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EFFECT OF POTASSIUM SILICATE FOLIAR ON SOME MAIZE (*ZEA MAYS* L.) HYBRIDS PRODUCTIVITY UNDER AGRICULTURAL BURIED DRAINS TILE NETWORK IN SALINE SOIL CONDITIONS

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ABSTRACT: Two experiment was conducted for two consecutive summer seasons of 2021 and 2022 summer seasons at saline soil in Sahl ElTena, North Sinai governorate, Egypt to investigate the response of some maize hybrids (MH) (*Zea maays amylaceae* L.) under new reclaimed conditions on plant density (PD). Each experiment included 12 treatments which were respectively to study the effect of foliar potassium silicate concentrations (1%, 2%, 3% K_2SiO_2 and tap water as a control) with three yellow maize hybrids (Giza 168, T.c 32 and pioneer 2055). This experiment was arranged in a split plot design with three replications, where foliar application of potassium silicate was randomly arranged in the main plots and maize hybrids were randomly distributed in the sub main plots. The obtained results showed significant differences among some maize hybrids treatments in all studied traits in both seasons. Also, results cleared that values of grain and biological yields were increased by each. In addition, results revealed that significant differences between maize hybrids for plant height (cm), total chlorophyll, flag leaf area, ear weight (g), 100-grain weight (g), grain weight/ ear (g), number rows/ ear, number grains/ row, grain yield ton/ ha, straw yield ton/ ha, biological yield ton/ ha, crop index (%), harvest index (%), grain yield (LE/ ha), straw yield (LE/ha), total gain (LE/ ha) and net gain (LE/ ha). The main results showed that pioneer 2055 hybrid surpassed Giza168 and Giza 352 hybrids in yield and yield components in the two seasons respectively. Moreover, increasing potassium silicate concentration increased yield and its components, the highest value of grain yield ton/ ha obtained from pioneer 2055which spraying by 3% K_2SiO_2.

Key words: Maize, cultivar, foliar, potassium, hybrids and yield

INTRODUCTION

Maize (*Zea mays* L.) is the third most important staple food crop in terms of area and production after wheat and rice. In Egypt the cultivated area occupies approximately 935,778 ha, which produces up to seven million tons of grains with an average yield of 7.60 ton/ ha, while the cultivated area of yellow maize in Egypt (960000 fed.) **(FAO, 2021)**.

Potassium (K) is an essential macronutrient with broad e_ects on higher plants. In maize, K alleviates the harmful e_ects of drought stress by di erent strategies, including the improvement of net carbon assimilation and phloem transport of sugars from leaves to roots **(Martineau *et al.*, 2017)**. Moreover, K can enhance leaf area, total yield, grain filling and water use e ciency (WUE) in the stressed plants by decreasing leaf evapotranspiration (**Ul-Allah *et al.*, 2020)**. In addition, K could play a key role in preventing oxidative damage of the maize plants by maintaining ROS homeostasis and enhancing antioxidant capacity **(Du *et al.*, 2019)**. Although silicon (Si) is not considered an essential mineral nutrient, several lines of evidence confirmed its benefits for plants,

particularly under biotic and abiotic stresses **(Kim *et al.*, 2017)**. It can promote photosynthesis by increasing the concentration of chlorophyll (**Cooke and Leishman**, **2016)**, and a ect the activities of RuBisCO and PEP-carboxylase that are required for Co_2 fixation (**Dos Santos *et al.*,** 2019). Furthermore, Si regulates antioxidant enzyme systems under diverse stress conditions. Under drought stress, Si deposits in the cell walls of xylem vessels could prevent their compression caused by the high rate of transpiration (**Snyder *et al.*,** 2007), and it can improve the hydraulic conductivity of the roots in the radial direction leading to enhance uptake of water (**Cao *et al.*, 2017)** and several essential nutrients (**Eneji *et al.*, 2008)**. Moreover, many previous reports indicated that Si could alleviate water deficit stress by improving osmotic adjustment and compatible solutes accumulation; *i.e.*, proline, soluble sugars, free amino acids and polyamines, in several plant species (**Yin *et al.*,** 2014). Potassium silicate (K_2SiO_3) is a soluble source of potassium and silicon; it can be used as a fertilizer.

Many authors reported that maize hybrids differed in productivity and its response to nutrient applications, such as **Sharifi and Taghizadeh (2009)** and **Faheed *et al.* (2016)**. Single cross10 hybrid surpassed three ways cross 310 in plant height, number of green leaves/ plant and ear leaf area **(Moharram, 2011)**. There are differential response of maize hybrids regarding to leaf area index, leaf area duration, net assimilation rate and crop growth rate **(Luque *et al.*, 2006; Azadgoleh and Kazmi, 2007)**. Maize hybrids differed in their grain and stover yields **(Ahmed, 2011)**.

Modes maize hybrids need to high amounts of nitrogen, phosphorus and potassium; therefore, two field experiments were conducted at the Experimental Farm of Sids Agricultural Research Station, ARC, Beni-Suef Governorate. Important nutrient for high-yielding crop species such as cereals, legumes, and vegetables. can be detected in limiting levels under some growing conditions, and without, plants may suffer subtle nutrient deficiency. Si deficiency decreased photosynthesis, lowered Biomass of plant parts, increased disease prevalence and insect attacks, increased wilting, and enhanced postharvest fall. Many investigators found significant differences among maize hybrids in growth characteristics, yield attributes and grain yield under different edaphic and climatic conditions.

The saline soil in Sahl ElTena, North Sinai is characterized by increasing salinity either in soil or in irrigated water and poor in mineral nutrients. It is well known that salinity and low fertility of the soil negatively affected the growth and yield of field crops, particularly maize under such condition.

Therefore, to maximize maize productivity under the saline soil, it is essential to identify the promising high yielding maize hybrids and determine the optimum foliar potassium silicate requirements that promote plant growth and improve grain and straw yields. So, the objective of the current study was to identify the high yielding hybrids and the proper amount of foliar potassium silicate for maximizing maize grain yield and its attributes under the saline soil at Sahl ElTena, North Sinai, Egypt.

MATERIALS AND METHODS

Experimentation, (factors, and their levels): A split-plot design with three replicates was used in both seasons. The main plot was used to investigate potassium silicate concentration. The potassium silicate concentration treatments were as follows: (1) water spray (as a control) without potassium silicate K_2SiO_2; (2) Foliar application of potassium silicate solution at the rate of 1% K_2SiO_2; (3) Foliar application of potassium silicate solution at the rate of 2% K_2SiO_2; (4) Foliar application of potassium silicate solution at the rate of 3% K_2SiO_2, the different concentrations of silicon were applied two times as a foliar spray at 40 and 60 days after sowing. The liquid K-silicate (K_2SiO_3; 10% K_2O, 25% SiO_2) was obtained from Abo Ghaneima Company Trade and Agencies, Alexandria—Abu Qir and applied at the rate of 1000 cm^3/l. The subplots were treated with yellow maize hybrids treatments (S.C168, T.C 352 and S.C pioneer 2055). Yellow maize hybrids were sown on June 3 and May 28 in 2021 and 2022, respectively. Maize seeds were sown in hills at 25 cm apart, and plants were thinned to one plant per hill. Calcium superphosphate (15.5%) was added at the rate of 110 kg P2O5/ha during soil preparation. Nitrogen fertilizer from ammonium sulphate (20.5% N) and ammonium nitrate (33.5%N) were added at the rate of 360 kg N/ha in two equal doses before the 1st and second

irrigations. Each sub plot consisted of 5 ridges 6 m in length and 70 cm in the width and plot area was 21 m^2 (square meter) and the treatments were distributed randomized in 3 replicates. All the agricultural practice was done according the recommendation of Ministry of Agriculture and Land Reclamation.

Data recording: During study the following data were recorded, plant height (cm), and total chlorophyll. At harvest time, the ears were harvested from the two middle ridges of each sub plot to determine the following characters; *i.e.*, ear length and diameter (cm), grain weight/ear (g), 100-grain weight (g), biological, grain and straw yield (t/ha) were estimated, Grain protein percentage (%) was determined according to the improved Kjeldahl method, where approxi-mately 1 g of grains of maize was hydrolyzed with 15 ml concentrated sulfuric acid (H_2SO_4) containing two copper catalyst tablets in a heat block at 420 °C for 2 h. After cooling, H_2O was added to the hydrolysates before neutralization and titration. The amount of total nitrogen in the grains were multiplied with the traditional conversion factor of 6.25 in order to determine total protein content

Statistical analysis: The obtained data were statistically analyzed according to 36 for split-plot arrangement. Also, the means between different treatments were compared using (LSD) a least significant differences test ($p \leq 0.05$) in the SPSS.v.16 software package.

Table (1). Physical and chemical properties of the experiment soil and irrigation water

Soil depth (cm)			**0-30**			**30-60**		
$CaCO_3$			3.16			1.25		
Organic Matter			1.05			0.43		
Sand			29.4			28.1		
Silt			8.80			11.5		
Clay			61.8			60.4		
Textural class			Clay			Clay		
Chemical properties								
pH (1:2.5 water :soil suspension)			8.60			8.80		
EC(dSm-1 in saturation extract)			108			101		
Soluble ions (mmolcL-1)								
Ca2+			80			68		
Mg2+			129			60		
Na+			1025			1022		
K+			23			19		
HCO-3			9			8		
Cl-			1140			1061		
SO2-4			108			100		
CEC (cmolc kg-1)			48			50		
ESP			32			37		
Irrigation water properties								
pH	**E.c dSm^{-1}**	**Cations $mmol/L^{-1}$**				**Anions $mmoL^{-1}$**		
		Ca^{+2}	**Mg^{+2}**	**Na^{+1}**	**K^{+1}**	**HCO_3**	**Cl^{-1}**	**SO_4**
7.83	**1.30**	2.06	4.00	6.48	0.31	2.51	7.28	3.06

RESULTS AND DISCUSSION

Effect of silicon concentrations, data recorded in Table 2 revealed that silicon treatments led to a significant increase in plant height, ear length, ear diameter, grain weight, of maize during the 2021 and 2022 seasons. The tallest plant height, longest ear length, largest ear diameter, and heaviest grain weight were recorded with high concentration (3%) of foliar applications of K-silicate. On the other hand, the lowest yield parameters were recorded with water spray treatments in both seasons. Silicon increased above mentioned parameters which

could be attributed to the role of Si in elongation and strengthening roots of plant resulting in increasing the ability to take up higher amounts of nutrients from the soil solution **(Ma and Yamaji, 2006)**.

Maize hybrids for all studied characters in both seasons, Plant height (cm) ranged from 192 cm (T.C.352) to 219 cm (Pioneer.2055) in the first season and 185 cm (T.C.352) to 210 cm (Pioneer 2055) in the second one. These results are in harmony with those obtained by **Aziz *et al.* (2020) and Dresler *et al.* (2015)**. Total Chlorophyll ranged from 49.87 (T.C.352) to 56.55 (Pioneer 2055) in the first season and 48.01 (T.C.352) to 53.91 (Pioneer.2055) in the second one. These results are in agreement with those found by **Xie *et al.* (2014)**. Flag leaf area ranged from 6.383 (T.C.352) to 7.242 (Pioneer.2055) in the first season and 6.075 (T.C.352) to 6.942 (Pioneer 2055) in the second one. These results are in harmony with those obtained by **Xie *et al.* (2015)**.

The results in Table 2 indicated that application of foliar potassium silicate increased significantly Maize. Plant height (cm) ranged from 135 cm (Without P.S) to 254 cm (3 % K_2SiO_2) in the first season and 130 cm (Without P.S) to 245 cm (3 % K_2SiO_2) in the second one. Total Chlorophyll, ranged from 44.18 (Without P.S) to 63.88 (3 % K_2SiO_2) in the first season and 42.41 (Without. P.S) to 60.54 (3 % K_2SiO_2) in the second one. These results are in harmony with those obtained by Abdeen (2021), Kandi ***et al.*** (2020). Flag Leaf Area ranged from 5.589 (Without P.S) to 7.556 (3 % K_2SiO_2) in the first season and 5.256 (Without P.S) to 7.144 (3 % K_2SiO_2) in the second one. These results are in harmony with those obtained by **Abdeen and Mancy (2018), Sirisuntornlak *et al.* (2021)**.

Table (2). Performance of maize hybrids and foliar potassium silicate concerning growth attributes of maize during the 2021 and 2022 seasons

		Plant height(cm)		Total Chlorophyll		Flag Leaf Area	
Maize Hybrids	Potassium silicate.%	2021	2022	2021	2022	2021	2022
Giza-168	Without. P.S	134	129	43.74	41.99	5.433	5.233
	1 % K2Si2O	180	173	48.03	46.34	6.700	6.400
	2 % K2Si2O	245	235	54.58	52.65	7.100	6.700
	3 % K2Si2O	252	242	63.70	59.48	7.367	7.067
T.C.352	Without. P.S	127	122	41.55	39.89	5.333	4.933
	1 % K2Si2O	171	164	45.85	44.02	6.400	6.367
	2 % K2Si2O	232	223	51.73	50.02	6.600	6.300
	3 % K2Si2O	239	231	60.35	58.10	7.200	6.700
Pioneer.2055	Without. P.S	145	139	47.24	45.35	6.000	5.600
	1 % K2Si2O	195	187	52.13	49.38	7.300	7.133
	2 % K2Si2O	265	254	59.23	56.86	7.567	7.367
	3 % K2Si2O	271	262	67.59	64.04	8.100	7.667
LSD 0.05 Interaction H×P.S		**6.16**	**6.26**	**1.61**	**1.64**	**0.15**	**0.17**
Giza-168		203	195	52.51	50.11	6.650	6.350
T.C.352		192	185	49.87	48.01	6.383	6.075
Pioneer.2055		219	210	56.55	53.91	7.242	6.942
LSD0.05 Maize Hybrids		**10.09**	**10.26**	**2.35**	**2.39**	**0.267**	**0.271**
	Without. P.S	135	130	44.18	42.41	5.589	5.256
	1 % K2Si2O	182	175	48.67	46.58	6.800	6.633
	2 % K2Si2O	247	238	55.18	53.18	7.089	6.789
	3 % K2Si2O	254	245	63.88	60.54	7.556	7.144
LSD 0.05 Potassium Silicate		**6.89**	**7.01**	**4.30**	**4.37**	**0.22**	**0.22**

** and * : Significant at 0.01 and 0.05 levels of probability, respectively. N.S: not significant.

Data presented in Table 3 revealed that K-silicate had significant effects on 100-grain weight, biological yield/ ha, grain yield/ ha and straw yield/ ha, in both seasons. As compared with other treatments, the highest values occurred when maize plants were sprayed K-silicate (3%), whereas the lowest values occurred with foliar water spray (control) treatments in 2021 and 2022 seasons. 100-grain weight increased with increasing K-silicate spraying three times by 17.01 and 15.52%, biological yield increased by 15.74 and 10.78%, straw. Ear weight (g), ranged from 478 g (T.C.352) to 543 g (Pioneer.2055) in the first season and 459 g (T.C.352) to 522 g (Pioneer 2055) in the second season. 100-grain Weight (g), varied from 25.67 g (T.C. 352) to 29.27 g (Pioneer 2055) in the first season and 24.67 g (T.C. 352) to 27.98 g (Pioneer.2055) in the second season. Harmony findings were observed by **(Freitas *et al.*, 2011)**. Grain weight/ear (g), varied from 120.083 g (T.C.352) to 136.500 g (Pioneer.2055) in the first season and 115.00 g (T.C.352) to 131.00g (Pioneer 2055) in the second season. Harmony findings were observed by (Khan ***et al.,*** 2017). Number of rows/ear varied from 11.23 (T.C.352) to 12.71 (Pioneer 2055) in the first season and 10.82 (T.C.352) to 12.07 (Pioneer 2055) in the second one. Number of grains/ row, changed from 34.51 (T.C.352) to 39.28 (Pioneer.2055) in the first season and 33.19 (T.C.352) to 37.62 (Pioneer 2055) in the second season.

The results in Table 3 indicated that application of foliar potassium silicate increased significantly Maize Ear weight (g), varied from 398 g (Without P.S) to 634 g (3 % K_2SiO_2) in the first season and 382 g (Without P.S) to 608 g (3 % K_2SiO_2) in the second one. 100-grain Weight (g), changed from 20.48 g (Without P.S) to 35.84 g (3 % K_2SiO_2) in the first season and 19.66 g (Without P.S) to 34.34 g (3 % K_2SiO_2) in the second season. grain weight/ear (g), ranged from 77.33 g (Without P.S) to 193.33 g (3 % K_2SiO_2) in the first season and 74.33 g (Without P.S) to 186.00 g (3 % K_2SiO_2) in the second season. Number of rows/ ear, varied from 10.81 (Without P.S) to 13.31 (3 % K_2SiO_2) in the first season and 10.39 (Without P.S) to 12.57 (3 % K_2SiO_2) in the second season. Number of grains/row, varied from 33.91 (Without P.S) to 39.37 (3 % K_2SiO_2) in the first season and 32.58 (Without P.S) to 37.76 (3 % K_2SiO_2) in the second season. These results are also in harmony with those reported by **Ahmad *et al.* (2018) and Al Rawi *et al.* (2021)**.

Data presented in Table 4 revealed significant differences between maize hybrids for all studied characters in both seasons. Grain yield ton/ha significantly varied from 6.292 (T.C.352) to 7.170 (Pioneer 2055) in the first season and 6.075 (T.C.352) to 6.917 (Pioneer 2055) in the second season. Straw yield (ton/ha), changed from 9.613 (T.C.352) to 10.933 (Pioneer 2055) in the first season and 9.229 (T.C.352) to 10.515 (Pioneer 2055) in the second season. Biological yield (ton/ ha) ranged from 15.905 (T.C.352) to 18.103 (Pioneer 2055) in the first season and 15.303 (T.C.352) to 17.432 (Pioneer.2055) in the second season. In this regard varietal differences for straw and biological yields were also documented by **(Mohsenzadeh *et al.*, 2011)**. Crop index (%) ranged from 65.25 (Giza-168) to 65.67 (Pioneer 2055) in the first season and 65.75 (Giza-168) to 65.83 (Pioneer 2055) in the second one. These results are in harmony with those obtained by **(Li *et al.*, 2007)**. Harvest index (%), varied from 39.42 (Giza-168) to 39.50 (Pioneer 2055) in the first season and 39.50 (Giza-168) to 39.67 (Pioneer 2055) in the second one. In this regard varietal differences for straw and biological yields were also documented by **El-Metwally *et al.* (2010)**.

The results in Table 4 indicated that application of foliar potassium silicate increased significantly Maize Grain yield ton/ha significantly varied from 5.961 (Without P.S) to 7.508 (3 % K_2SiO_2) in the first season and 5.789 (Without P.S) to 7.229 (3 % K_2SiO_2) in the second season These results are in harmony with those obtained by **(El-Naggar *et al.*, 2020), (Gomaa *et al.*, 2021) and (Kumaraswamy *et al.*, 2021)**. Straw yield (ton/ha), changed from 9.155 (1 % K_2SiO_2) to

11.077 (3 % K_2SiO_2) in the first season and 8.811 (1 % K_2SiO_2) to 10.653 (3 % K2Si2O) in the second season. Biological yield (ton/ha) ranged from 15.510 (1 % K_2SiO_2) to 18.585 (3 % K_2SiO_2) in the first season and 14.971 (1 % K_2SiO_2) to 17.882 (3 % K_2SiO_2) in the second season. These results are in harmony with those obtained by **Drikvand *et al.* (2022), Edfawy *et al.* (2021) and El-Mageed *et al.* (2021)**. Crop index (%) ranged from 59.11 (Without P.S) to 69.44 (1 % K_2SiO_2) in the first season and 59.78 (Without P.S) to 69.89 (1 % K_2SiO_2) in the second one. Harvest index (%), varied from 36.78 (Without K_2SiO_2) to 40.78 (1 % K_2SiO_2) in the first season and 37.22 (Without P.S) to 41.00 (1 % K_2SiO_2) in the second one. These results are in harmony with those obtained by **Ali *et al.* (2021)**.

Table (3). Performance of maize hybrids and foliar potassium silicate concerning yield attributes of maize during the 2021 and 2022 seasons

		Ear weight (g)		100- grain Weight (g)		Grain–weight /ear (g)		Number rows /ear		Number grains /row	
Maize Hybrids	Potassium silicate.%	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Giza-168	Without P.S	395	378	20.21	19.56	76.67	73.67	10.72	10.29	33.41	32.31
	1 % K_2SiO_2	469	450	24.85	23.85	105.67	101.67	11.04	10.89	35.43	34.15
	2 % K_2SiO_2	522	502	27.62	26.51	132.00	126.33	12.15	11.60	37.33	35.70
	3 % K_2SiO_2	628	602	35.48	34.06	191.33	184.33	13.17	12.65	38.94	37.38
T.C.352	Without P.S	374	359	19.25	18.48	73.00	70.00	10.14	9.78	31.93	30.62
	1 % K_2SiO_2	444	427	23.62	22.66	101.00	97.00	10.77	10.48	33.65	32.31
	2 % K_2SiO_2	498	476	26.11	25.19	124.33	118.00	11.48	11.02	35.46	34.29
	3 % K_2SiO_2	597	574	33.71	32.36	182.00	175.00	12.53	12.01	36.98	35.53
Pioneer.2055	Without P.S	425	409	21.98	20.95	82.33	79.33	11.57	11.11	36.37	34.82
	1 % K_2SiO_2	506	486	26.94	25.76	114.33	109.67	11.98	11.79	38.27	36.74
	2 % K_2SiO_2	565	543	29.8	28.64	142.67	136.33	13.06	12.33	40.31	38.55
	3 % K_2SiO_2	676	651	38.32	36.59	206.67	198.67	14.23	13.06	42.18	40.37
LSD0.05 Interaction H×P.S		**15.70**	**15.97**	**0.85**	**0.87**	**3.84**	**3.91**	**0.30**	**0.31**	**1.10**	**1.12**
Giza-168		503	483	27.04	26.00	126.417	121.50	11.77	11.36	36.28	34.88
T.C.352		478	459	25.67	24.67	120.083	115.00	11.23	10.82	34.51	33.19
Pioneer.2055		543	522	29.27	27.98	136.500	131.00	12.71	12.07	39.28	37.62
LSD0.05 Maize Hybrids		**24.21**	**24.62**	**1.34**	**1.36**	**6.37**	**6.47**	**0.53**	**0.54**	**1.72**	**1.75**
	Without. P.S	398	382	20.48	19.66	77.33	74.33	10.81	10.39	33.91	32.58
	1 % K2Si2O	473	454	25.14	24.09	107.00	102.78	11.27	11.05	35.78	34.40
	2 % K2Si2O	528	507	27.85	26.78	133.00	126.89	12.23	11.65	37.70	36.18
	3 % K2Si2O	634	608	35.84	34.34	193.33	186.00	13.31	12.57	39.37	37.76
LSD 0.05 Potassium Silicate		**53.51**	**24.42**	**2.68**	**2.27**	**24.85**	**25.28**	**0.55**	**0.56**	**1.61**	**1.64**

** and * : Significant at 0.01 and 0.05 levels of probability, respectively. N.S: not significant.

Table (4). Performance of maize hybrids and foliar potassium silicate concerning yield attributes of maize during the 2021 and 2022 seasons

		Grain yield Ton/ ha		Straw yield Ton/ha		Biological yield Ton /ha		Crop index (%)		Harvest index (%)	
Maize Hybrids	Potassium silicate.%	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Giza-168	Without. P.S	5.748	5.675	9.975	9.576	15.723	15.251	57.67	59.33	36.33	37.00
	1 % K2Si2O	6.350	6.104	9.064	8.718	15.414	14.821	70.00	70.00	41.00	41.00
	2 % K2Si2O	6.874	6.608	10.472	10.038	17.346	16.647	65.67	65.67	40.00	40.00
	3 % K2Si2O	7.421	7.154	10.970	10.561	18.392	17.715	67.67	68.00	40.33	40.00
T.C.352	Without. P.S	5.679	5.419	9.474	9.097	15.153	14.516	60.00	59.67	37.00	37.00
	1 % K2Si2O	5.962	5.792	8.611	8.271	14.573	14.063	69.33	70.00	40.67	41.00
	2 % K2Si2O	6.468	6.276	9.926	9.500	16.394	15.776	65.00	66.00	39.67	40.00
	3 % K2Si2O	7.058	6.811	10.442	10.046	17.500	16.857	67.67	67.67	40.33	40.33
Pioneer.2055	Without. P.S	6.455	6.271	10.807	10.400	17.262	16.672	59.67	60.33	37.00	37.67
	1 % K2Si2O	6.754	6.583	9.790	9.445	16.543	16.028	69.00	69.67	40.67	41.00
	2 % K2Si2O	7.425	7.091	11.318	10.863	18.743	17.954	66.00	65.33	40.00	39.67
	3 % K2Si2O	8.046	7.723	11.818	11.351	19.863	19.074	68.00	68.00	40.33	40.33
LSD0.05 Interaction H×P.S		**0.16**	**0.17**	**0.29**	**0.30**	**0.48**	**0.48**	**0.08**	**0.08**	**0.17**	**0.17**
Giza-168		6.598	6.385	10.120	9.723	16.719	16.109	65.25	65.75	39.42	39.50
T.C.352		6.292	6.075	9.613	9.229	15.905	15.303	65.50	65.83	39.42	39.58
Pioneer.2055		7.170	6.917	10.933	10.515	18.103	17.432	65.67	65.83	39.50	39.67
LSD0.05 Maize Hybrids		**0.31**	**0.31**	**0.50**	**0.51**	**0.80**	**0.82**	**0.08**	**0.083**	**0.04**	**0.04**
	Without. P.S	5.961	5.789	10.085	9.691	16.046	15.480	59.11	59.78	36.78	37.22
	1 % K2Si2O	6.355	6.160	9.155	8.811	15.510	14.971	69.44	69.89	40.78	41.00
	2 % K2Si2O	6.923	6.658	10.572	10.134	17.494	16.792	65.56	65.67	39.89	39.89
	3 % K2Si2O	7.508	7.229	11.077	10.653	18.585	17.882	67.78	67.89	40.33	40.22
LSD 0.05 Potassium Silicate		**0.38**	**0.38**	**0.46**	**0.47**	**0.52**	**0.53**	**1.83**	**1.83**	**0.61**	**0.61**

** and * : Significant at 0.01 and 0.05 levels of probability, respectively. values N.S: not significant.

As shown in Table 5 data revealed that significant differences between maize hybrids for all studied characters in both seasons. Grain return (LE/ ha), changed from 37750 (T.C.352) to 43020 (Pioneer 2055) in the first season and 36448 (T.C.352) to 41503 (Pioneer 2055) in the second season. Straw return (LE/ ha), ranged from 2884 (T.C.352) to 3280 (Pioneer 2055) in the first season and 2769 (T.C.352) to 3154 (Pioneer.2055) in the second season. Total gain (LE/ha), varied from 40634 (T.C.352) to 46300 (Pioneer.2055) in the first season and 39216 (T.C.352) to 44657 (Pioneer.2055) in the second season. These results are in harmony with those obtained by **Abd El-Aziz and Attia (2022)**. Net gain (LE/ha) significantly varied from 24134 (T.C.352) to 29800 (Pioneer 2055) in the first season and 22716 (T.C.352) to 28157 (Pioneer 2055) in the second season. Harmony findings were observed by **Abd El-Aziz *et al.* (2018)**.

The results in Table 5 indicated that application of foliar potassium silicate

increased significantly Maize Grain return (LE/ ha), changed from 35765 (Without P.S) to 45049 (3 % K_2SiO_2) in the first season and 34731 (Without P.S) to 43377 (3 % K_2SiO_2) in the second season. Straw return (LE/ ha), ranged from 2747 (1 % K_2SiO_2) to 3323 (3 % K_2SiO_2) in the first season and 2643 (1 % K_2SiO_2) to 3196 (3 % K_2SiO_2) in the second season. Total return (LE/ha), varied from 38790 (Without P.S) to 48372 (3 % K_2SiO_2) in the first season and 37639 (Without P.S) to 46573 (3 % K_2SiO_2) in the second season. These results are in harmony with those obtained by **Abd El-Aziz and El Sahed (2021)**. Net return (LE/ha) varied from 22290 (Without P.S) to 31872 (3 % K_2SiO_2) in the first season and 21139 (Without P.S) to 30073 (3 % K_2SiO_2) in the second season. These results are also in harmony with those reported by **Abd El-Aziz *et al.* (2017)**.

Table (5). Performance of maize hybrids and foliar potassium silicate concerning yield attributes of maize during the 2021 and 2022 seasons

		grain yield (L.E/ha)		straw yield (L.E/ha)		Total gain (L.E/ha)		Net gain (L.E/ha)	
Maize Hybrids	Potassium silicate.%	2021	2022	2021	2022	2021	2022	2021	2022
Giza-168	Without P.S	34486	34050	2993	2873	37479	36923	20979	20423
	1 % K_2SiO_2	38098	36622	2719	2615	40817	39237	24317	22737
	2 % K_2SiO_2	41246	39650	3142	3012	44388	42662	27888	26162
	3 % K_2SiO_2	44528	42924	3291	3169	47819	46093	31319	29593
T.C.352	Without P.S	34076	32516	2842	2729	36918	35245	20418	18745
	1 % K_2SiO_2	35770	34750	2584	2481	38354	37231	21854	20731
	2 % K_2SiO_2	38808	37656	2978	2850	41786	40506	25286	24006
	3 % K_2SiO_2	42346	40868	3133	3014	45479	43882	28979	27382
Pioneer.2055	Without P.S	38732	37628	3242	3120	41974	40748	25474	24248
	1 % K_2SiO_2	40522	39500	2937	2833	43459	42333	26959	25833
	2 % K_2SiO_2	44552	42546	3395	3259	47947	45805	31447	29305
	3 % K_2SiO_2	48274	46338	3545	3405	51819	49743	35319	33243
LSD0.05 Interaction H×P.S		**983**	**999**	**81**	**83**	**998**	**1031**	**998**	**1031**
Giza-168		39590	38312	3036	2917	42626	41229	26126	24729
T.C.352		37750	36448	2884	2769	40634	39216	24134	22716
Pioneer 2055		43020	41503	3280	3154	46300	44657	29800	28157
LSD0.05 Maize Hybrids		**1836**	**1867**	**138**	**142**	**1841**	**1901**	**1841**	**1901**
	Without P.S	35765	34731	3026	2908	38790	37639	22290	21139
	1 % K_2SiO_2	38130	36957	2747	2643	40877	39601	24377	23101
	2 % K_2SiO_2	41535	39951	3172	3040	44707	42991	28207	26491
	3 % K_2SiO_2	45049	43377	3323	3196	48372	46573	31872	30073
LSD 0.05 Potassium Silicate		**2276**	**2314**	**127**	**131**	**1862**	**1923**	**1862**	**1923**

** and * : Significant at 0.01 and 0.05 levels of probability, respectively. values N.S: not significant.

CONCLUSION

The Sahl ElTena, North Sinai governorate, Egypt is regarded as one of the saline soil places, as well as the rise in the ground water level. The main results showed that Pioneer 2055 hybrid surpassed Giza168 and Giza352 hybrids in yield and yield components in the two seasons, respectively. Increasing potassium silicate concentration increased yield and its components, the highest value of grain yield ton/ ha obtained from pioneer 2055which spraying by 3% K_2SiO_2.

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RESEARCH ARTICLE

Effect of potassium silicate foliar on some maize (*Zea mays* L.) Hybrids productivity under agricultural buried drains tile network in saline soil conditions

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