18.59	20.88	19.73
Sakha 93	90.00	95.00	92.50	362.10	389.60	375.90	45.57	47.03	46.30	39.45	43.24	41.35	11.59	17.50	14.54
Sakha 94	102.50	105.80	104.10	344.00	374.30	359.10	45.77	48.80	47.29	38.15	42.02	40.09	14.39	18.38	16.38
Sakha 95	105.00	108.30	106.60	438.10	476.60	457.40	49.96	52.38	51.17	46.06	47.57	46.81	19.66	21.69	20.67
Giza 168	97.50	103.30	100.40	351.50	391.50	371.50	45.30	49.03	47.16	34.3	37.12	35.71	13.11	17.05	15.08
Giza 171	98.30	102.50	100.40	407.50	419.10	413.30	49.51	50.27	49.89	43.44	46.18	44.81	15.50	19.91	17.70
Gemmeiza 9	95.00	102.50	98.70	312.30	358.00	335.10	43.94	46.75	45.35	34.83	36.87	35.85	11.72	13.25	12.49
Gemmeiza 11	99.10	100.80	100.00	304.30	335.30	319.80	46.35	46.94	46.64	42.31	44.75	43.53	9.80	11.60	10.70
Gemmeiza 12	94.10	99.10	96.60	345.10	408.60	376.90	48.01	50.24	49.13	37.68	38.59	38.13	15.50	16.52	16.01
Sids 12	99.10	103.30	101.20	300.10	331.30	315.70	47.78	49.43	48.61	36.46	39.06	37.76	10.97	14.33	12.65
Sids 13	96.60	100.00	98.30	340.10	368.30	354.20	45.98	47.92	46.95	32.35	35.19	33.77	13.62	16.88	15.25
Sids 14	105.80	109.10	107.50	416.00	450.50	433.20	51.12	52.17	51.64	41.71	45.97	43.84	17.55	19.99	18.77
Shandaweel 1	100.80	103.30	102.00	376.30	445.00	410.60	51.60	53.28	52.44	38.61	42.71	40.66	15.39	17.96	16.68
(SPL2018) # 1	86.60	91.60	89.10	326.50	366.00	346.20	43.45	45.14	44.30	40.28	43.96	42.12	12.28	15.15	13.71
(SPL2018) # 2	92.50	99.10	95.80	326.50	366.10	346.30	44.44	45.50	44.97	36.3	42.65	39.48	14.31	16.53	15.42
(SPL2018) # 3	97.50	100.80	99.10	395.50	435.80	415.60	47.90	50.16	49.03	39.96	40.84	40.4	16.57	19.66	18.11
LSD at (5%)	3.20	3.60	2.40	26.60	27.90	20.50	1.38	1.42	1.04	1.54	1.6	0.96	1.09	1.12	0.80
C. Interaction (F. test):															
A × B	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Nevertheless, Misr 1 cultivar surpassed the other studied wheat genotypes in proline content in wheat flag leaf and relative water content percentage as combined over both seasons of 2018/2019 and 2019/2020. However, Sids 14 cultivar gave the tallest plants as compared with other studied wheat genotypes as combined over both seasons of 2018/2019 and 2019/2020.

Though, Shandaweel 1 cultivar provided with the highest number of grains/spike as compared with other studied wheat genotypes as combined over both seasons of 2018/2019 and 2019/2020.

Whereas, Gemmeiza 11 cultivar resulted in the lowest means of chlorophyll a, b, total chlorophyll contents and grain yield/fed as combined over both seasons of 2018/2019 and 2019/2020. Sids 12 cultivar resulted in the lowest values of proline content in wheat flag leaf and number of spikes/m^2 as combined over both seasons of 2018/2019 and 2019/2020. (SPL2018)# 1 line resulted in the lowest values of relative water content percentage, plant height at harvest and number of grains/spike as combined over both seasons of 2018/2019 and 2019/2020. Sids 13 cultivar resulted in the lowest values of 1000-grain weight as combined over both seasons of 2018/2019 and 2019/2020.

These results could be attributed to the differences in the genetic makeup and genetic variables of the wheat genotypes studied. These results are in harmony with those reported by (El-Sayed *et al.,* 2018; Gomaa *et al.*, 2018; Hassanein *et al.*, 2018; Khan *et al.,* 2019 and Iwanska *et al.,* 2020).

3. Effect of the interaction:

The interaction between soil types and some wheat genotypes significantly affected physiological characters [chlorophyll a, b and total chlorophyll (mg/l), proline content (mg/g fresh weight) and relative water content (%)] and agronomical characters; plant height at harvest (cm), number of spikes/m^2, number of grains/spike, 1000-grain weight (g) and grain yield (ardab/fed) in the two growing seasons and its combined, with exception plant height at harvest in 2018/2019 and 2019/2020 seasons only as shown from data obtainable in (Tables 3 and 4).

As results of there are many significant effects of the interaction between soil types and some wheat genotypes as shown in (Tables 3 and 4). Therefore, the significant interaction between soil types and some wheat genotypes as combined over both seasons of 2018/2019 and 2019/2020 were focused herein.

The accomplished results of this research expose that cultivating wheat Sakha 95 cultivar under normal soil conditions resulted in the highest values of chlorophyll a, b and total chlorophyll contents, number of spikes/m^2, 1000-grain weight and grain yield/fed as combined over both seasons of 2018/2019 and 2019/2020 as shown in Tables 5 and 6. Cultivating wheat Misr 1 cultivar under salt-affected soil conditions resulted in the highest value of proline content in wheat flag leaf as combined over both seasons (Table 5). Cultivating wheat Misr 3 cultivar under normal soil conditions resulted in the highest percentage of relative water content as combined over both seasons (Table 5). Cultivating wheat Sids 14 cultivar under normal soil conditions resulted in the highest values of plant height at harvest and number of grains/spike as combined over both seasons (Table 6).

Table 5. Chlorophyll a, b, total chlorophyll and proline content in wheat flag leaf and relative water content percentage as affected by the interaction between soil types and some wheat genotypes as combined over both seasons of 2018/2019 and 2019/2020.

Wheat physiological characters	Chlorophyll a (mg/l)		Chlorophyll b (mg/l)		Total chlorophyll (mg/l)		Proline content (mg/g fresh weight)		Relative Water Content (%)	
Genotype	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil
Misr 1	11.87	8.36	3.93	3.51	15.80	11.87	0.237	0.382	81.44	80.34
Misr 2	10.36	7.30	3.24	1.87	13.61	9.18	0.224	0.294	80.56	72.61
Misr 3	12.55	7.65	4.60	2.96	17.16	10.61	0.264	0.341	82.67	74.77
Sakha 93	10.34	6.09	2.90	1.41	13.25	7.51	0.215	0.285	80.13	71.70
Sakha 94	11.01	7.11	3.42	2.14	14.43	9.25	0.225	0.300	80.86	72.90
Sakha 95	12.70	8.00	4.86	3.11	17.57	11.11	0.259	0.325	82.60	77.46
Giza 168	10.04	5.76	2.58	1.50	12.62	7.26	0.224	0.293	79.13	71.92
Giza 171	10.97	6.38	2.81	1.62	13.78	8.00	0.235	0.310	76.96	72.42
Gemmeiza 9	9.63	5.38	2.40	1.34	12.04	6.72	0.203	0.265	75.81	71.87
Gemmeiza 11	9.12	5.23	2.31	1.20	11.44	6.44	0.196	0.258	77.79	72.27
Gemmeiza 12	11.06	5.53	3.24	2.59	14.31	8.12	0.212	0.281	78.89	73.61
Sids 12	10.31	5.47	3.01	1.31	13.33	6.79	0.184	0.267	77.32	71.13
Sids 13	11.18	6.51	3.28	2.11	14.46	8.62	0.214	0.297	77.64	72.62
Sids 14	11.94	7.55	4.08	2.60	16.02	10.16	0.242	0.321	81.42	73.84
Shandaweel 1	10.58	8.29	3.10	3.13	13.69	11.41	0.230	0.381	81.79	79.84
(SPL2018) # 1	10.17	5.33	2.47	1.51	12.64	6.85	0.198	0.296	76.80	70.56
(SPL2018) # 2	10.34	6.27	2.69	2.13	13.03	8.40	0.205	0.300	78.43	71.49
(SPL2018) # 3	10.63	7.41	3.26	2.28	13.90	9.70	0.210	0.309	79.73	72.39
LSD at (5%)	0.16		0.18		0.26		0.010		0.73	

Whereas, the lowest values of chlorophyll a, b and total chlorophyll contents and grain yield/fed were produced from cultivating wheat Gemmeiza 11 cultivar under salt-affected soil conditions as combined over both seasons. Cultivating wheat Sids 12 cultivar under normal soil conditions produced the lowest value of proline content in wheat flag leaf as combined over both seasons. Cultivating wheat (SPL2018) # 1 line under salt-affected soil conditions produced the lowest percentage of relative water content and shortest plants as combined over both seasons. Cultivating wheat Sids 12 cultivar under salt-affected soil conditions produced the lowest value of number of spikes/m^2 as combined over both seasons.

Cultivating wheat Misr 2 cultivar under salt-affected soil conditions produced the lowest value of number of grains/spike as combined over both seasons. Cultivating wheat (SPL2018) # 2 line under salt-affected soil conditions produced the lowest value of 1000-grain weight as combined over both seasons.

Regarding to reduction percentage in grain yield of wheat genotypes as a result of growing in normal and salt-affected soils as combined over both seasons of 2018/2019 and 2019/2020 that presented in Table 6. The highest reduction percentage in grain yield (43.91 %) was recorded in Sids 13 cultivar due to growing it in salt-affected soil as compared growing it in normal soil as combined over both seasons, followed by Sakha 95 cultivar with reduction percentage in grain yield of 43.55 %, then Sids 14 cultivar with reduction percentage in grain yield of 42.20 %, Misr 3 cultivar with reduction percentage in grain yield of 42.12 %, Sids 12 cultivar with reduction percentage in grain yield of 40.28 %, (SPL2018) # 3 line with reduction percentage in grain yield of 40.02 %, Giza 171 cultivar with reduction percentage in grain yield of 37.57 %, (SPL2018) # 1 line with reduction percentage in grain yield of 37.11 (SPL2018) # 2 line with reduction percentage in grain yield of 35.87 %, Gemmeiza 12 cultivar with reduction percentage in grain yield of 37.71 %, Sakha 93 cultivar with reduction percentage in grain yield of 34.53 %, Sakha 94 cultivar with reduction percentage in grain yield of 33.71 %, Giza 168 cultivar with reduction percentage in grain yield of 31.41%, Misr 2 cultivar with reduction percentage in grain yield of 27.62 %, Gemmeiza 11 cultivar with reduction percentage in grain yield of 21.37 %, Misr 1 cultivar with reduction percentage in grain yield of 21.36 % and Shandaweel 1 cultivar with reduction percentage in grain yield of 15.85 % as combined over both seasons as shown in Table 6. However, Gemmeiza 9 cultivar had the lowest reduction percentage in grain yield (9.39 %) by reason of growing it in salt-affected soil as compared growing it in normal soil as combined over both seasons as given away in Table 6.

The stress susceptibility index (SSI)

The stress susceptibility index (SSI) evaluates the relative tolerance of bread wheat genotypes to salt stress based on the mean of grain yield over two seasons.

The mean (SSI) during two seasons appeared to be a suitable selection index to distinguish resistant genotypes, according to (Hamam and Negim, 2014). Researchers have used SSI to identify susceptible and tolerance genotypes (Clarke *et al.*, 1992). Low stress susceptibility index (SSI<1) is synonymous to higher stress tolerance, but the genotypes with a stress index greater than one (SSI>1), would be susceptible.

As shown in Table 7, the stress susceptibility index (SSI) estimations varied among genotypes, range from (0.29) for Gemmeiza 9 cultivar to (1.36) for Sakha 95 cultivar. The highest salinity susceptibility index of investigated wheat genotypes based on grain yield of them was Sakha 95 cultivar with SSI value of 1.36, followed by Sids 13 cultivar with SSI value of 1.25, then Sids 14 cultivar with SSI value of 1.22, Misr 3 cultivar with SSI value of 1.18, Sids 12 with SSI value of 1.16, (SPL2018) # 3 promising line with SSI value of 1.14, (SPL2018) # 1 promising line with SSI value of 1.10, Giza 171 cultivar with SSI value of 1.09, (SPL2018) # 2 promising line with SSI value of 1.06 and Gemmeiza 12 cultivar with SSI value of 1.04 as combined over 2018/2019 and 2019/2020 seasons. However, Sakha 93, Sakha 94, Giza 168, Misr 2, Misr 1, Gemmeiza 11, Shandaweel 1 and Gemmeiza 9 cultivars had stress susceptibility index (SSI) less than 1.00, which were 0.99, 0.97, 0.91, 0.82, 0.64, 0.62, 0.44 and 0.29 of them, respectively as combined over both seasons.

As a result of these findings, the Gemmeiza 9, Shandaweel 1, Gemmeiza 11, Misr 1 and Misr 2 genotypes could be defined as salinity tolerant genotypes. Sids 13, Sids 14, Misr 3, Sids 12 and (SPL2018) # 3 promising line were moderately tolerant to salinity stress. On the other hand, Sakha 95 cultivar was the most sensitive genotypes.

Nevertheless, tolerance and susceptibility indices are not ideal to characterize genotypes with high yield performance and high-stress tolerance under both locations (Thiry *et al.*, 2016). (Ragab and Kheir 2019) were therefore interested in the superiority of grain yield under the studied stress conditions as well as the stress susceptibility index.

Table 6. Plant height at harvest, number of spikes/m^2, number of grains/spike, 1000-grain weight, grain yield/fed and reduction percentage in grain yield as affected by the interaction between soil types and some wheat genotypes as combined over both seasons of 2018/2019 and 2019/2020.

Wheat physiological characters	Plant height at harvest (cm)		Number of spikes/m^2		Number of grains/spike		1000-grain weight (g)		Grain yield (ardab/fed)		Reduction percentage in grain yield
Genotype	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil	Normal soil	Salt-affected soil	
Misr 1	109.10	90.00	500.80	350.60	50.53	49.31	42.670	39.220	20.04	15.76	21.36
Misr 2	114.10	93.30	468.30	216.30	53.16	37.75	38.560	31.440	14.99	10.85	27.62
Misr 3	115.00	95.80	580.10	304.30	57.95	46.70	52.600	39.990	25.00	14.47	42.12
Sakha 93	99.10	85.80	482.30	269.50	51.50	41.11	50.330	32.370	17.58	11.51	34.53
Sakha 94	115.00	93.30	453.60	264.60	54.75	39.83	47.000	33.170	19.70	13.06	33.71
Sakha 95	115.80	97.50	588.10	326.60	56.59	45.76	53.340	40.290	26.43	14.92	43.55
Giza 168	110.00	90.80	485.80	257.10	50.66	43.67	43.140	28.280	17.89	12.27	31.41
Giza 171	110.80	90.00	547.30	279.30	56.52	43.27	50.890	38.730	21.80	13.61	37.57
Gemmeiza 9	107.50	90.00	442.80	227.50	46.97	43.73	44.540	27.150	13.10	11.87	9.39
Gemmeiza 11	107.50	92.50	428.00	211.60	52.98	40.30	49.620	37.450	11.98	9.42	21.37
Gemmeiza 12	105.00	88.30	498.80	255.00	54.52	43.73	40.610	35.650	19.49	12.53	35.71
Sids 12	110.80	91.60	434.50	197.00	54.99	42.23	42.820	32.700	15.84	9.46	40.28
Sids 13	105.80	90.80	470.00	238.50	53.06	40.85	39.410	28.120	19.54	10.96	43.91
Sids 14	119.10	95.80	557.80	308.60	58.24	45.05	52.450	35.230	23.79	13.75	42.2
Shandaweel 1	111.60	92.50	469.30	352.00	56.26	48.62	51.350	29.970	18.11	15.24	15.85
(SPL2018) # 1	99.10	79.10	475.50	217.00	50.20	39.75	48.540	35.710	16.84	10.59	37.11
(SPL2018) # 2	104.10	87.50	432.80	259.80	46.07	42.52	49.910	29.050	18.79	12.05	35.87
(SPL2018) # 3	107.50	90.80	548.60	282.60	55.62	42.44	44.370	36.420	22.65	13.58	40.04
LSD at (5%)	3.40		29.10		1.47		1.350		1.13		

Table 7. Stress susceptibility index (SSI) of investigated wheat genotypes as combined over both seasons of 2018/2019 and 2019/2020.

Wheat genotype	SSI	Wheat genotype	SSI	Wheat genotype	SSI
Misr 1	0.64	Giza 168	0.91	Sids 13	1.25
Misr 2	0.82	Giza 171	1.09	Sids 14	1.22
Misr 3	1.18	Gemmeiza 9	0.29	Shandaweel 1	0.44
Sakha 93	0.99	Gemmeiza 11	0.62	(SPL2018) # 1	1.10
Sakha 94	0.97	Gemmeiza 12	1.04	(SPL2018) # 2	1.06
Sakha 95	1.36	Sids 12	1.16	(SPL2018) # 3	1.14

CONCLUSION

It could be concluded depending on this research that cultivating wheat genotypes under salt-affected soil conditions was accompanied with the lowest values of all studied physiological and agronomical characters of wheat in the two growing seasons and its combined. Furthermore, it could notable that cultivating wheat Sakha 95 cultivar under normal soil conditions produced the highest physiological and agronomical characters. Bread wheat of Misr 1 and Shandaweel 1 can be used in salt-affected soils, in terms of salt tolerance. Besides, the highest salinity susceptibility index tolerance of investigated wheat genotypes was Sakha 95 cultivar, followed by Sids 13 cultivar, Sids 14 cultivar, Misr 3 cultivar, Sids 12 cultivar and (SPL2018) # 3 promising line according to stress susceptibility index (SSI) results under the environmental conditions of Sakha district, Kafr El-Sheikh Governorate, Egypt.

REFERENCES

Abdelsalam, N.R. and E.E. Kandil (2016). Assessment of genetic variations and growth/yield performance of some Egyptian and Yemeni wheat cultivars under saline condition. Egypt. Acad. J. Bio. Sci., 7(1): 9-26.

Abedi, T.; A. Alemzadeh and S.A. Kazemeini (2010). Effect of organic and inorganic fertilizers on grain yield and protein banding pattern of wheat. Australian J. Crop Sci., 4: 384-389.

Ashraf, M. (2004). Some important physiological selection criteria for salt tolerance in plants. Flora, 199: 361-376.

Asif, M. A.; M. Garcia; J. Tilbrook; C. Brien; K. Dowling; B. Berger; R. K. Schilling; L. Short; C. Trittermann; M. Gilliham; D. Fleury; S. J. Roy and A. S. Pearson (2020). Identification of salt tolerance QTL in a wheat RIL mapping population using destructive and non-destructive phenotyping. Functional Plant Biology, doi.org /10.1071 /FP20167.

Baqir, H.A. and M.A.S. Al-Naqeeb (2018). Response of growth and yield of the three bread wheat cultivars to applying yeast powder methods in different concentrations. Intern. J. Agric. Stat. Sci., 14(Sup. 1): 327-336.

Bates, L.S.; R.P. Walden and I.D. Teare (1973). Rapid determination of free proline for water studies. Plant and Soil 39: 205-208.

Clarke, J.M.; R.M. DePauw and T.M. Townley-Smith (1992). Evaluation of methods for quantification of drought tolerance in wheat. Crop Sci., 32: 728-732.

Ebaid, M.; A.I. Nawar; Sanaa, I. Milad; M.N. Barakat and O.M. Ibrahim (2019). Agronomic and physiological evaluation of Egyptian wheat cultivars under salinity stress. Middle East J. of Agric. Res., 8(4): 1361-1370, DOI: 10.36632/mejar/2019.8.4.36.

El-Sayed, A.A.; A.M. Omar; S.A. Elsaied and Basma, E. El-Samahey (2018). Yield, yield traits and grain properties of some bread wheat cultivars as influenced by planting dates under Egyptian conditions. J. Plant Production, Mansoura Univ., 9(3): 233-239.

FAO, (2022). Food and Agriculture Organization. Faostat, FAO Statistics Division, April, 2022. http://www. fao.org/ faostat/ en/#data /QC.

Fischer, R. and R. Maurer (1978). Drought resistance in spring wheat cultivars. I. Grain yield responses. Australian J. of Agric. Res., 29: 897-912, http://dx.doi.org/10.1071/ AR9780897.

Gomaa, M.A.; F.I. Radwan; E.E. Kandil and M.A.F. Al-Msari (2018). Response of some Egyptian and Iraqi wheat cultivars to mineral and nan-ofertilization. Egypt. Acad. J. Bio. Sci., 9(1): 19-26.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. 2nd Ed., Jhon Wiley and Sons Inc., New York, pp: 95-109.

Grattan, S.R. and C.M. Grieve (1999). Salinity mineral nutrient relations in horticultural crops. Sci. Hort., 78: 127-57.

Hamam, K.A. and O. Negim (2014). Evaluation of wheat genotypes and some soil properties under saline water irrigation. Annals of Agricultural Sciences, 59: 165-176.

Hassanein, M.S.; Amal, G. Ahmed and Nabila, M. Zaki (2018). Effect of nitrogen fertilizer and bio-fertilizer on yield and yield components of two wheat cultivars under sandy soil. Middle East J. of App. Sci., 8(1): 37-42.

Hollington, P.A. (1998). Technological breakthroughs in screening and breeding wheat varieties for salt tolerance. In Proc. of the National Conf. on Salinity Management in Agric., eds. S.K. Gupta, S.K. Sharma and N.K. Tyagi, pp: 273-289.

Iwanska, M.; J. Paderewski; M. Stepien and P.C. Rodrigues (2020). Adaptation of Winter wheat cultivars to different environments: A case study in Poland. Agronomy 2020, 10, 632; doi: 10.3390 /agronomy10050632.

Kandil, A.A.; A.E.M. Sharief; S.E. Seadh and D.S.K. Altai (2016). Role of humic acid and amino acids in limiting loss of nitrogen fertilizer and increasing productivity of some wheat cultivars grown under newly reclaimed sandy soil. Int. J. Adv. Res. Biol. Sci., 3(4): 123-136.

Khan, F.U.; M. Khan; S.G. Khattak; Z. Iqbal; J. Iqbal and Z. Saleem (2019). Performance of some improved bread wheat varieties grown in Khyber Pakhtunkhwa, Pakistan. Adv. Plants Agric. Res., (1): 191-193.

Moran, R. (1982). Formulae for determination of chlorophyll pigments with N, N-Dimethyl formamid. Plant Physiol. 69 (6): 1376-1381.

Munns R., R. A. James and A. Lauchli (2006). Approaches to increasing the salt tolerance of wheat and other cereals. J. Exp. Bot. 57: 1025-1043.

Munns, R. (2002). Comparative physiology of salt and water stress. Plant Cell and Enviro., 25: 239-250.

Munns, R. (2005). Genes and salt tolerance: Bringing them together. New Phytology, 167: 645-663.

Munns, R. and M. Tester (2008). Mechanisms of salt tolerance. Ann. Rev. of Plant Bio., 59: 651-681.

Page, A.L. (1982). Methods of soil analysis, Part 2, chemical and microbical properties (2nd Ed.). American Society of Agronomy. In Soil Sci. of Amer. Inc. Madison Wisconsin, USA.

Paranychianakis, N.V. and K.S. Chartzoulakis (2005). Irrigation of Mediterranean crops with saline water: From physiology to management practices. Agric. Ecosys and Environ, 10: 171-187.

Ragab, K. and A. S. Kheir (2019). Characterizing some Egyptian bread wheat cultivars for salinity tolerance. J. of Plant Production, Mansoura Univ, 10 (12): 1043-49.

Ritchie, S.W. and H.T. Nguyen (1990). Leaf water content and gas exchange parameters of two wheat genotypes differing in drought resistance. Crop Sci. 30: 105-111.

Seleiman, M.F.; M.T. Aslam; B.A. Alhammad; M.U. Hassan; R. Maqbool; M.U. Chattha; I. Khan; H.I. Gitari; O.S. Uslu; R. Roy and M.L. Battaglia (2022). Salinity stress in wheat: effects, mechanisms and management strategies. Phyton, 91(4): 667-694, DOI: 10.32604 /phyton. 2022. 017365.

Singh, P.; O.P. Choudhary and P. Singh (2018). Performance of some wheat cultivars under saline irrigation water in field conditions. Com. in Soil Sci. and Plant Analysis, DOI: 10.1080 /00103624 .2018.1427258.

Snedecor, G.W. and W.G. Cochran (1980). "Statistical Methods" 7th Ed. The Iowa State Univ. Press, Iowa, USA.

Thiry A.A.; P.N. Chavez Dulanto; M.P. Reynolds and W.J. Davies (2016). How can we improve crop genotypes to increase stress resilience and productivity in a future climate? A new crop screening method based on productivity and resistance to abiotic stress. J. Exp. Bot. 67: 5593-5603.

Yadav, S.S.; R.J. Redden; J.L. Hatfield; A.W. Ebert and D. Hunter (2018). Food Security and Climate Change. John Wiley & Sons, Dec. 14, 2018 - Technology & Engineering, p. 568.

تقييم إنتاجية قمح الخبز للتراكيب الوراثيه المصريه الحديثه تحت ظروف التربه العاديه والتربه المتأثره بالأملاح فى مناطق شمال الدلتا, مصر

محمد سعيد جنيدي[1] و نفين لطفى عريان[2]

[1] قسم بحوث القمح, معهد بحوث المحاصيل الحقلية, مركز البحوث الزراعية, مصر.

[2] قسم بحوث فسيولوجيا المحاصيل, معهد بحوث المحاصيل الحقلية, مركز البحوث الزراعية, مصر.

غالبًا ما يتم إجراء معظم دراسات تحمل المحاصيل للملوحه في تجارب الأصص فى الصوب الزراعيه، إلا أنها تكون محدوده تحت ظروف التجارب الحقليه. لذلك أجريت تجربه حقليه تحت ظروف التربه العاديه والتربه المتأثره بالأملاح خلال موسمي النمو 2019/2018 و2020/2019 في المزرعه البحثيه بمحطة البحوث الزراعية بسخا، مركز البحوث الزراعيه، الجيزه، مصر، لدراسة سلوك بعض التراكيب الوراثيه المصريه الحديثه من قمح الخبز على الصفات الفسيولوجيه والمحصوليه. لذلك تم تنفيذ تجربه لكل نوع تربه (تربه عاديه درجة التوصيل الكهربى لها تتراوح بين ds/m 2.3-1.5 وتربه متأثره بالأملاح ودرجة التوصيل الكهربى لها تتراوح بين ds/m 10.4-8.7) في تجربه منفصله. تم تنفيذ كل تجربه لنوع التربه فى تصميم القطاعات كاملة العشوائيه فى ثلاث مكررات، حيث إشتملت كل تجربه على ثمانية عشر تركيب وراثى من قمح الخبز. ثم تم إجراء التحليل التجميعى بين كلا نوعى التربه ومواسم الزراعه. أدت زراعة جميع التراكيب الوراثيه للقمح تحت ظروف التربه العاديه إلى زياده معنويه في جميع الصفات الفسيولوجيه والمحصوليه لقمح الخبز تحت هذه الدراسه، حيث أعطت أعلى القيم لتلك الصفات في كلا الموسمين والتحليل التجميعى لهما. وتفوق صنف القمح سخا 95 يتبعه الصنف مصر 3 على التراكيب الوراثية الأخرى تحت الدراسه فى صفات محتوى كلوروفيل أ، ب، محتوى الكلوروفيل الكلي، عدد السنابل بالمتر المربع، وزن ال 1000 حبه ومحصول الحبوب للفدان، حيث سجل أعلى القيم لتلك الصفات في كلا الموسمين وأيضاً التحليل التجميعى لهما. وتحت ظروف التربه المتأثره بالأملاح كان الصنف مصر1 يليه الصنف شندويل 1 أعطا أعلى القيم لكل الصفات المدروسه فى كلا الموسمين. من النتائج المتحصل عليها أيضاً من هذه الدراسه, يمكن التوصية بزراعة صنف القمح سخا 95 تحت ظروف التربة العاديه للحصول على أعلى القيم للصفات الفسيولوجيه والمحصوليه. علاوة على ذلك، فإن صنف القمح سخا 95 كان الأعلى فى حساسية تحمل الملوحة بالمقارنة بالتراكيب الوراثيه الأخرى تحت هذه الدراسه، يليه الصنف سدس 13، ثم الصنف سدس 14، ثم الصنف مصر 3 , ثم الصنف سدس 12 والسلالة المبشره (SPL2018) # 3 بناءاً على نتائج مؤشر الحساسية للملوحة (SSI) تحت الظروف البيئيه لمنطقة سخا، محافظة كفر الشيخ، جمهورية مصر العربيه.