Response of Two Sweet Sorghum Varieties to Mineral and Bio- Phosphate Fertilization

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ABSTRACT

Two field experiments were carried out during 2016 and 2017 sumer seasons at the farm of the Agricultural Research Station in Al Sabhia, Alexandria, Egypt, to study the response of two sweet sorghum varieties to three mineral phosphates (calcium mono phosphate 12.5 P_2O_5) levels and two bio- fertilizer (phosphorein) levels on plant growth and its sugar content. The experiment was set up as Split-split plot design in three replications, the main plots were assigned to two sweet sorghum varieties viz., Sugar drip and Mn 4080 and sub plots were occupied with three levels of calcium mono phosphate (0, 100 and 200 kg/fed). Phosphorein inoculation (uninoculation, and inoculation) were arranged in the sub-sub plots treatments. The studied plant characters i.e. weight (g), height (cm), stalk diameter, saltk sugar content (%), leaf weight/plant (g), leaves number, nodes number, leaf length (cm) and leaf width. The results indicated that the effect of mineral and bio-fertilizer levels had significant effect on yield, yield components and quality traits, varieties differed significantly in all studied characters in both seasons.The highest former traits produced by Mn-4080 and Sugar drip variety. The highest values of plant attributes were obtained by Sugar drip variety with 200 kg/fed (super phosphate 12.5% P_2O_5) with inoculation by phosphorein.

Key words: Sweet sorghum, varieties, mineral, bio fertilization, phosphates

INTRODUCTION

Sweet sorghum (*Sorghum biocolor* L.) is planted mainly for syrup, which is called Black honey. It is one of the major sources for syrup production (Osman *et. al.*, 2005 and Mohamed *et. al.*, 2006). It is considered as a C4 plant and Characterized by high stalk and sugar yield (Antonopoulou *et al.*, 2008). Sweet sorghum has taller plant height and possess high biomass (Turhollow *et al.*, 2010). Furthermore, stalk of sweet sorghum produce juice that has high sugar content, which can be used as a main source of ethanol production (Hons et al., 1986 and Reddy and Yang 2005), whereas grain of sorghum can be also used as food, feed and functional food (Sumaryono, 2006). The high sucrose rate of its stalk is not as much as sugarcane and sugar beet plants as well as it has a lower water requirement and drought tolerant, also, its speedy growth rate, early ripeness, high energy value in addition suitable to sub-tropical and temperate region of the world (Rego *et al.*, 2003 and McLaren *et al*. 2003). Sorghum grain and juice can be also used to produce other kind of industrial products such as bioplastic, beverages, syrup and also bioethanol. Therefore, this leads to save sugar cane yield for sugar production and reduce the gap between sugar production and consumption which reached 1.10 million t/year in Egypt (CCSC 2010).

Many characters like green stalk yield, stalk sugar %, stalk juice extractability and grain yield have been proved as major contributors to its economic superiority (Almodares *et al.*, 2008). Variety development is, however, firstly based on the exploitation of genetic variability of the genotypes with the traits of interest (Makanda *et al*., 2009)

Productivity of sweet sorghum is influenced by many factors. Variety was one of the most decisions. There is a great difference among sorghum varieties in stalk dimension, yield and its components (Mohamed *et al*., 2006). Sweet sorghum varieties showed significant differences in leaf area, plant height and diameter, % of sucrose, purity, juice and syrup extraction, stripped stalk, juice and syrup yields (Ismail *et. al.*, 2007 and Aly *et al*., 2008).

Different phosphorous fertilizers are considered as one of the main sources to provide with the requirements of plants in arid and semi-arid areas of the world. However, the adverse effects of mineral phosphorous fertilizers have restricted their application, especially in dry regions. A significant increase in yield production of *Phaseolus mango* was obtained by applying a mixed animal manure and phosphorus solubilizing bacteria fertilizer (Daneshian *et al.*, 2002). Application of phosphorus fertilizer in moderate drought stress had an increase effect on biomass production and water use efficiency. Appropriate soil, P, biofertilization and choice of varieties seriously effaced on crop productivity and soil sustainability the highly values (Benlhabib *et al.*, 2014).

Phosphorous fertilizer application along with phosphorus solubilizing bacteria had a better effect on yield production compared to sole chemical phosphorous fertilizer application (Elkhatib et al.,2009**;** Gill and Dellon, 1995). The seed inoculation by both *Tricoderma* and *Pseudomonas bacteria* have a more efficient effect on nitrogen and phosphorus absorption,

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grain weight, floret in kernel, stalk weight and grain yield of sorghum in a vertisoils. Seed inoculation by *Pseudomonas* resulted in 6 to 8% higher yield compared to control while inoculation by *Tricoderma* recorded 28 to 30% increase in grain yield. The combined seed inoculation by fungi and bacteria along with application of phosphorus fertilizer result in a better nutrient absorption for plants in poor and infertile soils (Hons *et al.,* 1986). The effect of inoculation by phosphorus sulobilizing bacteria (*Pseudomonas* type) and *mycohrriza* fungi on nitrogen and phosphorus absorption and grain yield of sorghum was studied. The inoculation by combination of both microorganisms led to 6-8% increase in grain yield, N and P absorption over the inoculation by sole bacteria and 28-30% increment over sole fungi inoculation (Reddy and Yang, 2005).

The objective of this investigation was to estimate the growth of two sweet sorghum genotype treated with mineral and bio- fertilization.

MATERIALS AND METHODS

This investigation was carried out at the farm of Al-Sabhia Agricultural station in, Alexandria, Egypt, during the two summer seasons of 2016 and 2017.The objective of this work was to evaluate two sweet sorghum varieties under the effect of three levels of calcium super phosphates as mineral fertilizer and two levels from phospherien as bio- fertilizer on plant characteristics of sweet sorghum.

The experiment was set up according to three-factorial (Split-split plot) block design in three replications, with the basic plot size of 10.5 m^2, each experimental basic unit included 5 ridges, 60 cm apart and 3.5 m long. The main plots were assigned to two sweet sorghum varieties viz., Sugar drip and Mn-4080. The sub plots were occupied with three levels of calcium super phosphate (15.5 P_2O_5) at the levels of (0, 100 and 200 kg/fed) with soil preparation. Bio- fertilizer (Phosphorein inoculation) (without and 1 kg/fed) were arranged in the sub-sub plots with sowing as grain inoculation.

Nitrogen as ammonium nitrate (33.5% N) at the level of 100 kg/fed in three equal doses i.e., added at planting, after 21 days from planting and after 35 days from planting. Potassium sulphate (48% K_2O) form at the level of 24 kg was applied in on dose after thinning. Hills thinned at two plants/hill after 21 days from sowing. Other cultural practices such as hoeing, irrigation (surface), etc., were maintained aimed at levels to assure optimum production.

The preceding winter crop was berseem clover (*Trifolium alexandrinum* L.) in both seasons. Experiments were sown on 10th May and 28th April in the first and second season, respectively. At harvest was at dough to ripe stage on (the end of September) in 2016 and 2017 seasons, respectively.

Table 1. Some Physical and chemical properties of the experimental soil in 2016 and 2017 seasons

Soil properties	Seasons	
	2016	2017
A- Mechanical analysis		
Sand	14.70	14.40
Silt	40.90	41.00
Clay	44.40	44.60
Soil texture	Clay loam	Clay loam
B- Chemical properties		
p^H (1:1)	7.70	7.60
EC (1:1) ds/m	3.60	3.40
1- Soluble cations (1:2)		
K^+	1.40	1.45
Ca^{++}	14.20	15.40
Mg^{++}	11.30	11.50
Na^+	13.60	13.80
2- Soluble anions (1:2)		
CO^-_3+ HCO^-_3	2.80	2.90
CL^-	19.50	19.70
SO^-_4	12.60	12.50
Calcium carbonate %	6.70	6.80
Total nitrogen %	1.10	1.20
Available P.(mg/kg)	3.70	3.60
Organic matter (%)	1.50	1.60

Physical and chemical analysis of soil at the experimental site in both seasons of study are presented in Table (1). The soil is a sandy clay loam in both seasons, and defined (Soil Survey Staff, USDA, 1999).

At harvest time a random sample of twenty plants from each sub-sub plot was taken to determine the flowing traits; plant weight (g), plant height (cm), stalk diameter, stalk sugar %, leaf weight/plant (g), leaves number, nodes number, leaf length, and leaf width.

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split-split plot design according to Gomez and Gomez (1984). Least Significant Difference (LSD) method was used to test the differences between treatment means at 5% level of probability. Correlations of the traits obtained from the experiment were computed using Costat program. All the statistical analyses were performed by using CoStat V6.4 (2005) for Windows.

RERSULTS AND DISCUSSION

The results in Tables (2 and 3) revealed the response of two sweet sorghum varieties to three levels of phosphate fertilizer and biofertilizer inoculation and their interaction during 2016 and 2017 seasons.

The results shown in Table (2) indicated that there was significant difference between the two sweet sorghum varieties i.e., Mn 4080 and Sugar drip in plant weight, and plant height in the second and the first seasons, while it had no difference on stalk diameter and stem sugar % in both seasons. Sugar drip genotype recorded the highest mean values of plant weight (797.2), plant height (234.8 and 217.6 cm) as compared with the other genotype (Mn 4080) which gave the lowest ones in both seasons, respectively. These results are in harmony with those obtained by Murray *et al*. (2008); Ritter *et al.* (2008); Srinivas *et al*. (2009); and Shiringani *et al*. (2010) who found the variances of these three traits within genotype.

With respect to phosphate fertilizer levels, results in Table (2) revealed that there was significant effect on plant weight (g), plant height (cm), stalk diameter and stem sugar % in the two seasons, where the rate of calcium super phosphate at 200 kg/fed achieved the highest mean values of plant weight (850.0 and 820.8 g), plant height (236.8 and 214.6 cm), stalk diameter (2.4 and 2.0 cm), and stem sugar (9.5 and 12.7 %) as compared with other levels, however control treatment (0 kg/fed) gave the lowest values of these traits in both seasons, respectively. The influence of phosphorus is mainly an aggregate of the functions played by nutrients in mitigating negative effects of biotic and abiotic stresses. Plants provided with sufficient amounts of phosphorus are less sensitive to water deficiency, high temperatures and pathogen attacks, and produce high yield (Ma *et al*. 2006).

Regarding the effect of biofertilizer grain inoculation of sweet sorghum, results in Table (2) showed that biofertilizer affected significantly on pervious characters. Where, using phosphorien as biofertilizer recorded the highest values of plant weight (797.2 and 730.6 g) plant height (237.7 and 220.4 cm), stalk diameter (2.5 and 1.9 cm), and stem sugar (9.9 and 12.3 %) in comparison with uninoculation treatment (without biofertilizer) in the first and the second seasons, respectively. These results agreed with those recorded by Reddy and Yang (2005).

Table (3) report that there was significant difference between the two sweet sorghum varieties i.e., Mn 4080 and Sugar drip in the studied characters like, leaf weight (g) only in the second season, leaves number, node number only in the first season, leaf length, and leaf width while it had no difference on leaf length (cm) in both seasons. Whereas, Mn-4080 genotype recorded the highest mean values of leaf weight (111.2 and 204.2 g), and leaves number (12.9 and 13.7), on the other hand, Sugar drip genotype gave the highest value of node number (12.2 and 14.6), and leaf width (7.3 and 8.7 cm) in both seasons, respectively.

Also, results in Table (3) show the significant effect of phosphate fertilizer levels on leaf attribute of sweet sorghum, where the application of calcium super phosphate at the rate of 200 kg/fed recorded the highest mean values of leaf weight (107.6 and 191.9 g), node number (13.1 and 16.2), leaf length (74.5 and 84.7 cm), and leaf width (7.3 and 9.2 cm) as compared with others levels, however control treatment (0 kg/fed) gave the lowest values of these traits in both seasons, respectively. On the other wise, there was no significant difference on leaves number as affected by levels of mineral phosphorous fertilizer in both seasons. Teshome *et al.* (2015) agreed with these results and they showed that to increase growth and yield can be use up to 160 kg/fed.

In respect to biofertilizer effect of sweet sorghum on leaf characters, results in Table (3) show that biofertilizer affected significantly on leaf characters. Where, the highest values of leaf weight (113.5 and 219.5 g), node number (13.2 and 14.9), leaf length (72.1 and 79.6 cm), and leaf width (7.4 and 8.7 cm) were obtained by grain inoculation by phosphorien as biofertilizer in comparison with uninoculation treatment (without biofertilizer) in both seasons, respectively.

These results agreed with those recorded by Reddy and Yang (2005).

Also, the interaction among the three factors effect on pervious characters are shown in Table (3).

Table 2. Plant attributes of sweet sorghum varieties as affected by three levels of phosphors and biofertilizer and their interaction in both seasons

Treatments	Plant weight (g)		Plant height (cm)		Stalk diameter (cm)		Stalk sugar%	
	2016	2017	2016	2017	2016	2017	2016	2017
A). Varieties								
Mn- 4080	672.2	663.9	230.4	207.1	1.8	1.9	9.6	11.5
Sugar drip	797.2	691.7	234.8	217.6	2.2	1.7	9.2	11.1
LSD at 0.05	99.2	43.1	15.6	9.5	ns	ns	ns	ns
B). Phosphors levels (kg/fed)								
0 (control)	650.0	583.3	231.0	190.8	1.8	1.6	8.9	9.6
100	704.2	629.2	230.1	216.7	1.9	1.7	9.5	11.6
200	850.0	820.8	236.8	214.6	2.4	2.0	9.8	12.7
LSD at 0.05	44.4	60.5	5.4	14.7	0.2	0.2	0.4	0.5
C). Biofertilizer inoculation								
without	672.2	625.0	227.5	194.3	1.6	1.6	9.1	10.3
Phosphorein	797.2	730.6	237.7	220.4	2.5	1.9	9.9	12.3
LSD at 0.05	60.2	38.3	6.3	7.2	0.1	0.2	0.5	0.4
Interaction								
AB	*	*	*	*	ns	*	*	*
AC	*	*	ns	ns	ns	*	ns	*
BC	ns	ns	*	*	ns	ns	ns	*
ABC	ns	*	*	*	ns	ns	ns	ns

ns: not significant difference, * significant differences at 5%, levels of probability.

Table 3. Leaf attributes of sweet sorghum varieties as affected by three levels of phosphors and biofertilizer and their interaction in both seasons

Treatments	Fresh Leaf Weight/plant (g)		Leaves number/plant		Node number/plant		Leaf length (cm)		Leaf width (cm)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
A). Varieties										
Mn 4080	111.2	204.2	15.4	17.9	11.9	14.3	70.1	80.4	6.2 b	8.2
Sugar drip	81.7	126.8	12.9	13.7	12.2	14.6	69.7	81.0	7.3 a	8.7
LSD at 0.05	ns	52.9	1.3	1.7	0.6	ns	ns	ns	1.1	0.36
B). Phosphors levels (kg/fed)										
0	84.4	151.5	14.3	16.3	11.3b	12.9 c	65.1 c	79.1 b	6.2 c	7.7 b
100	97.3	153.1	13.8	16.6	11.8 b	14.3 b	70.0 b	79.2 b	6.7 b	8.4 b
200	107.6	191.9	14.3	14.7	13.1 a	16.2 a	74.5 a	84.7 a	7.3 a	9.2 a
LSD at 0.05	7.6	20.7	ns	ns	1.0	0.9	3.9	5.2	0.4	0.9
C). Biofertilizer inoculation										
without	79.4 b	111.5 b	13.9	16.3	11.0 b	13.9 b	67.7 b	82.3	6.2 b	8.2 b
Phosphorein	113.5 a	219.5 a	14.4	15.4	13.2 a	14.9 a	72.1 a	79.6	7.4 a	8.7 a
LSD at 0.05	8.6	15.1	ns	ns	0.6	0.8	3.7	4.7	0.5	0.4
Interaction										
AB	*	*	*	ns	ns	ns	*	ns	*	*
AC	ns	*	*	*	*	ns	ns	ns	*	ns
BC	ns	ns	*	ns	ns	*	ns	ns	*	ns
ABC	ns	ns	*	ns	ns	*	ns	ns	ns	ns

ns: not significant difference, * significant differences at 5%, levels of probability.

Correlations of eight traits for Mn- 4080 genotype of sweet sorghum were presented in Table (4). Differences were observed in the correlation coefficients in terms of the magnitude and direction under different environments. Plant weight had positively and significantly correlated with plant height (r=0.510* and 0.514**) in the first and combined season, respectively, node number, sugar %, leaf weight only in the first season, while no significant correlation with plant weight at leaves number, leaf length and leaf width for Mn- 4080 genotype. On the other hand, Plant height had positively and significantly correlated with stalk diameter (r=0.509*), node number (0.574*), sugar % (0.508*), leaf weight (0.507*) only in the second season. Meanwhile, Stalk diameter had positively and significantly correlated with node number (r=0.700*, 0.678* and 0.555***), sugar % (0.729***, 0.723 and 0.606***) and leaf weight (0.778*, 0.694** and 0.575***) in the first, second and combined season, and correlated positively with leaf width (0.622***) only in the second season. However, node number of Mn- 4080 genotype had positively and significantly correlated with stalk sugar % and leaf weight in the combined seasons and leaf length only in the combined season and leaf width in the second and combined seasons. While, sugar % had positive correlation with leaf weight and in leaf width in the combined season. On the other side, leaf weight had positive correlation with leaf length and leaf width in only the combined season. On the other hand, leaves number had positive correlation with leaf width only in the combined seasons. Also, leaf length had positive correlation with leaf width in the second and combined season. These results are in agreement with those obtained by Audilakshmi *et al*. (2010)

Table 4. Correlation coefficients of eight traits for Mn4080 sweet sorghum genotype

	Pant height	Stalk diameter	Node number	Sugar%	Leaf Weight	Leaves number	leaf length	leaf width
				1st season				
Plant Weight	0.510*	0.431	0.513*	0.508*	0.484*	-0.184	-0.072	0.237
Pant height		0.120	0.389	0.348	0.418	-0.042	-0.327	-0.256
Stalk diameter			0.700**	0.729***	0.778***	0.078	0.113	0.364
Node No				0.652**	0.782***	0.292	-0.124	0.154
Sugar%					0.645**	0.181	-0.088	0.239
Leaf weight						0.111	-0.246	-0.390
Leaf No.							0.010	0.651**
leaf length								0.080
				2nd Season				
Plant Weight	0.348	0.310	0.410	0.433	0.088	-0.446	0.054	0.162
Pant height		0.509*	0.574*	0.105	0.426	-0.190	0.079	0.507*
Stalk diameter			0.678**	0.723***	0.694**	0.168	0.103	0.622**
Node No				0.467	0.218	-0.038	0.096	0.695**
Sugar%					0.423	0.132	0.220	0.424
Leaf weight						-0.016	0.151	0.235
Leaf No.							0.094	0.067
leaf length								0.471*
				Combined two seasons				
Plant Weight	0.514**	0.309	0.009	0.052	-0.112	-0.056	-0.289	-0.218
Pant height		0.293	0.093	-0.110	0.083	0.063	-0.320	-0.154
Stalk diameter			0.555***	0.606***	0.575***	0.080	0.118	0.382
Node No				0.692***	0.560***	-0.124	0.380*	0.733***
Sugar%					0.627***	-0.165	0.379	0.613***
Leaf weight						-0.100	0.403*	0.612***
Leaf No.							-0.295	-0.330
leaf length								0.621***

*, **, Significant differences at 5% and 1% levels of probability, respectively.

who indicated that significantly positive correlations show that the changes of two variables are in the same direction, while negative correlations indicate their inverse relationships with each other. For example, stalk yield has significantly positive correlations with plant height, stem diameter and juiciness.

Correlations of nine traits for Sugar drip genotype of sweet sorghum were presented in Table (5).

Differences were observed in the correlation coefficients in terms of the magnitude and direction under different environments. Plant weight had positively and significantly correlated with node number in the first and second season, sugar % in the second season, leaf weight and leaf width the first season. On the other hand, Plant height had positively and significantly correlated with leaf weight only in the second season. Meanwhile, Stalk diameter had not correlated with the other characters. However, node number had positively and significantly correlated with stalk sugar % in the second and combined season and leaf weight in the first season and leaves number the second season and leaf length and leaf width only in the combined season. While, sugar % had positive correlation with leaf length in the combined season. On the other side, leaf weight had positive correlation with leaves number in only the combined season. On the other hand, leaves number had positive correlation with leaf length and leaf width only in the combined season. While, leaf length had no correlation with the other characters in the second and combined season.

Table 5. Correlation coefficients of eight traits for Sugar drip sweet sorghum variety

	Plant height	Stalk diameter	Node number	Sugar%	Leaf Weight	Leaves number	leaf length	leaf width
				1st season				
Plant Weight	-0.104	0.080	0.792***	0.248	0.499*	-0.443	0.059	0.605**
Pant height		-0.184	0.163	0.401	0.079	0.394	0.188	0.083
Stalk diameter			0.127	-0.339	0.394	-0.419	0.044	-0.029
Node No				0.411	0.526*	-0.297	0.116	0.649**
Sugar%					-0.012	-0.377	0.223	0.388
Leaf weight						0.184	0.051	0.011
Leaf No.							0.006	0.087
leaf length								0.346
				2nd Season				
Plant Weight	0.075	0.402	0.711***	0.929***	-0.221	-0.698**	0.130	-0.036
Pant height		0.299	-0.426	-0.008	0.521*	0.045	-0.406	-0.286
Stalk diameter			0.202	0.331	0.092	-0.133	0.340	-0.367
Node No				0.707**	-0.300	-0.614**	0.296	-0.183
Sugar%					-0.115	-0.014	-0.437	-0.492*
Leaf weight						-0.826***	0.203	0.144
Leaf No.							-0.023	-0.043
leaf length								0.014
				Combined over the two seasons				
Plant Weight	-0.011	0.068	0.690***	0.650***	-0.017	-0.247	0.115	0.282
Pant height		0.031	-0.407*	-0.217	0.093	-0.366**	-0.486**	-0.280
Stalk diameter			0.009	-0.147	0.032	-0.269	-0.075	-0.097
Node No				0.685***	0.147	0.174	0.453**	0.347*
Sugar%					0.180	0.187	0.335*	0.246
Leaf weight						0.400*	0.150	0.003
Leaf No.							0.638***	0.334*
leaf length								0.241

*, ** Significant differences at 5% and 1% levels of probability, respectively.

These results are in agreement with those obtained by Murray *et al*. (2008) who observed the similar correlations between most of the interesting traits and production. Makanda *et al.* (2009) discussed that the negative and highly significant correlation between grain yield and stem biomass suggested that the presence of a yield penalty as biomass is improved.

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الملخص العربي

استجابة صنفين من الذرة الرفيعة السكرية للتسميد الفوسفاتي المعدني والحيوي

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أجريت تجربتان حقليتان في المزرعة البحثية – محطة البحوث الزراعية – الصبحية – الأسكندرية خلال موسمي ٢٠١٦ و٢٠١٧ لدراسة أستجابة صنفين من الذرة الرفيعة السكرية للتسميد الفوسفاتي المعدني والحيوي.

استخدم تصميم القطع المنشقة مرتين في ثلاث مكررات ، حيث وزعت الأصناف Mn 4080 و Sugar drip في القطع الرئيسية ،ووزعت ثلاثة معدلات من سماد سوبر فوسفات الكالسيوم الأحادي (٠ ، ١٠٠ ، ٢٠٠ كجم/فدان) بالقطع الشقية الأولى ، بينما وزعت معاملات التسميد الحيوي الفوسفوري (بدون تلقيح ، تلقيح الحبوب بالفوسفورين) بالقطع الشقية الثانية. كل قطعة تجريبية اشتملت خمسة خطوط بمساحة ١٠,٥ متر مربع بمسافة بين الجور ٢٥ سم وتمت الزراعة في ١٠ مايو ٢٠١٦ و ٢٨ ابريل ٢٠١٧ خلال موسمي الزراعة وتم الحصاد في نهاية سبتمبر.

وكانت أهم الصفات المدروسة (وزن النبات وأرتفاع النبات وقطر الساق ونسبة السكر بالساق ، وزن الورقة ، عدد العقد/نبات ، وطول الورقة ،وعرض الورقة).

أوضحت النتائج مايلي:

١. وجد تأثيراً معنوياً لعوامل الدراسة الثلاثة على الصفات المدروسة خلال موسمي الزراعة.

٢. وجد اختلافاً معنوياً بين صنفي الذرة السكرية الرفيعة في معظم الصفات المدروسة مثل وزن النبات ،وأرتفاع النبات ، ووزن الورقة ، وعدد العقد/نبات ،وعرض الورقة فيماعدا قطر الساق ونسبة السكر بالساق وطول الورقة خلال موسمي الزراعة.

٣.تفوق صنف Sugar drip على صنف Mn- 4080 في وزن النبات ،و ارتفاع النبات بينما تفوق الصنف الأخير على الأول في صفات الورقة مثل وزن الورقة ،و عدد الأوراق/نبات ،و عدد العقد/نبات ،و عرض الورقة.

٤.أختلفت مستويات التسميد الفوسفاتي المعدني في تأثيرها إختلافاً معنوياً في كل الصفات المدروسة فيما عدا صفة عدد الأوراق/نبات ، حيث حقق التسميد بمعدل ٢٠٠ كجم سماد/فدان أعلى قيم للصفات المدروسة بينما أعطت معاملة الكنترول (٠ كجم/فدان) أقل القيم خلال الموسمين.

٥.وجد إختلافاً معنوياً بين تلقيح حبوب الذرة السكرية بالفوسفورين وعدم التلقيح حيث حقق التسميد الحيوي (الفوسفورين) أعلى المتوسطات القيم خلال موسمي الدراسة.

٦. التداخل معنوياً بين معاملات العوامل الثلاثة في بعض الصفات المدروسة.

٧.وجد الارتباط موجب بين صفات النبات وصفات الأوراق في كل صنف من الذرة السكرية.

يمكن التوصية بزراعة أحد صنفي الذرة الرفيعة السكرية مع الأضافة الأرضية للسماد المعدني الفوسفوري بمعدل ٢٠٠/كجم مع التلقيح بالفوسفورين حيث أن هذه التوليفة ذات تأثير معنوي على الصفات المدروسة تحت الظروف البيئية لمنطقة الدراسة.