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The Role of Salicylic Acid in Increasing the Productivity of some Wheat Cultivars under Saline Soil Conditions at South Sinai

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ABSTRACT

Population growth and a water deficit are threats to the world. There is just salt water available in dry locations, years experiments were conducted throughout the winter wheat harvesting seasons of 2020/2021, 2021/20222 and 2022/2023 at El-Tur area, South Sinai. at implications of spraying salicylic acid (SA) solutions at the concentrations of 0 (CK), 50 mg L^{-1}(A1), 100 mg L^{-1} (SA_2) and 150 mg L^{-1} (SA_3) on yield related traits of three bread wheat cultivars of Misr-2(V_1), Gemmeiza12 (V_2) and Sids-13 (V_3) under new reclaimed sandy soil and salinity water conditions. The findings showed that there were considerable variations amongst wheat cultivars for the 24 investigated traits, The Gemmeiza12 wheat cultivar had the maximum grain production over three seasons when 150 mg L^{-1} salicylic acid was applied (3628 kg/ha in the first season, 3770 kg/ha in the second season, and 3911 kg/ha in the third season). However, the wheat cultivar Gemmeiza12 and treatment of 150 mg L^{-1} salicylic acid in El-Tur region, South Sinai in Egypt, might give the most economically viable wheat grain and straw yields.

Keywords: Wheat, Salicylic, Sinai, cultivar.

INTRODUCTION

For the vast majority of people, wheat (*Triticum aestivum L.*) is most significant and staple food crop, and its straw is utilized as livestock feed. According to FAO STAT 2021, it is currently grown on almost 226 million hectares around the world, producing a total of 761 million tons. With a total cultivation area of around 1.411 million hectares and a production volume of over 9 million tons, wheat plays a significant role in Egypt's agricultural strategies. While Egypt imports over 45% of its wheat needs each year. This illustrates the scope of the issue and the work necessary to increase wheat output on Egypt.

The newly recovered soil at El-Tur, South Sinai, is distinguished by increased salt in the soil or in irrigation water, as well as being deficient in mineral nutrients. Salinity and poor soil fertility are widely known to negatively affect affected the growth and yield of field crops, particularly wheat under such conditions. It is evident that wheat cultivars varied in their yield potentiality under newly reclaimed soil ranging from 2.9 to 4.2 tons/ha (Inamullah *et al.* 2011), 6.6 to 8.4 tons/ha (Kamal *et al.* 2011) and 3.2 to 5.7 tons/ha (Kandil *et al.* 2016). Thus, selection and cultivation of the high yield cultivar under such condition is very important for wheat production.

Salicylic (SA), a type of small-molecule phenolic compound, is regarded as a plant endogenous signal molecule (Yan and Dong. 2014). SA is primarily found in plant tissues and has the ability to influence a wide range of physiological processes, primarily controlling plant growth, photosynthetic capacity, and development (Miura and Tada,. 2014 and Berkowitz *et al.* 2016). A that can be reduced by SA application include salt (Jayakannan *et al* 2015), cold, drought, and heavy-metal herbicide toxicity (Akbulut *et al.*2018). Low concentrations of SA appear to be beneficial for plant metabolism, and prior research has demonstrated that SA can counteract the growth-inhibiting effects of salinity in several plant species, including strawberry, garlic, and onion (Abd-Elkader 2016 and Nangare *et al.*2018).

Numerous abiotic and biotic stressors have an impact on wheat productivity. Salinity is one of the most significant and growing abiotic stresses in regions of the world where wheat is produced, and it has a considerable impact on wheat growth and output. The growth and production of wheat plants were boosted by the application of 50 M SA (Sahu *et al.*2010). It was discovered that applying SA to plants seems to increase a pre-adaptive response to salt stress, encouraging defensive responses to the photosynthetic pigments and maintaining membrane straightness in plants, which promotes plant growth. In this regard, SA treatment significantly increased endogenous SA levels, reduced lipid peroxidation concentration, enhanced antioxidant enzyme activity and non-enzymatic compound content, improved the potassium to sodium ratio, and increased plant growth, all of which contributed to an improvement in abiotic tolerance (Li *et al.*2013). However, (Metwally *et al.*2003) indicated that SA has great agronomic potential to enhance plant tolerance under stress conditions, and that its impact is mostly influenced by the concentration, application method, and plant species. Therefore, in this study, three wheat cultivars received exogenous SA application to investigate its impact on enhancing growth and yield of bread wheat farmed in sandy soil with drip irrigation in the El-Tur region, South Sinai of Egypt, and to provide technical strategies for improving wheat production in the salinity conditions. The aim of this study was to investigate the impact of salicylic acid

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treatments on the productivity of some bread wheat (*Triticum aestivum* L.) varieties raised on recently restored sandy soil.

MATERIALS AND METHODS

Wheat cultivars and salicylic acid (SA) treatment.

Three wheat cultivars, Misr-2 (V1), Sids-13 (V2) and Gemmeiza-12 (V3) were used in this study; it came from the Wheat Research Section of the Field Crops Research Institute at the Giza Agricultural Research Centre in Egypt. With four replicates and a split-split plot design, the studies treatments contained 12 as combinations between three wheat cultivars with the four levels of SA spray treatments, 0 (water, without SA, CK), 50 mg L^{-1}(A1), 100 mg L^{-1} (SA2)and 150 mg L^{-1} (SA3). Wheat cultivars were as the main plot, and the SA treatments as the sub-plots.

The sub-plot area was 10.5 m^2, was 3.5 m long, and was 3 m broad. It was 1/952 of an ha. At a seeding rate of 143 kg/ha, wheat seeds were sowed. (according to 1000-grain weight of each cultivar) were hand-drilled in rows that were 3.5 m long and 20 cm apart and planted on November 30 of each season. Prior to irrigation, three doses of salicylic acid were applied at a rate of at 25, 50 and 75 days after sowing plants sprayed with 0 ppm, 50 ppm, 100 ppm and 150 ppm salicylic acid. Irrigation with sprinkler every five days at a rate of 71 meters/ha.

Soil characteristics and agronomic practises

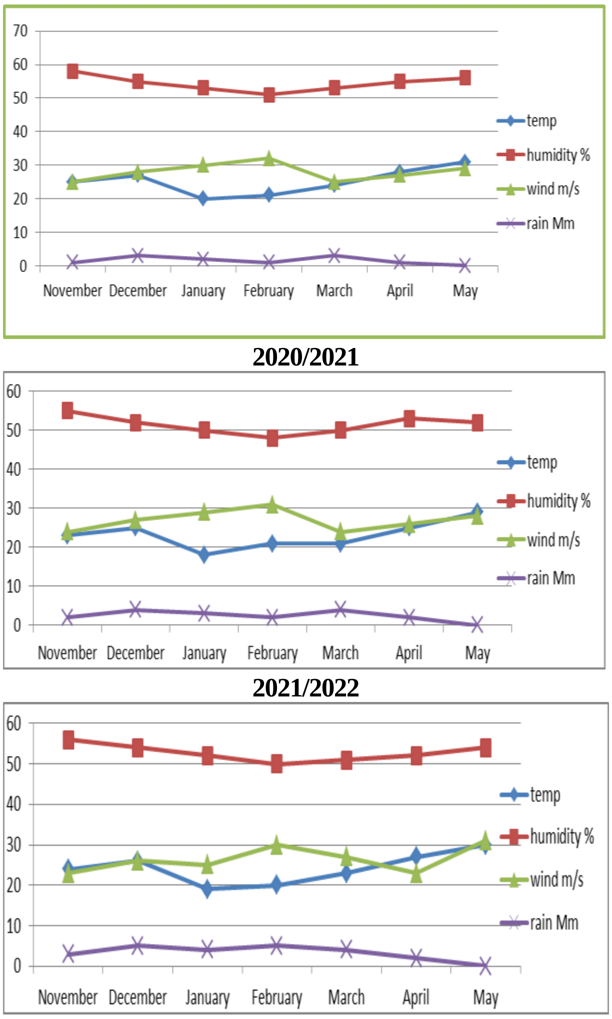
The trials were conducted in the El-Tur area of South Sinai of Egypt during the winter growing seasons of 2018/2019, 2019/2020, and 2020/2021. It was situated 15 km west of El-Tur city at the (2819′ 14″ N, 3335′ 51″ E) coordinates.

Before sowing, soil samples were taken to a depth of 0–30 cm, and Auger performed physical and chemical analyses on them, as can be seen in Table 1. The experimental field underwent two plowings, compaction, division, and subsequent division into experimental units with the aforementioned dimensions. During soil preparation, calcium superphosphate (15.5% P2O5) was applied at a rate of 74 kg P2O5/ha. Potassium sulphate (48% k2O) was broadcast prior to sowing at a rate of 115 kg k2O/ha. fertiliser with nitrogen was applied at the total rate of 282 kg N/ha, of those, ammonium sulphate (20.6% N) was broadcasted at the rate of 150 kg N/ha before sowing, and Prior to irrigation, ammonium nitrate (33.5% N) was administered in three equal doses at a rate of 250 kg N/ha at 25, 50, and 75 days following sowing (a total of 750 kg ammonium nitrate). On the advice of the Ministry of Agriculture, typical agricultural methods for cultivating wheat were used.

Table 1. The mean chemical and physical properties of representative soil samples (0-30 cm depth) in the experimental site before sowing and of the irrigation water for the three growing seasons.

Soil properties	Values	Irrigation Water	Values
Clay	3.6	PH	6.74
Silt	8.3	EC (dS m^{-1})	3.63
Sand	87.1	Aminouim N (mg L^{-1})	5.64
Texture Grade	Sandy	Nitrare N (mg L^{-1})	22.3
PH (Ext. 1:1)	7.32	Phosphorus (mg L^{-1})	0.08
EC (Ext. 1:1), dS m^{-1}	2.34	Potassium (mg L^{-1})	0.67
Total $CaCO_3$ (%)	33.2		
Total Organic Carbon (%)	0.25		
Total Organic Matter (%)	0.423		
Nitrogen (mg kg^{-1})	17.2		
Phosphorus (mg kg^{-1})	1.58		
Potassium (mg kg^{-1})	45.7		

As shown in Fig. (1), meteorological data from three seasons were collected from the El-Tur region meteorological station, the South Sinai station, and the Desert Research Centre. According to Table 1, the irrigation water was tested for pH, EC, captions, and anions throughout the course of three seasons.



2020/2021

2021/2022

2022/2023

Fig. 1. Meteorological parameters of El-Tur area, South Sinai of Egypt. Station, Desert Res in 2020/2021, 2021/2022 and 2022/2023 growing seasons.

Growth traits

One square was randomly chosen from each sub plot after 90 days of sowing to estimate:

1- Using a Minolta camera and the SPAD.502 value, the total chlorophyll in ten plants' flag leaves was assessed. The average was then determined.

2- Flag leaf area (cm) was estimated using the allowing formula.

F. L. A.= flag leaf Length x maximum width x 0.75 according to (Watson. 1952).

3- Fresh weight of shoots/m^2.

4- Dry weight of shoots/m^2.

5- Each sub-sub plot's ten plants were measured in height from the ground to their tips, and the average was computed.

B. 120 dayes Ten guarded plants were selected from each sub-subplot during seeding, and the following characters were esteemed:

2- Spike length (cm): as an average of ten random spikes.

3- Number of spikelets/spik an average of ten random spike.

C. Yield and its components.

Following characters were estimated on one square meter that was randomly chosen from each subplot during harvest:

1- The number of spikes per m^2 was calculated using a randomly selected one m2 from each plot.
2- Average of 10 random spikes, measured for length in cm.
3- Number of grains/spike: A sample of ten main spikes from 10 randomly chosen plants in each plot were taken and the data was recorded.
4- 1000-grain weight (g): This weight was determined by weighing 1000 grains randomly selected from each sub-sub plot.
5- Biological yield (kg/ha): This was calculated by weighing all of the plants that were present in the selected square meter and converting to kg/ha.
6- Grain yield (kg/ha): The harvested grains from each square meter of each sub-sub plot were air dried, threshed and weighed in kilograms before being converted to kilograms per hectare.
7- Weighing the straw yield provided an estimate of the straw yield (kg/ha).
8-Crop index: It was determined by multiplying the grain yield (kg/fed) by the straw yield (kg/fed).
9- The formula used to determine the harvest index (%) was as follows: harvest index (%) = grain yield (kg/fed)/biological yield (kg/fed).

D. Grain quality:

1- Nitrogen content (%): The new kjeldahle method, as described by the (A.O.A.C. 1980), was used to mill and conduct chemical analysis on samples of grains that represented each sub-sub plot.
2- Protein content. (%): Protein content was estimated as follows: Nitrogen content multiplied by 6.25.

a. **Protein yield/fad.** It was estimated using the following formula:

Protein yield /fad. = grain yield /fad. × Protein content (%).

b. **Total carbohydrate.**

Determination of total carbohydrate in wheat grains using the (Dubois 1956) technique of phenol-sulfuric acid.

H- Economic evaluation

1. Grain yield times price + straw yield times price equals total gain (LE/ hectare).
2. Total gain - expenses equals net return (LE/ha.).
3. The price information covered the cost of all farm supplies, labour, and farm equipment. The cost per tonne of maize grains was 4670 LE. In contrast, the cost of straw was (tonne) = 2000 LE.
4. Total costs = 9600 LE per hectare.

Yield traits determination

Each sub-sub plot had one square randomly chosen during harvest in order to examine the associated features. Each sub-plot was to estimate grain, straw, and biological yields. At harvest, 10 guarded plants were randomly selected from each sub-plot to estimate all wheat yield parameters.

Statistical analysis

The collected data were statistically analyzed using the split design and analysis of variance (ANOVA) as per (Gomez and Gomez's 1984) description. Version 2.10 of MGRAPH was utilized along with the MSTAT statistical software. According to (Seducer and Cochran 1980), the difference between treatment means was calculated using the least significant difference (LSD) method at a 5% level of probability.

RESULTS AND DISCUSSION

Results in Table 2 indicated of salicylic acid increased significantly wheat FW: (g/m^2); DW: (g/m^2); NT: No. of Tailoring (m^2); C: Chlorophyll; LA: Leaf area; PH: plant height, after 90 days from sowing. Results in Table (5) Plant height (cm) ranged from 68.60 cm (SA: Without) to 80.55 cm (SA: 150 mg L^{-1}) in the first season, 71.29 cm (SA: Without) to 83.69 cm (SA: 150 mg L^{-1}) in the second one and 73.97 cm (SA: Without) to 86.83 cm (SA: 150 mg L^{-1}) in the three season.

Table 2. Effect of Salicylic acid treatment on wheat grain yield ant its attributes, as during the three growing seasons.

Salicylic Acid Treatment (SI)	Dry Weight	Fresh Weight	No. of Tillers	Chlorophyll	Leaf Area	Plant height
			2020/2021			
CK	618d	2008d	377d	54.35d	16.07d	68.60d
50 mg L^{-1}	698c	2047c	403c	56.04c	18.45c	77.05c
100 mg L^{-1}	717b	2182b	409b	60.13b	19.48b	77.06b
150 mg L^{-1}	745a	2233a	415a	61.51a	21.19a	80.55a
F. test	*	*	*	**	**	*
			2021/2022			
CK	1107d	3579d	392d	56.48d	16.70d	71.29d
50 mg L^{-1}	1249c	3648c	419c	58.23c	19.20c	80.05c
100 mg L^{-1}	1283b	3893b	425b	62.49b	20.30b	81.05b
150 mg L^{-1}	1333a	3981a	431a	63.91a	22.00a	83.69a
F. test	*	**	**	**	**	**
			2022/2023			
CK	1596d	5150d	406d	58.60d	17.33d	73.97d
50 mg L^{-1}	1799c	5248c	434c	60.42c	19.88c	83.04c
100 mg L^{-1}	1849b	5604b	441b	64.84b	21.03b	85.03b
150 mg L^{-1}	1920a	5728a	447a	66.30a	22.86a	86.83a
F. test	**	**	*	**	**	**

**** : Significant at 0.01 level of probability, and N.S: not significant. HA_0): without Humic acid; HA_1): 50 mg L^{-1}; HA_2): 100 mg L^{-1}; HA_3): 150 mg L^{-1}**

Effects of SA on yield traits of wheat

Results in Table 3 indicated that application of salicylic acid increased significantly wheat yield and its components at Yield and its components after 150 days from sowing. The results in Table (6) indicated that application of salicylic acid. Number of spikes/spike ranged from 15.90 (SA: Without) to 17.52 (SA: 150 mg L^{-1}) in the first season, 16.54 (SA: Without) to 18.20 (SA: 150 mg L^{-1}) in the second one and 17.18 (SA: Without) to 18.88 (SA: 150 mg L^{-1}) in the three season. Spike length (cm) ranged from 8.12 cm (SA: Without) to 10.35 cm (SA: 150 mg L^{-1}) in the first season, 8.44 cm (SA: Without) to 10.78 cm (SA: 150 mg L^{-1}) in the second one and 8.75 cm (SA: Without) to 11.20 cm (SA: 150 mg L^{-1}) in the three season. Number of grains /spike ranged from 22.67 (SA: Without) to 28.17 (SA: 150 mg L^{-1}) in the first season, 23.50 (SA: Without) to 29.21 (SA: 150 mg L^{-1}) in the second one and 24.33 (SA: Without) to 30.25 (SA: 150 mg L^{-1}) in the three season. Number of spikes/ m^2 ranged from 182 m^2 (SA: Without) to 212 m^2 (SA: 150 mg L^{-1}) in the first season, 189 m^2 (SA: Without) to 221m^2 (SA: 150 mg L^{-1}) in the second one and 196 m^2 (SA: Without) to 229 m^2 (SA: 150 mg L^{-1}) in the three season. 1000-grain weight (g) ranged from 43.78 g (SA: 150 mg L^{-1}) to 47.60 g (SA: Without) in the first season, 42.30 g (SA: 150 mg L^{-1}) to 46.30 g (SA: 50 mg L^{-1}) in the second one and 40.85 g (SA: 150 mg L^{-1}) to 45.23 g (SA: 50 mg L^{-1}) in the three season.

Table 3. Effect of Salicylic acid treatments on wheat yield ant its attributes, as during the three growing seasons.

Salicylic Acid Treatment (SI)	No. of Spikes/ Spike	Spike Length (cm)	No. of Grains/ Spike	No. of Spikes/ (m^2)	1000-grain Weight (g)	Weight of Grains/spike (g)	Grain Yield (kg/ha)	Straw Yield (kg/ha)	Biological Yield (kg/ha)
					2020/2021				
CK	15.90d	8.12d	22.67d	182d	47.60a	1.188d	2488d	3815d	6303d
50 mg L^{-1}	16.24c	9.56c	24.08c	199c	47.37b	1.249c	2879c	4537c	7416c
100 mg L^{-1}	16.93b	9.76b	26.17b	208b	44.98c	1.290b	3104b	5072b	8176b
150 mg L^{-1}	17.52a	10.35a	28.17a	212a	43.78d	1.355a	3338a	5863a	9202a
F. test	*	*	**	**	*	**	**	**	**
					2021/2022				
CK	16.54d	8.44d	23.50d	189d	45.90b	1.189d	2586d	4059d	6645d
50 mg L^{-1}	16.89c	9.94c	24.50c	207c	46.30a	1.250c	2992c	4771c	7763c
100 mg L^{-1}	17.59b	10.14b	26.71b	216b	44.00c	1.291b	3226b	5306b	8532b
150 mg L^{-1}	18.20a	10.78a	29.21a	221a	42.30d	1.357a	3469a	5952a	9421a
F. test	*	*	**	**	**	**	**	**	*
					2022/2023				
CK	17.18d	8.75d	24.33d	196d	44.23b	1.190d	2684d	4302d	6986d
50 mg L^{-1}	17.53c	10.31c	24.92c	215c	45.23a	1.250c	3104c	5005c	8109c
100 mg L^{-1}	18.25b	10.52b	27.25b	224b	42.95c	1.292b	3348b	5539b	8887b
150 mg L^{-1}	18.88a	11.20a	30.25a	229a	40.85d	1.358a	3599a	6041a	9640a
F. test	*	*	**	*	**	**	**	**	*

**** : Significant at 0.01 level of probability, and N.S: not significant. HA_0): without Humic acid; HA_1): 50 mg L^{-1}; HA_2): 100 mg L^{-1}; HA_3): 150 mg L^{-1}**

Effects of SA treatments wheat.

The outcomes in Table 4 demonstrated that use of SA increased significantly wheat yield and its components after harvest at Yield after 150 days following seeding and its constituent parts. The outcomes in Table (7) demonstrated that use of salicylic acid. Grain yield (L.E /ha) ranged from 11619 L.E /ha (SA: Without) to 15589 L.E /ha (SA: 150 mg L^{-1}) in the first season, 12077 L.E /ha (SA: Without) to 16199 L.E /ha (SA: 150 mg L^{-1}) in the second one and 12534 L.E /ha (SA: Without) to 16808 L.E /ha (SA: 150 mg L^{-1}) across three seasons. Harmonic results were noted by (Abd El-Aziz, et al 2017). Straw yield (L.E /ha) ranged from 7631 L.E /ha (SA: Without) to 11727 L.E /ha (SA: 150 mg L^{-1}) in the first season, 8118 L.E /ha (SA: Without) to 11905 L.E /ha (SA: 150 mg L^{-1}) in the second one and 8604 L.E /ha (SA: Without) to 12082 L.E /ha (SA: 150 mg L^{-1}) in the three season. Total gain (L.E /ha) ranged from 19249 L.E /ha (SA: Without) to 27316 L.E /ha (SA: 150 mg L^{-1}) in the first season, 20194 L.E /ha (SA: Without) to 28103 L.E /ha (SA: 150 mg L^{-1}) in the second one and 21138 L.E /ha (SA: Without) to 28890 L.E /ha (SA: 150 mg L^{-1}) in the three season. Net gain (L.E /ha) ranged from 9649 L.E /ha (SA: Without) to 17716 L.E /ha (SA: 150 mg L^{-1}) in the first season, 10594 L.E /ha (SA: Without) to 18503 L.E /ha (SA: 150 mg L^{-1}) in the second one and 11538 L.E /ha (SA: Without) to 19290 L.E /ha (SA: 150 mg L^{-1}) in the three season.

Table 4. **Effect of Salicylic acid treatments on wheat grain yield ant related traits, as during the three growing seasons.**

Salicylic Acid Treatment (SI)	L.E Grain Yield	L.E Straw Yield	Total Gain	Net Gain	Crop Index	Harvest Index	Carbohydrates On seeds	Protein On seeds	Protein Yield
					2020/2021				
CK	11619d	7631d	19249d	9649d	66.00a	39.70a	59.07d	8.83d	220d
50 mg L^{-1}	13447c	9073c	22520c	12920c	63.70b	38.70b	60.98c	8.93c	257c
100 mg L^{-1}	14497b	10143b	24641b	15041b	61.30c	38.00c	62.63b	9.01b	280b
150 mg L^{-1}	15589a	11727a	27316a	17716a	57.30d	36.30d	63.56a	9.70a	324a
F. test	**	**	**	**	**	*	**	*	*
					20201/2022				
CK	12077d	8118d	20194d	10594d	64.40a	39.10a	59.81d	8.95d	232d
50 mg L^{-1}	13972c	9542c	23514c	13914c	63.00b	38.45b	61.74c	9.05c	271c
100 mg L^{-1}	15066b	10611b	25677b	16077b	61.10c	37.90c	63.41b	9.13b	295b
150 mg L^{-1}	16199a	11905a	28103a	18503a	58.80d	36.80d	64.35a	9.83a	341a
F. test	**	**	**	**	**	**	**	**	*
					2022/2023				
CK	12534d	8604d	21138d	11538d	62.80a	38.50a	60.54d	9.06d	243d
50 mg L^{-1}	14496c	10011c	24507c	14907c	62.20b	38.20b	62.50c	9.16c	284c
100 mg L^{-1}	15634b	11078b	26712b	17112b	60.80c	37.80c	64.19b	9.25b	310b
150 mg L^{-1}	16808a	12082a	28890a	19290a	60.30d	37.30d	65.15a	9.95a	358a
F. test	**	**	**	**	**	**	**	**	*

**** : Significant at 0.01 level of probability, and N.S: not significant. HA_0): without Humic acid; HA_1): 50 mg L^{-1}; HA_2): 100 mg L^{-1}; HA_3): 150 mg L^{-1}**

Effects of interactions wheat cultivars and salicylic acid treatments.

The results in Table 5 indicated that application of interactions wheat cultivars and salicylic acid increased significantly wheat yield and its components Grain yield (L.E /ha) ranged from 12226 L.E /ha (Sids-13 and SA: Without) to 16940 L.E /ha (Gemmeiza12 and SA: 150 mg L^{-1}) in the first season, 11289 L.E /ha (Sids-13 and SA: Without) to 17603 L.E /ha (Gemmeiza12 and SA: 150 mg L^{-1}) in the second one and 11716 L.E /ha (Sids-13 and SA: Without) to 18265 L.E /ha (Gemmeiza12 and SA: 150 mg L^{-1}). Straw yield (L.E /ha) ranged from 6894 L.E /ha (Misr-2 and SA: Without) to 12445 L.E /ha (Sids-13 and SA: 150 mg L^{-1}) in the first season, 7445 L.E /ha (Misr-2 and SA: Without) to 12711 L.E /ha (Sids-13 and SA: 150 mg L^{-1}) in the second one and 7996 L.E /ha (Misr-2 and SA: Without) to 12976 L.E /ha (Sids-13 and SA: 150 mg L^{-1}). Total gain (L.E /ha) ranged from 18612 L.E /ha (Sids-13 and SA: Without) to 27960 L.E /ha (Gemmeiza12 and SA:

150 mg L^{-1}) in the first season, 19478 L.E /ha (Sids-13 and SA: Without) to 28710 L.E /ha (Gemmeiza12 and SA: 150 mg L^{-1}) in the second one and 20343 L.E /ha (Sids-13 and SA: Without) to 29459 L.E /ha (Gemmeiza12 and SA: 150 mg L^{-1}). Net gain (L.E /ha) ranged from 9012 L.E /ha (Sids-13 and SA: Without) to 18360 L.E /ha (Gemmeiza12 and SA: 150 mg L^{-1}) in the first season, 9878 L.E /ha (Sids-13 and SA: Without) to 19110 L.E /ha (Gemmeiza12 and SA: 150 mg L^{-1}) in the second one and 10743 L.E /ha (Sids-13 and SA: Without) to 19859 L.E /ha Gemmeiza12 and SA: 150 mg L^{-1}.

Drought and salinity water causes reductions the yield and its components, Data Salicylic acid and wheat cultivars for all examined variables found substantial differences in three seasons.

Table 5. Effect of interaction between wheat cultivars, salicylic acid during the three

Wheat Cultivars	SA treatment	Grain yield (kg/ha)	Straw Yield (kg/ha)	Biological Yield (kg/ha)	Grain Return (L.E /ha)	Straw Return (L.E /ha)	Total Return (L.E /ha)	Net Return (L.E /ha)
				2020/2021				
	CK	2682	3447	6129	12526	6894	19420	9820
	50 mg L^{-1}	2929	4511	7440	13679	9021	22700	13100
	100 mg L^{-1}	3234	5110	8344	15104	10221	25325	15724
Misr-2	150 mg L^{-1}	3447	5858	9305	16098	11715	27813	18213
	CK	2456	4124	6580	11467	8248	19715	10115
	50 mg L^{-1}	3091	4394	7485	14435	8788	23223	13623
	100 mg L^{-1}	3354	4872	8226	15662	9745	25407	15807
Gemmeiza12	150 mg L^{-1}	3628	5510	9138	16940	11020	27960	18360
	CK	2326	3875	6201	10862	7750	18612	9012
	50 mg L^{-1}	2618	4706	7324	12226	9411	21637	12037
Sids-13	100 mg L^{-1}	2725	5233	7958	12726	10465	23191	13591
	150 mg L^{-1}	2940	6223	9163	13730	12445	26175	16575
LSD, 0.05		**	**	**	**	**	**	**
				2021/2022				
	CK	2788	3723	6511	13019	7445	20464	10864
	50 mg L^{-1}	3044	4758	7801	14213	9514	23727	14127
	100 mg L^{-1}	3362	5413	8775	15699	10827	26526	16925
Misr-2	150 mg L^{-1}	3582	5949	9531	16727	11896	28623	19023
	CK	2553	4360	6913	11920	8719	20639	11039
	50 mg L^{-1}	3213	4665	7878	15002	9331	24332	14732
	100 mg L^{-1}	3486	5063	8548	16276	10126	26401	16801
Gemmeiza12	150 mg L^{-1}	3770	5554	9323	17603	11107	28710	19110
	CK	2418	4095	6512	11289	8189	19478	9878
	50 mg L^{-1}	2720	4892	7611	12699	9782	22481	12881
Sids-13	100 mg L^{-1}	2832	5440	8272	13222	10880	24102	14502
	150 mg L^{-1}	3055	6355	9411	14267	12711	26977	17377
LSD, 0.05		**	**	**	**	**	**	**
				2022/2023				
	CK	2894	3998	6892	13512	7996	21508	11908
	50 mg L^{-1}	3158	5004	8162	14746	10007	24753	15153
	100 mg L^{-1}	3489	5716	9205	16294	11432	27726	18126
Misr-2	150 mg L^{-1}	3717	6039	9756	17356	12077	29433	19833
	CK	2650	4595	7245	12373	9189	21562	11962
	50 mg L^{-1}	3334	4936	8270	15568	9873	25441	15841
	100 mg L^{-1}	3617	5253	8870	16889	10506	27395	17795
Gemmeiza12	150 mg L^{-1}	3911	5597	9508	18265	11194	29459	19859
	CK	2509	4314	6823	11716	8627	20343	10743
	50 mg L^{-1}	2821	5077	7898	13172	10153	23325	13725
Sids-13	100 mg L^{-1}	2938	5647	8585	13718	11294	25012	15412
	150 mg L^{-1}	3170	6487	9658	14803	12976	27779	18179
LSD, 0.05		**	**	**	**	**	**	**

V_1): Misr-2; V_2): Sids-13; V_3): Gemmeiza12. SA_0): without salicylic acid; SA_1): 150 mg L^{-1}; SA_2): 150 mg L^{-1}; SA_3): 150 mg L^{-1}.

Effect of wheat cultivars:

Data in Table 5 showed notable variations amongst wheat cultivars for all characters examined over three seasons. Significant differences amongst wheat cultivars were found by the combined assessments of the three seasons (Fig. 2), for Number of spikes/ m^2. Wheat cultivar Gemmeiza-12 had the highest Number of spikes (218) followed by Sids-13 (215) and then Misr-2 (214). Was also found by (Hassanein *et al.* 2013, El-Shabrawi *et al.* 2015 and Zaki *et al.* 2015).

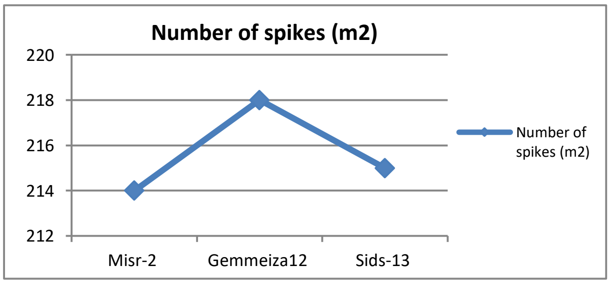


Fig. 2. Effect of three bread wheat cultivars on Number of spikes/ m^2 during in three seasons.

The combined studies of the three seasons (Fig. 3) showed a clear distinction in plant height (cm) amongst wheat varieties. Wheat cultivar Misr-2 had the tallest plant (84.04 cm), which was followed by Sids-13 (80.74 cm) and Gemmeiza-12 (81.88 cm). Harmonic results were noted by (Kandil *et al.* 2012, Sabbour *et al.* 2016 and Kandil *et al.* 2017).

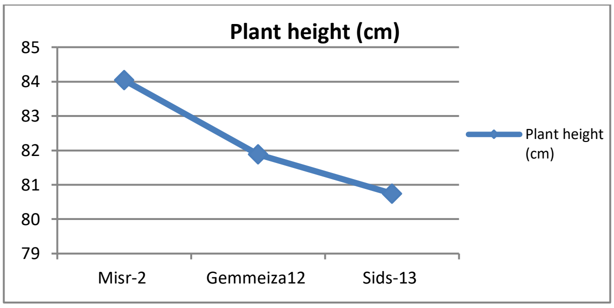


Fig. 3. Effect of three bread wheat cultivars on Plant height (cm) during in three seasons.

For Spike Length (cm), the combined analyses of the three seasons (Fig. 4) showed a considerable variation among wheat varieties. Gemmeiza-12, a wheat cultivar, has the longest spikes (10.40 cm), followed by Misr-2 (10.15 cm), and Sids-13 (10.03 cm). These outcomes follow the same pattern as those attained by (Hassanein *et al.* 2012, Pal *et al.* 2012, Abo-Remaila and Abou El Enin. 2017).

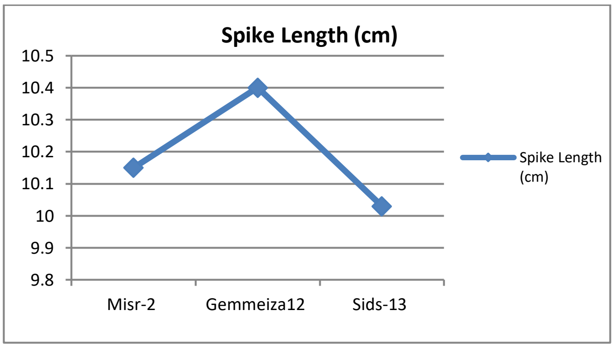


Fig. 4. Effect of three bread wheat cultivars on Spike Length (cm) during in three seasons.

For 1000-grain Weight (g), the combined assessments of the three seasons (Fig. 5) showed a substantial variation amongst wheat cultivars. The 1000-grain weight of the wheat cultivar Gemmeiza-12 was 45.64 g, followed by Misr-2 (43.69 g) and Sids-13 (40.61 g). The same outcome was also noted by (Longove *et al*. 2014, Kandil and Marie 2017, Monpara and Kalariya. 2009 and Wali *et al.* 2015).

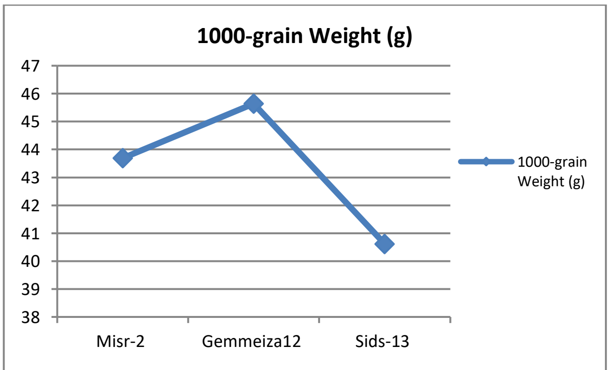


Fig. 5. Effect of three bread wheat cultivars on 1000 -grain Weight (g) during in three seasons.

In terms of grain yield (kg/fed), the combined assessments of the three seasons (Fig. 6) showed notable variations across wheat varieties. Gemmeiza-12, a wheat cultivar, produced the most grains (3378 kg/ha) followed by Misr-2 3314 kg/ha) and then Sids-13 (2859 kg/ha). Harmony findings were observed by (Al Otayk. 2010, Hendawey, M.H. 2009, Abd El- Lattief. 2014 and Abd El-Aziz, *et al.* 2018).

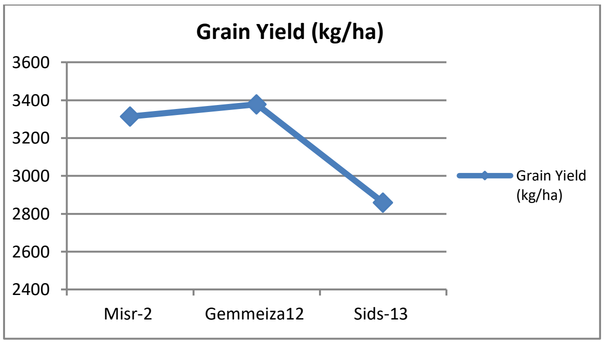


Fig. 6. Effect of three bread wheat cultivars on grain yield (kg /ha) during in three seasons.

Effect of Salicylic acid:

There has been a great deal of research done on the evaluation techniques for wheat's tolerance to salinity and drought. Drought tolerance coefficient of yield, drought tolerance index of yield, and thorough assessment of key drought tolerance features are all terms used to describe yield under drought conditions. Application of salicylic acid significantly increased the Plant height (cm) in wheat. According to the data of combined analyses of the three seasons (Fig. 7), the increases of Plant height (cm) in wheat were 11, 13 and 15% due to addition of 50, 100 and 150 mg L^{-1} salicylic acid. Harmony findings were observed by (Nadimpoor and Mojaddam. 2015, Hafidi, *et al.* 2012 and El-Awadi, *et al.* 2014).

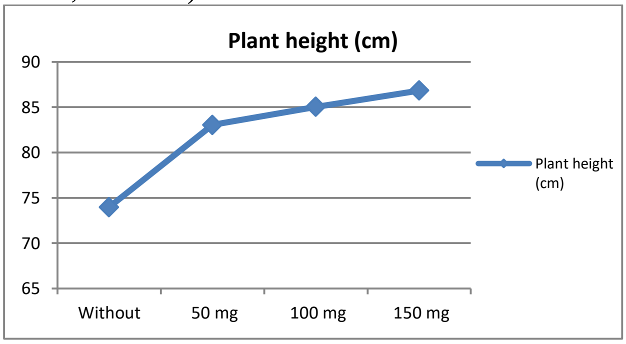


Fig. 7. Salicylic acid's effect on plant height (in cm) throughout the course of three seasons.

Wheat spike length (cm) was dramatically boosted by salicylic acid application. According to the data of combined analyses of the three seasons (Fig. 8), the increases of Spike length in wheat were 15, 17 and 22% due to addition of 50, 100 and 150 mg L^{-1} salicylic acid. Have been used by many researchers (Zeidan *et al*. 2005, Abd El-Salam, *et al.* 2016, Anwar *et al.* 2016 and Rasool *et al.* 2015).

The Straw Yield (kg/ha) in wheat was dramatically improved by salicylic acid application. The findings from the combined studies of the three seasons (Fig. 9) show that the increases in wheat straw yield were 14, 22 and 29% due to addition of 50, 100 and 150 mg L^{-1} salicylic acid. The similar result was also reported by (Khan *et al.* 2010, Ehsan *et al.* 2016, Ahmad *et al.* 2013, Iqbal *et al.* 2016 and Zaki *et al.* 2007).

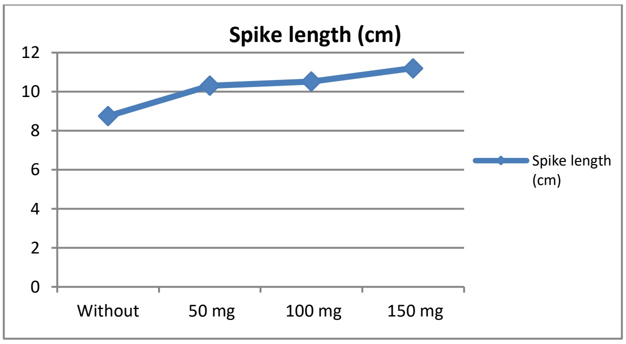


Fig. 8. Salicylic acid's impact on spike length (cm) during the course of three seasons.

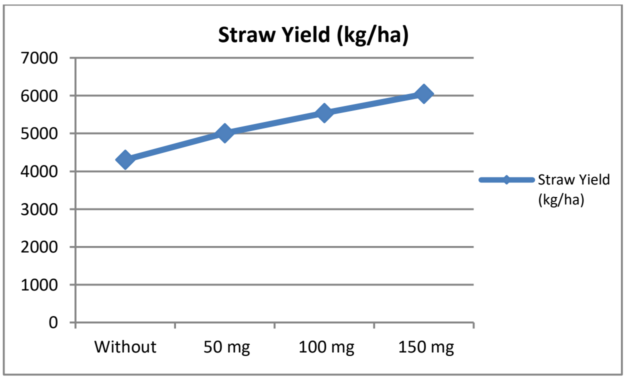


Fig. 9. Salicylic acid's impact on three-season straw yield (kg/ha).

Salicylic acid application greatly enhanced wheat grain production. The findings from the combined studies of the three seasons (Fig. 10) show that the improvements in wheat grain yield were 14, 20 and 25% due to addition of 50, 100 and 150 mg L^{-1} salicylic acid. These results are in the same trend with those obtained by (Abou-Keriasha and Eissa. 2014, Abou El–Enin. 2017 and Inamullah and Ali. 2014).

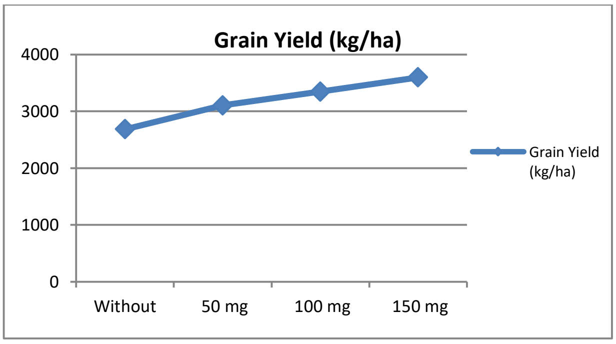


Fig. 10. Effect of salicylic acid on grain yield (kg /ha) during in three seasons.

Effect of interactions:

For Straw yield kg/fed, the relationship between wheat cultivars and salicylic acid was highly significant (Fig. 11). Wheat cultivar Sids-13 and application of 150 mg L-1 resulted in the maximum straw production (6487 kg/ha). The lowest result (3998 kg/ha) was recorded in Misr-2, when salicylic acid was not applied. Significant relationships exist between wheat cultivars and salicylic acid levels in terms of straw yield (kg/ha). Also discovered by (Radwan, *et al.* 2014, Abd El-Hamid, *et al.* 2013 and Attia and Shaalan. 2016).

For grain yield kg/fed, the interaction between wheat cultivars and salicylic acid was significantly significant (Fig. 12). With a 150 mg L-1 spray and the wheat cultivar Gemmeiza-12, the highest grain yield (3911 kg/ha) was achieved. The lowest result (2509 kg/ha) was recorded in Sids-13, where salicylic acid was not applied. Significant interactions exist between salicylic acid levels and grain yield (kg/ha) for different wheat cultivars. These outcomes follow the same pattern as those attained by (Bakry *et al.* 2013, Bakry *et al.* 2015 and Abd El-Aziz, et al. 2017).

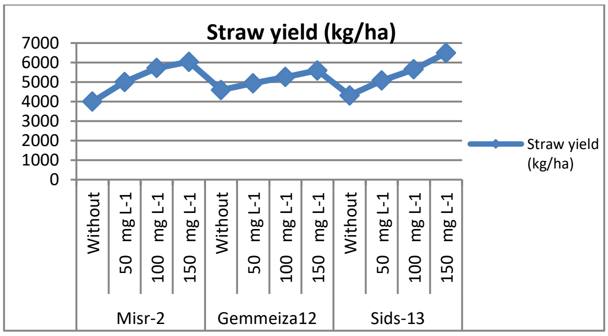


Fig. 11. Straw yield (kg/ha) as a result of the interaction between wheat cultivars and salicylic acid over the course of three seasons.

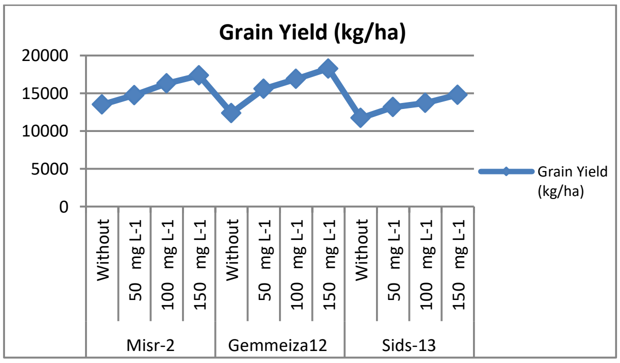


Fig. 12. Grain yield (kg/ha) as a result of the interaction between wheat cultivars and salicylic acid over the course of three seasons.

For net growth L.E/ha, the interaction between wheat cultivars and salicylic acid was extremely significant (Fig. 13). With a 150 mg L-1 spray and the wheat cultivar Gemmeiza-12, the highest grain yield (19859 L.E/ha) was achieved. The Sids-13 site recorded the lowest number (10743 L.E/ha) without the use of salicylic acid. For net increase (L.E/ha), there is a significant relationship between wheat cultivars and salicylic acid levels. Harmonic results were noted by (Abd El-Aziz and El Sahed. 2021 and El-Metwally *et al.* 2010).

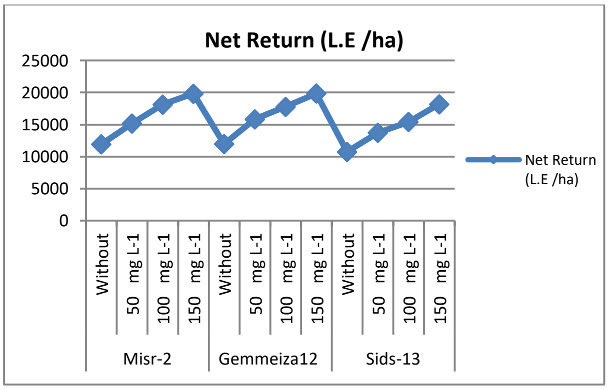


Fig. 13. Effect of the interaction between wheat cultivars and salicylic acid net gain (L.E /ha) during in three seasons.

CONCLUSION

The Tur Sinai region is one of the world's driest, with an annual rainfall rate of just 20 millimetres, which is insufficient for any form of agriculture. It was important to rely on salty groundwater because 3000 PPM to grow wheat to contribute to feeding the Bedouins in these areas, which are 400 km from Cairo. Conclusion: In the El-Tur area of the South Sinai region of Egypt, the cultivation of the wheat cultivar Gemmeiza-12 and 150 mg L-1 salicylic acid generated the most economically produced bread wheat.

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دور حمض السلسيلك فى زيادة انتاجية بعض اصناف القمح تحت ظروف الأراضي الملحية – بجنوب سيناء

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الملخص

أجريت تجربتين حقليتين تحت ظروف الزراعة فى الأراضي حديثة الاستصلاح بمنطقة طور سيناء محافظة جنوب سيناء خلال موسمي 2019/2018 ، 2020/2019 ، 2021/2020على التوالي. وذلك بهدف دراسة تأثير حمض السلسيلك على بعض اصناف القمح. وكانت معاملات الدراسة كما يلى: ثلاث اصناف من قمح الخبز (مصر 2 ، سدس 13 ، جميزة 12) اربعة معاملات حمض السلسيلك (SA) : (بدون اضافة SA_0 - 50ملجم/لتر SA_1 ، 100ملجم/لتر SA_2 - واخيراً 150ملجم/لتر SA_3) أظهرت النتائج ما يلى : أعلى إنتاج للحبوب (3628 كجم/هكتار في الموسم الأول ، 3770 كجم/هكتار في الموسم الثاني و 3911 كجم/هكتار في الموسم الثالث) من صنف جميزة 12 باستخدام 150ملجم/لتر حمض السلسيلك في الثلاثة مواسم. ومع ذلك ، يمكن الحصول على محصول حبوب القمح والقش الاقتصادي من صنف القمح جميزة 12 واستخدام 150ملجم/لتر حمض السلسيلك في منطقة الطور ، جنوب سيناء في مصر.