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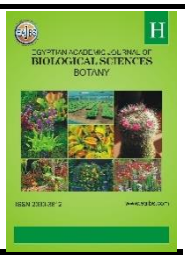

Response of Some Maize Hybrids to Foliar Application of Silicon Under Soil Affected by Salinity

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ABSTRACT

Two field experiments were carried out at the Experimental Farm of Faculty of Agriculture (Saba Basha), Alexandria University, Egypt, during two successive summer seasons of 2019 and 2020, to study the response of four maize hybrids to foliar application of silicon (Si) under salinity conditions. This experiment was laid out in a split-plot design in three replications. Where, the main plots were allocated by maize hybrids (SC 2066, SC 2055, SC 3062, and TWC 352), while the subplots were occupied by foliar application of Si concentrations (spray water, 100, 150, and 200 mg/l). The results showed that the four maize hybrids differed in all the studied characters i.e. plant height at harvest, ear length (cm), number of rows/ear, number of grains/row, number of grains/ear, 100-grain weight (g), biological yield, grain yield (t/ha), straw yield (t/ha), and harvest index (%), where TWC352 recorded the highest values of these traits. Increasing Si rates from 0 to 200 mg/l increased all the studied parameters in both seasons. The interaction was significant in all characters, whereas sowing SC3062 hybrid with foliar application of the higher concentration 200 mg/l of Si achieved the highest mean values of yield and yield components under the soil as affected by salinity in both seasons.

INTRODUCTION

Maize (*Zea mays* L.) is one of the important cereal crops in the world after wheat and rice (Gerpacio and Pingali, 2007). It is mostly a vital cereal crop especially in Egypt, great attention has been paid to increase its total production, particularly if it is used in the manufacture of bread. The area devoted to maize cultivation in Egypt is about 935778 ha and the average yield of maize reached about 7.60 t/ha (FAO, 2018).

Si can be used to increase salt tolerance for maize where it was found to correct, to some extent, the negative impacts of salinity on growth, yield, nutrients uptake, or photosynthetic activity (Pei *et al*., 2010). However, Hanafy *et al.* (2008) showed that application of Si at the rate of 250 mg/l significantly increased growth parameters, while increasing the rates of Si from100 to 250 mg/l significantly improved grains yield and its components as compared with the control non-sprayed plants (water spray) under saline conditions. Si may rise plant tolerance to salinity in many types of plants through a different mechanism which includes low sodium Na absorption, transportation, and increase plant

water status (Ali *et al.*, 2012; Toledo *et al.*, 2012). Foliar application of potassium silicate (K- silicate) from 50 to 100 mg/L resulted in a significant effect on plant height, stem diameter, leaf area, and dry weight of maize. Also, this treatment developed some photosynthetic pigments, essential nutrients by plants which translated finally to an increase in maize yield as compared with the control treatments (Shedeed, 2018).

As for the effect of silicon in plant protection against the risk of stress, numerous studies have emphasized the importance of silicon in the increase of growth and production under heat stress and drought plays an important role in protecting plants from abiotic and biotic stresses. For instance, Si is effective in alleviating abiotic stresses, including salinity, drought, and temperature (Liang *et al*., 2008). So, application silicon plays an important role in plant growth and development, including enriched pollination, rise dry biomass, and yield (Korndörfer and Lepsch, 2001). It has better on seed germination, growth and development, and physiological function of soybean (La *et al.*, 2004). Moreover, Salar and Torabian (2018) indicated that under salt stress between the treatments, 0.5 and 1 mM of nano-silicon oxide enhanced growth and increase in K^+ concentration of soybean. However, foliar application of K-silicate has the potential to reduce the negative effects of drought stress on crops (Ali *et al*., 2019).

The main objective of this study was to investigate the response of some maize hybrids to Si under the soil as affected by salinity.

MATERIALS AND METHODS

A field experiment was conducted on the Experimental Farm of Faculty Agriculture (Saba Basha), Alexandria University, Ibees Region, Alexandria Governorate, Egypt, during the two successive growth summer seasons of 2019 and 2020. This investigation aimed to study the response of some maize hybrids to foliar application of Si under salinity conditions.

A. Type of Soil:

A surface sample (0 – 30 cm) was collected before planting to identify some physical and chemical properties of this soil as shown in Table (1) were determined as the method described by Chapman and Pratt (1978).

The preceding crop was Egyptian clover (*Trifoluim alexandrinum L*.) in the first and second seasons of this study.

Table 1. Soil physical and chemical properties of the experimental sites in both seasons 2019 and 2020.

Soil properties	Season	
	2019	2020
A) Mechanical analysis		
Clay %	41.00	40.00
Sand %	29.00	28.00
Silt %	30.00	32.00
Soil texture	Clay loam soil	
B) Chemical properties		
pH (1: 1)	8.10	8.01
E.C. (dS/m) (1:2)	3.40	3.30
1) Soluble cations (1:2) (cmol/kg soil)		
K^+	1.52	1.49
Ca^{++}	8.50	9.14
Mg^{++}	12.01	12.11
Na^{++}	11.40	10.5
2) Soluble anions (1 : 2) (cmol/kg soil)		
$CO_3^{--} + HCO_3^-$	1.92	1.88
Cl^-	19.35	18.90
SO_4^{--}	12.16	12.5
Calcium carbonate (%)	6.60	6.40
Total nitrogen (mg/kg)	1.10	0.99
Available phosphate (mg/kg)	3.70	3.55
Organic matter (%)	1.41	1.40

B. Experimental Design:

The experiment was designed as a split-plot design. Where, the main plots were maize hybrids (SC2066, SC2055, SC3062, and TWC352) located main plots, while the subplots were occupied by foliar application of Si concentrations (spray water, 100, 150 and 200 mg/l).

Each plot size was 10.5 m^2 included 5 ridges each 3.00 m in length and 0.70 m in width. Sowing takes place on May 31th and 17th June in 2019 and 2020 seasons, respectively. The field was sprayed with herbicide the irrigation then irrigated on the same day.

The seeds were planted at the rate of 2 seeds/hill. Holes were made on the north side of each ridge and thinned to one plant/hill before the first irrigation. maize hybrids grains were gained from Misr High Tech International Seed Co. and Pioneer overseas International Seed Co. which was obtained from Agricultural Extension - Ministry of Agriculture and Land Reclamation.

C. Application of Fertilizer:

Phosphorus fertilizer was added at a rate of 480 kg/ha calcium superphosphate (12.5% P_2O_5) just before sowing. Mineral nitrogen fertilizer at the rate (288 kg N/ha) was in the form of urea (46 % N) and applied at two equal doses the first one after thinning before the first irrigation (20days A.s) and the second dose was before the second irrigation(32day DAS).

The commercial silicon from obtained El- Gomhoureya Company, Egypt was prepared in concentrations of 100, 150, and 200 mg/l and sprayed at two times during the growing seasons after 25 and 40 days after sowing.

D. Studied Characteristics:

Plant height at harvest, ear length (cm), number of rows/ear, number of grains/row, number of grains/ear, 100- grain weight (g), biological yield, grain yield (t/ha), straw yield (t/ha) and harvest index (%) were measured in both seasons

E. Statistical Analysis:

Data obtained was exposed to the proper method of statistical analysis of variance as described by Gomez and Gomez (1984). The treatments means were compared using the least significant differences test (LSD) at 5% level of probability. All statistical analysis was done by CoStat 6.311 (2005).

RESULTS AND DISCUSSION

The results in Table (2) showed that plant height at harvest (cm), ear length (cm), number of grains/row, number of grains/ear, and 100- grain weight (g) of the four maize hybrids were significantly affected by foliar application of Si in 2019 and 2020 seasons.

Results presented in Table (2) revealed that there was a significant difference among the four maize in plant height (cm), ear length (cm), number of grains/row, number of grains/ear, and 100-grain weight (g) in both seasons, where maize hybrid SC3062 gave the tallest plants, and recorded the highest values of ear length (cm), number of grains/row, number of grains/ear and 100-grain weight (g), while SC2066 gave the lowest values of the previous characters in both seasons. The differences among maize hybrids could be due to genetic factors. These findings are in harmony with those revealed by Amin *et al*. (2016), and Hodge (2019) they revealed that there was a significantly different response of some maize hybrid to Si application concentration.

Also, Table (2) reported that increasing Si concentration from 0 to 200 mg/l increased plant height (cm), ear length (cm), number of grains/row, number of grains/ear, and 100-grain weight (g) in both seasons. An increase of these traits may be due to the vital role in the growth of the plant. These findings results are confirmed by Abdeen *et al*. (2018);

Shedeed (2018); Ren *et al*. (2002) they revealed that foliar spraying of potassium silicate (k- silicate) in a gradually increased series of concentrations resulted in a significant effect on growth, yield parameters of maize. Likewise, using K- silicate gave the highest values of yield characters of the crops.

Table 2. Mean values of plant height (cm), ear length (cm), number of grains/row, number of grains/ear and 100-grain weight (g) of the four maize hybrids as affected by silicon (Si) and their interaction in both seasons.

Treatment	Plant height (cm)		Ear length (cm)		No. of grains/row		No. of grains/ear		100- grain weight (g)	
	Seasons									
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
A) Maize hybrids										
SC2066	153.62c	151.59c	17.50c	16.95c	38.42d	38.78c	537.83c	542,97c	38.54c	39.25c
SC2055	167.25b	163.32b	18.75bc	19.15b	41.08c	42.40b	582.00b	600.90b	43.38b	43.30b
SC3062	197.70a	190.28a	22.58 a	22.62a	47.75a	47.97a	756.67a	753.30a	48.79a	50.21a
TWC352	161.06b	159.17b	19.83 b	20.59b	44.00b	44.18b	646.50 b	649.83b	48.10a	47.90a
$LSD_{0.05\ (A)}$	7.44	7.45	1.78	1.68	2.47	2.26	46.65	50.14	1.36	3.30
B) (Si) in mg/l										
Spray water	137.5d	136.59d	17.67c	18.38b	39.50c	38.82d	567.83d	550.93d	42.70b	43.98b
100	153.75c	153.20c	18.58c	19.13 b	40.67c	40.95c	598.83c	603.73c	43.17b	44.34b
150	184.16b	177.33b	20.00b	18.64 b	42.58b	44.62b	634.83b	664.87b	43.67b	44.22b
200	204.22a	197.23a	22.42a	23.17 a	48.50a	48.95a	721.50a	727.47a	47.33a	48.13a
$LSD_{0.05\ (B)}$	6.55	5.94	1.30	1.35	1.74	2.02	29.58	34.37	1.72	2.92
Interaction										
A x B	*	*	*	*	*	*	*	*	*	*

- The similar letters in the same column referred there was no significant between these values at 0.05 level of probability, *: significant difference at 0.05 level of probability.

The interaction between four maize hybrids and Si rates was significant in plant height (cm), ear length (cm), number of grains/row, number of grains/ear and 100-grain weight (Table 3). Whereas, planting SC3062 with foliar application of Si at the rate of 200 mg/l achieved the highest mean values of plant height (cm) recorded the highest values of ear length (cm), number of grains/row, number of grains/ear and 100-grain weight (g) in both seasons. While the lowest values were recorded with SC 2066 plus untreated treatments (spray water) in two seasons.

Table 3. The interaction effect between maize hybrids and Si in both seasons

Treatments		Plant height (cm)		Ear length (cm)		No. of grains/row		No. of grains/ear		100- grain weight (g)	
Maize hybrids	Silicon (Si) in mg/l	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
SC2066	Spray water	124.17	122.50	15.33	15.23	34.67	33.67	485.33	471.33	37.23	36.70
	100	137.67	140.52	16.67	16.57	34.33	35.27	480.67	493.73	37.33	38.63
	150	173.8	162.00	18.33	16.00	38.00	39.30	532.00	549.73	38.93	39.33
	200	178.8	181.33	19.67	20.00	46.67	46.93	653.33	657.07	40.67	42.33
SC2055	Spray water	130.33	130.00	16.67	17.80	38.00	37.67	532.00	527.33	40.84	42.10
	100	150.67	146.33	18.00	18.57	39.33	39.93	578.00	588.27	45.00	46.09
	150	181.33	173.00	17.33	16.90	41.00	43.80	574.00	613.20	44.00	42.00
	200	206.67	203.93	23.00	23.33	46.00	48.20	644.00	674.80	43.67	43.00
SC3062	Spray water	161.33	160.86	20.67	21.23	44.33	43.33	680.00	636.67	49.33	57.10
	100	178.33	176.28	21.67	22.57	45.33	46.27	725.33	740.27	42.00	43.00
	150	208.00	206.00	23.33	22.00	49.00	50.27	784.00	804.27	42.81	46.06
	200	243.13	218.00	24.67	24.67	52.33	52.00	837.33	832.00	53.00	54.67
TWC352	Spray water	134.17	133.00	18.00	19.23	41.00	40.60	574.00	568.40	43.40	40.00
	100	148.33	149.67	18.00	18.80	43.67	42.33	611.33	592.67	48.33	49.63
	150	173.50	168.33	20.00	19.67	42.33	45.13	649.33	692.27	48.93	49.50
	200	188.23	185.67	23.33	23.67	49.00	48.67	751.33	746.00	52.00	52.50
$LSD_{0.05\ (A\ x\ B)}$			13.11	11.88	2.70	3.48	4.05	58.52	68.75	3.44	5.85

The results in Table (4) revealed that grain yield (t/ha), straw yield (t/ha), biological yield (t/ha) and harvest index (HI %) of the four maize hybrids were significantly affected by foliar application of Si in 2019 and 2020 seasons.

Results presented in Table (4) revealed that there was a significant difference among the four maize in grain yield (t/ha), straw yield (t/ha), and biological yield (t/ha), except harvest index (HI %) in both seasons, where SC3062 recorded the highest values of these traits, meanwhile the lowest ones were given with SC2066 in both seasons. The differences among maize hybrids could be due to genetic factors. These findings are in agreement with those obtained by Amin *et al*. (2016); Hodge (2019) they revealed that there was a significantly different response of some maize hybrid as affected by Si rates.

Also, Table (4) reported that increasing Si concentration from 0 to 200 mg/l increased grain yield (t/ha), straw yield (t/ha), and biological yield (t/ha) except harvest index (HI %) in both seasons. An increase of these traits may be due to the vital role in the growth of the plant. These results are in agreement with those obtained by Abdeen *et al*. (2018); Shedeed (2018) cleared that foliar application of K- silicate in a gradually increased series of concentrations resulted in a significant effect on growth, yield parameters of maize. Likewise, using K- silicate gave the highest values of yield characters of the crops.

Table 4. Mean values of grain yield (t/ha), straw yield (t/ha), biological yield (t/ha), and harvest index (HI %) of the four maize hybrids as affected by Si and their interaction in both seasons.

Treatment	Grain yield (ton/ha)		Straw yield (ton/ha)		Biological yield (ton/ha)		Harvest index (HI %)	
	Season							
	2019	2020	2019	2020	2019	2020	2019	2020
SC2066	6.43c	6.30d	8.20c	7.62d	14.63c	13.92d	43.95	45.26
SC2055	7.22b	7.28b	8.79b	8.54b	16.01b	15.82b	45.10	46.02
SC3062	7.89a	7.91a	9.65a	9.31a	17.54a	17.22a	44.98	45.93
TWC352	6.77c	6.70c	8.25c	8.14c	14.82c	14.84c	45.68	45.15
$LSD_{0.05\ (A)}$	0.38	0.29	0.28	0.34	0.32	0.50	ns	Ns
Si concentration (mg/l)								
Spray water	6.03d	6.21d	8.05c	7.72c	14.08d	13.93d	42.83c	44.58b
100	6.97c	6.70c	8.46b	8.04c	15.43c	14.74c	45.17ab	45.45ab
150	7.41b	7.40b	9.08a	8.61b	16.49b	16.01b	44.94b	46.22a
200	7.89a	7.87a	9.10a	9.25a	16.99a	17.12a	46.44a	45.97ab
$LSD_{0.05\ (B)}$	0.21	0.22	0.37	0.44	0.41	0.52	1.30	1.40
A x B	*	*	*	*	*	*	*	*

- The similar letters in the same column referred there was no significant between these values at 0.05 level of probability, *: significant difference at 0.05 level of probability.

Table (5) showed the interaction between four maize hybrids and Si rates, where there was a significant in grain yield (t/ha), straw yield (t/ha), and biological yield (t/ha) except harvest index (HI %) in both seasons**.** Whereas, planting SC3062 with foliar application of Si at the rate of 200 mg/l achieved the highest mean values of grain yield (t/ha), straw yield (t/ha), biological yield (t/ha), and harvest index (HI %), while the lowest ones were given with SC 2066 + untreated treatments (spray water) in two seasons.

Table 5. The interaction effect between maize hybrids and (Si) in both seasons.

Treatments		Grain yield (t/ha)		Straw yield (t/ha)		Biological yield (t/ha)		Harvest index (HI %)	
Maize hybrids	Silicon (Si) in mg/l	2019	2020	2019	2020	2019	2020	2019	2020
SC2066	Spray water	5.73	5.80	7.14	6.87	12.87	12.67	44.52	45.78
	100	6.21	5.91	7.92	7.20	14.13	13.11	43.95	45.08
	150	6.77	6.40	9.04	7.77	15.81	14.17	42.82	45.17
	200	7.00	7.09	8.71	8.64	15.71	15.73	44.56	45.07
SC2055	Spray water	6.24	6.42	8.12	7.96	14.36	14.38	43.45	44.65
	100	7.18	7.25	9.20	8.20	16.38	15.45	43.83	46.93
	150	7.30	7.71	8.73	8.63	16.03	16.34	45.54	47.18
	200	8.15	7.74	9.10	9.38	17.25	17.12	47.25	45.21
SC3062	Spray water	6.35	6.73	9.66	8.93	16.31	15.66	38.93	42.98
	100	7.96	7.64	9.15	9.10	17.11	16.74	46.52	45.64
	150	8.33	8.00	9.74	9.36	18.07	17.36	46.10	46.08
	200	8.92	9.25	9.74	9.84	18.66	19.09	47.80	48.45
TWC352	Spray water	5.80	5.90	6.99	7.10	12.79	13.00	45.35	45.38
	100	6.53	6.01	7.57	7.65	14.10	13.66	46.31	44.00
	150	7.26	7.49	8.79	8.70	16.05	16.19	45.23	46.26
	200	7.49	7.40	8.83	9.13	16.32	16.53	45.89	44.77
$LSD_{0.05\ (A\ x\ B)}$		0.41	0.45	0.73	0.87	0.81	1.02	2.60	2.79

Conclusion:

From the results of the two growing season's field's study, it was concluded that yield, its components of the maize hybrids i.e. SC 3062 increased with foliar application of 200 mg/l of silicon (Si) at the two times under salinity conditions at Alexandria Governorate, Egypt and the similar regions.

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ARABIC SUMMARY

إستجابه بعض هجن الذره الشاميه للرش الورقي بالسليكون تحت الأراضي المتأثرة بالملوحة

محمود عبد العزيز جمعة ، عصام إسماعيل إسماعيل قنديل ، علي أحمد الصاوي البنا ، ضرغام هادي حسن الجلابي
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تحتل الذرة الشامية المركز الثالث من حيث الأهميّة الأقتصادية على مستوى العالم بعد القمح والأرزوتعتبر الغذاء الرئيسي لعدد كبير من دول العالم ،وهي تستخدم بشكل رئيسي في إنتاج زيت الذرة ،وإنتاج طحين الذرة ونشا الذرة ، كما تُستخدم كأعلاف للحيوانات ،وتدخل أيضاً في الكثير من الصناعات الغذائية وفي إنتاج الوقود الحيوي ، والجدير بالذكر أن الذرة الصفراء لها الكثير من الفوائد الصحية بفضل مكوّناتها الغذائية عالية القيمة. وتهدف الدول لزيادة أنتاجية محصول الذرة وتقليل استيراده من الخارج لتوفير العملات الصعبة وتقليل العجز بين الاستهلاك والأنتاج خاصة في مصر والعراق وذلك بإختيار الهجن الجديدة عالية الأنتاجية وزيادة انتاجيتها تحت ظروف الأراضي الملحية ، لذا أجريت تجارب حقلية خلال موسمى 2019 و 2020 لدراسة أستجابة أربعة هجن من الذرة الشامية الصفراء ، للرش الورقى السليكون لتقليل تأثير ملوحة التربة فى تصميم تجريبى وهو القطع المنشقة مرة واحدة Split plot design فى ثلاث مكررات مع التوزيع العشوائى للمعاملات.

كان المحصول السابق البرسيم المصري خلال موسمي الزراعة. ووزعت المعاملات عشوائياً كما يلي:

أ- القطع الرئيسية :اربعه هجن من الذرة الشامية الصفراء(هـ.ف 2066 و هـ.ف. و 2055 و هـ.ف. 3062 و(هـ. ث. 352).

ب- القطع تحت الرئيسية :اربعه تركيزات من السليكون (الرش بالماء (الكنترول) – 100 ، 150 ، 200ملجم / لتر).

وكانت مساحة القطعة التجريبية 10.5 م^2 تضم 5 خطوط بطول 3 م وعرض الخط 70سم. وكان موعد الزراعة في الموسم الأول 15 مايو/2019 وفي الموسم الثاني 10 يونيو/ 2020 وزراعة الحبوب على مسافة 30 سم بين الجور ويتم الف على نبات واحد بالجوره قبل رية المحاياة .

تم الحصول على تقاوي الهجن من شركة هاي تك الدولية (هـ.ف 2066 و هـ.ف. 2055) و من شركة بايونير الدولية (هـ.ف. 3062) و ومن وزراة الزراعة (هـ. ث. 352). وتحصل على السليكون من شركة الجمهورية وتحضير التركيزات المستخدمة في الرش الورقي للنباتات (100 و 150 و 200 ملجم/لتر مياه) وتم الرش مرتين بعد 25 و 40 يوم من الزراعة بمعدل 500 لتر / هكتار.

المعاملات الزراعية أجريت على حسب توصيات وزراة الزراعة واستصلاح الأراضي خلال موسمي الزراعة.

وكانت الصفات المدروسة هي:

أرتفاع النبات , طول الكوز , عدد الحبوب بالصف , عدد الحبوب بالكوز , وزن مئة حبة , محصول الحبوب طن/هكتار , محصول القش طن / هكتار , المحصول البايلوجي طن/هكتار , دليل الحصاد

ولخصت أهم النتائج فيما يلي:

- أوضحت النتائج وجود استجابة معنوية لبعض هجن الذرة الشامية تحت تأثير مستويات مختلفة من السليكون خلال موسمي الزراعة 2019 و 2020.
- اختلفت هجن الذرة الشامية معنوياً فيما بينهم في صفات النمو والمحصول ومكوناته. حيث حقق الهجين فردي 3062 أعلى متوسطات قيم في ارتفاع النبات (سم) و طول الكوز (سم) و عدد الحبوب/صف و عدد الحبوب/كوز ووزن 100 حبة ومحصول الحبوب (طن/هكتار) و محصول القش (طن/هكتار) ومحصول البيولوجي (طن/هكتار) ولم تختلف هذه الهجن في دليل الحصاد (%)بينما أقل متوسطات القيم لهذه الصفات سجلت مع هجين فردي 2066 خلال موسمي الدراسة.
- أظهرت النتائج أن الرش الورقي لنباتات الذرة الشامية بالسليكون أثر تأثير معنوياً على الصفات المدروسة حيث وجد أن زيادة تركيز الرش الورقي للسيليكون من 0 الى 200 ملجم/لتر ادى الى زيادة معنوية في ارتفاع النبات (سم) و طول الكوز (سم) و عدد الحبوب/صف و عدد الحبوب/كوز ووزن 100 حبة ومحصول الحبوب (طن/هكتار) و محصول القش (طن/هكتار) ومحصول البيولوجي (طن/هكتار) ودليل الحصاد في حين أن الرش الورقي بالماء (الكنترول) حقق اقل قيم لهذه الصفات خلال موسمي الزراعة.
- وجد أن هناك تأثير معنوياً للتداخل بين عاملي الدراسة هجن الذرة الشامية والرش الورقي للسليكون ووجد أن زراعة هجين فردي 3062 مع الرش الورقي بمعدل 200 ملجم /لتر سجلت أعلى القيم لكل من ارتفاع النبات (سم) و طول الكوز (سم) و عدد الحبوب/صف و عدد الحبوب/كوز ووزن 100 حبة ومحصول الحبوب (طن/هكتار) و محصول القش (طن/هكتار) ومحصول البيولوجي (طن/هكتار) ودليل الحصاد ومحتوى الحبوب من البروتين بينما أقل القيم سجلت مع زراعة هجين فردي 2066 مع الرش بالماء (بدون سليكون) خلال موسمي الدراسة.

التوصية:

توصي الدراسة بزراعة هجين فردي 3062 والرش الورقي بمعدل 200 ملجم سليكون / لتر مياه للحصول على محصول حبوب مرتفع من الذرة عند الزراعة في الأراضي المتأثرة بالاملاح تحت ظروف منطقة ابيس محافظة الأسكندرية جمهورية مصر العربية والمناطق المماثلة .