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ORIGINAL ARTICLES

Effect of Sowing Date And Potassium Fertilizer Application on Growth, Yield And Quality of Sweet Corn (*Zea mays Var. Rugosa*)

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ABSTRACT

Two field experiments were carried out during the two successive growing seasons of 2009/2010 and 2010/2011 in the private farm AL-Masoud of Wady El-Molak Cultivation Site, Ismailia Governorate, Egypt. Experiments designed to study the effect of sowing dates (15th August and 15th September), different levels of potassium (60, 90, 120 and 150 kg Potassium sulphate/fed.) and application in 2, 3 and 4 doses on the growth, yield and quality of sweet corn (*Zea mays* L.) F1 Hybrid Pacific Hybrix 5. Results showed that sweet corn sowing on 15th August improved all sweet corn tested vegetative growth parameters, plant height, number of leaves, stem diameter & fresh weight as compared with sowing on 15th September. Moreover, a significant increment in vegetative growth parameters were evident with increasing the level of potassium application from 60, 90, and 120 up to 150 kg potassium sulphate/fed and the number of doses applied. Same trend were observed for total fresh ear yield and ear quality and nutritive value of sweet corn kernel.

Key words: Sweet corn, Sowing date, Potassium level application, Number of applied doses, Vegetative growth, Fresh ear yield, Kernel nutritive value.

INTRODUCTION

Sweet corn (*Zea mays var. rugosa*) is one of the most important vegetable crops promising, grown in Egypt for local market and exportation. It is differs from other corns (field maize, popcorn and ornamental) because the kernels have high sugar content in the milk or early dough stage. Sweet corn is one of the most important exportable vegetable crops (fresh, frozen or canned kernel) du to it is most popular vegetable for consumption in many country i. e. Europe, Japan and South-East Asia, so that it was one of the important in Egyptian economy in the last years. In last years, the amount consumption of sweet corn was gradually increased in Egypt.

Weather conditions of planting region is most important factors which affecting the vegetative growth, yield and ear quality of sweet corn. Sweet corn is a warm-season, growing season temperature of 15–32°C. It is ready to pick in 75–105 days, depending on the cultivar, locality and sowing time. Planting time is strongly influenced by the temperature of the soil at sowing date, which should be at least 12°C (Abdullah Ktem *et al.*, 2004). Many investigators reported that the vegetative growth, fresh ear yield, fresh quality and nutritive value of sweet corn kernel were increased by sowing in the warm-season (Vijay Jat *et al.,* 2009 and Zafar Hayat Khan *et al.,* 2011).

Potassium is a regulator for many of the metabolic processes in the cells, plays an important role on promotion of enzymes activity and enhancing the translocation of assimilates and protein synthesis (Devlin and Witham, 1986). Potassium fertilizers levels or doses application is the most important factor affecting the vegetative growth, yield and ear quality of sweet corn. The optimum K-fertilizers requirements to obtain the best yield and quality of sweet corn differed according to soil content of potassium. An increase in the vegetative growth, yield and ear quality of sweet corn was reported by increasing the amount of potassium applied; i.e. Simic *et al.,* 2010; Ebrahimi, *et al.,* 2011; Peykarestan *et al.,* 2012 and Rahimi *et al.,* 2012. reported that increasing of potassium fertilizer application result in an increase in number of leaves, stem diameter and biomass. Also, application of 200 kg K/ha increased grains number per row, grains weight per row, 1000 grains weight and increased grains yield and earlier tasseling. Besides, an improve in the quality of sweet corn ear i.e. water soluble sugar content of fresh grains were observed by Chen *et al*., 1993; while, Yuying Li *et al*.,2003 showed an increase in protein, cysteine and methionine content and reduction in starch content and a raise in crude protein content by Chen-YiBing *et al*., 2005with increasing K-application.

Splitting potassium fertilizer applied to many doses gave the best vegetative growth, yield and ear quality of sweet corn and improved cob yields, N and K uptake and crude protein content as reported by Kalpana and

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Anbumani, 2003 and Ganesaraja *et al*. 2009; which was explained as an effect of continuance supply to plants with potassium.

Materials and Methods

Two field experiments were carried out during the two successive growing seasons of 2009/2010 and 2010/2011 in the AL-Masoud farm of Wady Elmolak Cultivation Site, Ismailia Governorate, Egypt.

The experiments aimed to study the effect of sowing dates, different levels of potassium and doses of potassium on the growth, yield and quality of sweet corn. Seeds of Sweet corn (*Zea mays* L.) F1 Hybrid Pacific Hybrix 5, were sown in the second week of August and September. After preparing the soil for cultivation, ditches of 20 cm width was performed and the distance between every two ditches was 80 cm. Organic manure as well as 100 and 150 kg/fed. ammonium sulphate and super-phosphate, respectively, were added through the ditches and then it was covered by sand. Laterals of drip irrigation system were spread over the ditches. Seeds were sown in hills at 25 cm apart on one side of ridge of 80 cm width. Four seeds were sown per hill then thinned to two seedlings. The recommended culture practices of production were followed.

The soil of the experimental field was loamy sand in texture. The chemical analysis of the experimental soil was presented in Table (A) and the meteorological data at Wady Elmolak were presented in Table (B).

The field experiment:

This experiment included 24 treatments which were the combinations between two sowing dates (15th August and 15th September), four levels of potassium application (60, 90, 120 and 150 kg Potassium sulphate /fed.) and three doses of potassium application, potassium levels application were divided to equal 2, 3 and 4 doses i.e. 2-doses applied at 20 and 30 days after sowing, 3-doses applied at 20, 30 and 40 days after sowing and 4-doses applied at 20, 30, 40 and 50 days after sowing.

A split-split-plot design with four replications were used, sowing dates were arranged in the main plots, while the levels of potassium were allotted at random in sub-plots and doses of potassium were arranged randomly in sub-sub-plots. Plot area was 24 m^2 which contain three line of drip irrigation with 80 cm in width and 10 m in length.

Table A: Physical and chemical properties of the experimental soil.

Analyzed fractions	2009/2010	2010/2011
Physical properties		
Clay %	3.0	4.0
Silt %	14	14
Sand %	83	82
Soil type	loamy sand	loamy sand
Chemical properties		
PH	8.1	7.95
Available nitrogen (mg/100 gm. Soil)	1.22	1.29
Available phosphorus (mg/100 gm. Soil)	1.95	2.00
Available potassium (mg/100 gm. Soil)	4.29	4.32
$CaCo_3$ (mg/100 gm. Soil)	2.50	2.50

The permanent wilting point (PWP) and field capacity (FC) of the trial soil were determined according to Israelson and Hansen (1962).

Table B: The maximum, minimum, mean of temperatures, relative humidity and total rain at Wady Elmolak region during 2009/2010 and 2010/2011.

Month	Maximum Temp. (◦C)	Minimum Temp. (◦C)	Mean Temp. (◦C)	Mean RH	Total Rain (mm)
2009					
August	35.5	22.8	28.4	63.3	0.0
September	33.3	21.2	26.7	65.3	0.0
October	32.0	19.7	25.0	65.3	0.0
November	25.5	12.8	18.7	66.3	0.2
December	22.4	9.9	15.8	73	0.0
2010					
August	37.1	24.8	30.1	65	0.0
September	34.2	21.9	27.5	62.7	0.0
October	32.2	20.0	25.6	61.7	0.0
November	27.8	15.0	20.9	72.3	0.0
December	23.3	9.9	16.0	64.3	0.0

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Data recorded:

Plant growth measurements:

A representative sample of 6 plants were taken at random from each experimental plot for measuring the plant growth characters at harvest. The plant growth measurements were as follows:
Plant height (cm) from soil surface to the highest point of the plant.
Number of leaves per plant.
Stem diameter (cm)
Plant fresh weight (g)

Yield:

Ear parameters:

Thirty ears from each plot were taken randomly at harvest to record the following data:
Ear length: ear base to top.
Ear diameter: central ear diameter.
Number of row.
Number of kernels/row.
Ear weight.

Total yield were recorded per feddan:

Chemical composition of kernels at harvest:

Total sugars, reducing sugars and sucrose (non reducing sugars) were measured colormetrically using spectrophotometer Model 6305 UV/visible range with 520 mm wavelength according to Somogyi (1952) and Nelson (1974).

The total soluble solids (TSS) was obtained by using the hand refractometer, according to method described by A.O.A.C. (1990).

The dry matter percent was determined by weighing one hundred gram of fresh kernels and then dried at 70°C until a constant weight was obtained (Chappman, 1966).

Statistical analysis:

All data were subjected to statistical analysis according to the procedures reported by Snedecor and Cochran (1982) and means were compared by Duncan's multiple range tests at the 5 % level of probability Duncan (1955) in the two seasons of experimentation.

Results and Discussion

Vegetative growth i.e. plant height, number of leaves, stem diameter and fresh weight, of sweet corn.

Effect of sowing date:

Data shown in tables 1a & 1b revealed that all the vegetative growth parameters were significantly increased by sowing sweet corn in 15th August as compared with sowing in 15th September. However, the variances on plant height and number of leaves failed to reach the level of significance in the second season.

Effect of potassium level application:

Obtained data, tables 1a & 1b, showed a gradual and significant increase by increasing the level of potassium application from 60 up to 150 kg potassium sulphate per feddan. Results were true for both growing seasons, with no significant differences between number of leaves on plants received 120 or 150 kg potassium sulphate/fed., 120 or 90 kg potassium sulphate/fed. with those received 90 or 60 kg potassium sulphate/fed. in the second season.

Effect of number of potassium application in doses:

Same trend were observed, increasing the number of potassium doses application from 2 up to 4 doses a gradual & significant increase in vegetative parameters under study; tables 1a & 1b. Results were true in both growing seasons, with no significant differences in number of leaves on plants received 2 or 3-doses and those received 3 or 4-doses in both growing seasons.

Treatments interaction:

The effect of the sowing date, potassium level and number of potassium doses application interaction on vegetative growth parameters were significantly affected. As shown in tables 1a & 1b, the highest values were recorded with sowing at 15th august and adding 150 kg potassium sulphate at 4-doses. However, the lowest values were recorded by sowing at 15th September and application 60 kg potassium sulphate as 2-doses. These results were true in both growing seasons.

This result may be due to that the weather conditions in the first sowing date (15th August) were the most favorable to sweet corn growth more than the planting at 15th September and hence led to an increase in fertilizers uptake resulting on increasing the vegetative growth of sweet corn as reported by Vijay Jat *et al.,* 2009 and Zafar Hayat Khan *et al.,* 2011.

Potassium plays an important role as a regulatory for many of the metabolic processes in the cells. These might explain the increment in the vegetative growth by increasing the level of potassium application, through the promotion of enzymes activity and enhancing the translocation of assimilates and protein synthesis. This result are in agreement with those reported by Vijay Jat *et al.,* (2009), Zafar Hayat Khan *et al.,* (2011) and Simic *et al.,* (2010), Ebrahimi, *et al.,* (2011), Peykarestan *et al.,* (2012), Rahimi *et al.,*(2012), whom reported that increasing leve of potassium fertilizer application results in an increased number of leaves, stem diameter, biomass and earlier tasseling.

Moreover, dividing the amount of potassium applied to many doses promote the plant growth through continues supply with potassium over all the growing season; which cause an increment in vegetative growth of sweet corn as reported by Kalpana and Anbumani (2003) and Ganesaraja *et al*. (2009).

Ear yield and quality (i.e. Ear length, diameter, number of rows/ear, number of kernels/row and ear weight).

Effect of sowing date:

Data in Tables (2a & 2b) show the effect of sowing date on fresh ear yield and ear quality. Results in Table 2a & 2b clearly indicate that all the parameters under study were significantly increased by planting at 15th August as compared with planting at15th September. These results were true in both growing seasons. However, the variances between number of rows/ear and number of kernels/row failed to reach the level of significance in the second season.

This result my be due to that the weather conditions in the first sowing date (15th August) were the most favorable to sweet corn growth more than the planting at 15th September, which increasing the vegetative growth of sweet corn and in turn on increasing total fresh ear yield and improving the ear quality. These results are in harmony with those reported by Vijay Jat *et al.,* 2009 and Zafar Hayat Khan *et al.,* 2011).

Table 1a: Effect of the interaction treatments between sowing date, potassium levels and number of doses application on vegetative growth of sweet corn in the first season (2009/2010).

Treatments			Plant height (cm)		Number of leaves		Stem diameter (cm		Plant fresh weight (g)	
Sowing date	K-Level application (kg/fed.) Potassium sulfate	Number of K-Doses application								
15th August	60	2	108.7	m	7.67	cd	1.67	jk	497.7	op
		3	118	jkl	7.67	cd	1.90	fgh	541.1	n
		4	122.3	hijk	8.67	abcd	1.93	efgh	562.7	lm
	90	2	119.7	ijkl	8.33	abcd	2.03	ef	572.3	k
		3	131.7	defgh	8.33	abcd	2.20	cd	602.0	j
		4	136	cde	9.00	abc	2.20	cd	623.2	i
	120	2	135.7	cdef	9.00	abc	2.20	cd	731.5	gh
		3	140.7	abcd	9.33	abc	2.30	bc	757.9	fg
		4	145.3	abc	9.33	abc	2.30	bc	831.0	e
	150	2	146.7	ab	9.67	ab	2.30	bc	908.2	cd
		3	149.3	a	10.00	a	2.40	ab	917.5	bc
		4	144	abc	10.00	a	2.53	a	977.6	a
15th September	60	2	112.3	lm	7.00	d	1.40	l	462.4	q
		3	115	klm	7.67	cd	1.57	k	481.7	p
		4	120	ijkl	7.67	cd	1.57	k	516.3	o

	90	2	119.3	ijkl	8.00	bcd	1.73	ij	544.5	mn
		3	123.3	ghijk	8.33	abcd	1.83	hi	564.9	l
		4	124.3	ghijk	8.67	abcd	1.87	ghi	568.6	k
	120	2	126.3	fghij	8.67	abcd	1.87	ghi	609.4	j
		3	128.7	efghi	8.67	abcd	1.90	fgh	716.3	h
		4	132.7	defg	9.33	abc	2.00	efg	752.7	g
	150	2	136.7	cde	9.67	ab	2.03	ef	810.2	f
		3	138.7	bcd	9.00	abc	2.07	de	907.1	cd
		4	145.3	abc	9.67	ab	2.23	c	919.7	b
Sowing date	15^{th} august		133.2	A	8.92	A	2.16	A	710.2	A
	15^{th} September		126.9	B	8.53	B	1.84	B	654.5	B
K-Level application	60 kg/fed. (potassium sulfate)		116.1	D	7.72	D	1.67	D	510.3	D
	90 kg/fed. (potassium sulfate)		125.7	C	8.44	C	1.98	C	579.2	C
	120 kg/fed.(potassium sulfate)		134.9	B	9.06	B	2.09	B	733.1	B
	150 kg/fed.(potassium sulfate)		143.4	A	9.67	A	2.26	A	907.7	A
K-Doses application	2		125.7	C	8.50	B	1.90	C	642.0	C
	3		130.7	B	8.63	AB	2.02	B	686.1	B
	4		133.8	A	9.04	A	2.08	A	719.0	A

Values followed by the same letter (s) are not significantly different at 5 %

Table 1b: Effect of the interaction treatments between sowing date, potassium levels and number of doses application on vegetative growth of sweet corn in the second season (2010/2011).

Treatments			Plant height (cm)		Number of leaves		Stem diameter (cm		Plant fresh weight (g)	
Sowing date	K-Level application (kg/fed.) Potassium sulfate	Number of K-Doses application								
15^{th} August	60	2	119.3	hi	8.33	bc	1.83	k	523.9	mn
		3	122.7	fghi	7.67	c	2.00	hi	559.6	l
		4	124.3	fghi	9.33	abc	2.00	hi	573.1	k
	90	2	127	efgh	8.67	abc	2.10	fg	598.5	ij
		3	128	efgh	8.67	abc	2.20	e	633.7	h
		4	128.7	efgh	9.33	abc	2.20	e	675.0	g
	120	2	131.3	def	9.33	abc	2.30	cd	710.0	f
		3	136	cde	9.67	ab	2.33	c	742.3	e
		4	141.7	bc	9.00	abc	2.40	bc	852.9	c
	150	2	145.7	b	9.67	ab	2.40	bc	956.0	bc
		3	146.3	b	10.33	a	2.47	b	968.1	b
		4	158.7	a	9.67	ab	2.60	a	1029.0	a
15^{th} September	60	2	108.3	j	8.00	bc	1.53	m	486.8	o
		3	117.7	i	8.00	bc	1.70	l	507.1	n
		4	120	ghi	8.33	bc	1.70	l	533.4	m
	90	2	122.3	fghi	8.00	bc	1.87	jk	592.3	j
		3	124.3	fghi	8.00	bc	1.93	ij	594.6	j
		4	129.3	efg	9.33	abc	1.97	i	602.4	hi
	120	2	130.7	def	8.33	bc	2.07	gh	641.5	h
		3	134.3	cde	8.67	abc	2.10	fg	655.9	gh
		4	138.7	bcd	9.67	ab	2.17	ef	777.8	d
	150	2	141.3	bc	9.00	abc	2.23	de	874.7	c
		3	143.3	bc	9.67	ab	2.23	de	954.8	bc
		4	147.3	b	9.33	abc	2.37	c	965.8	b
Sowing date	15^{th} August		134.1	A	9.14	A	2.24	A	735.3	A
	15^{th} September		129.8	A	8.69	A	1.99	B	682.3	B
K-Level application	60 kg/fed. (potassium sulfate)		118.7	D	8.28	C	1.79	D	530.7	D
	90 kg/fed. (potassium sulfate)		126.6	C	8.67	BC	2.04	C	616.2	C
	120 kg/fed.(potassium sulfate)		135.4	B	9.11	AB	2.23	B	730.1	B
	150 kg/fed.(potassium sulfate)		147.1	A	9.61	A	2.38	A	958.1	A
K-Doses application	2		128.3	C	8.67	B	2.04	C	673.0	C
	3		131.6	B	8.83	AB	2.12	B	702.0	B
	4		136.1	A	9.25	A	2.18	A	751.3	A

Values followed by the same letter (s) are not significantly different at 5 %

Effect of potassium level application:

Data in Tables (2a & 2b) showed a gradual and significant increase in all the studied parameters by increasing the level of potassium application from 60 up to 150 kg potassium sulphate/fed. These results were true in both growing seasons, except for number of kernels/row which variances failed to reach the level of significance in both seasons.

These results may be due to the role of potassium on promotion many of the metabolic processes in the cells, enzymes activity and enhancing the translocation of assimilates and protein synthesis, which increasing

the vegetative growth of sweet corn and in turn on increasing total fresh ear yield and improving the ear quality. These results are in harmony with those reported by Simic *et al.,* 2010; Ebrahimi, *et al.,* 2011; Peykarestan *et al.,* (2012) and Rahimi *et al.,* 2012. They reported that increasing of potassium fertilizer application caused an increased grains number per row, grains weight per row, 1000 grains weight and increased grains yield.

Effect of number of potassium doses application:

Obtained results, tables 2a & 2b, evidently showed a gradual and significant increase in parameters under study by increasing the number of doses application from 2, 3 up to 4 doses. These results were true in both growing seasons. Except for number of kernels/row in the first season, or adding potassium levels as 2 or 3 and 3 or 4-doses which variances failed to reach the level of significance in the second season, as well as number of rows/ear in the first season, which variances between adding potassium as 2 or 3-doses failed to reach the level of significance.

This result my due to that, divided the amount of potassium application to many doses promote the plant growth through continues supply with potassium over all the growing season. Many investigators reported that application of potassium fertilizers as a splits doses caused an increased in vegetative growth of sweet corn plants and increasing the fresh ear yield as well as improved the ear quality (Kalpana and Anbumani, 2003 and Ganesaraja *et al*. 2009).

Treatments interaction:

The interaction of treatments on fresh ear yield (ton/fed.) and fresh ear quality i.e. were obviously and significantly affected each other's. The highest values were recorded with sowing at 15th August and adding the highest level of potassium application (150 kg/fed.) as 4 equal doses. However, the lowest values were recorded with sowing at 15th September and adding the lowest level of potassium application (90 kg/fed.) as 2 equal doses (Tables 2a & 2b).

As mentioned above, This result may be due to that the weather conditions in the first sowing date (15th August) were the most favorable to sweet corn growth more than the planting at 15th September and the role of potassium on promotion of many of the metabolic processes, enzymes activity and enhancing the translocation of assimilates and protein synthesis, which in turn affect the vegetative growth of sweet corn and hence on increasing the fresh ear yield and quality. This result are agree with those reported by Vijay Jat *et al.,* (2009), Zafar Hayat Khan *et al.,* (2011) and Simic *et al.,* (2010), Ebrahimi, *et al.,* (2011), Peykarestan *et al.,* (2012), Rahimi *et al.,*(2012).

Table 2a: Effect of the interaction treatments between sowing date, potassium levels and number of doses application on fresh ear yield and quality of sweet corn in the first season (2009/2010).

Treatments			Ear length (cm)		Ear diameter (mm)		Number of rows/ear		Number of kernels/row		Ear weight (g)		Total yield (ton/fed.)	
Sowing date	K-Level application (kg/fed.) Potassium sulfate	Number of K-Doses application												
15th August	60	2	16.67	ef	35	l	12	h	30	gh	166.3	jk	10.69	n
		3	17.17	cdef	35	l	12	h	31	efgh	166.0	jk	11.38	m
		4	17.5	cdef	36	l	12.67	gh	31	efgh	175.7	ij	12.31	l
	90	2	18.5	c	37.67	jk	12.67	gh	33.67	defg	195.0	ghi	13.72	j
		3	20.17	b	38.33	ij	12.67	gh	33.33	defg	199.3	fgh	14.66	hi
		4	20.17	b	39	hij	14	efg	34	defg	209.0	fg	15.52	f
	120	2	20.5	b	40	gh	14.67	def	34.67	defg	233.3	de	16.24	e
		3	20.5	b	43.33	de	15.33	cde	34.67	defg	260.7	c	16.96	cd
		4	22	a	44	cd	16	bcd	35.67	cdef	287.3	b	17.33	c
	150	2	21.83	a	45	c	17.33	ab	40.33	abc	335.3	a	18.09	b
		3	22.5	a	48	b	17.33	ab	41.33	ab	335.7	a	18.48	b
		4	23	a	50.33	a	18	a	43	a	353.3	a	19.94	a
15th September	60	2	13.17	h	28.67	n	12	h	26.33	h	146.7	kl	7.99	
		3	13.17	h	29.33	n	12.67	gh	27	h	144.0	l	8.63	p
		4	13	h	31	m	12.67	gh	27	h	158.3	jkl	9.50	o
	90	2	13.5	h	32.33	m	13.33	fgh	30.33	fgh	162.0	jkl	10.82	n
		3	13.83	gh	35	l	14.67	def	33	defg	175.3	ij	11.69	m
		4	14.83	g	36.33	kl	15.33	cde	33.67	defg	179.3	hij	12.50	l
	120	2	16.17	f	37.67	jk	14.67	def	34.33	defg	200.7	fg	13.17	k
		3	17	def	39.67	hi	15.33	cde	33.33	defg	219.0	ef	13.84	j
		4	17.17	cdef	41.33	fg	16	bcd	34.67	defg	234.7	de	14.19	ij
	150	2	17.83	cde	42.33	ef	16	bcd	36.33	bcde	247.3	cd	14.89	gh
		3	18.17	cd	42.67	def	16.67	abc	36.67	bcd	256.3	c	15.26	fg
		4	18.5	c	42.67	def	17.33	ab	38.33	abcd	265.0	c	16.62	de
Sowing date	15th august		20.04	A	40.97	A	14.56	A	35.22	A	243.1	A	15.44	A
	15th September		15.53	B	36.58	B	14.72	A	32.58	A	199.1	B	12.43	B
K-Level application	60 kg/fed. (potassium sulfate)		15.11	D	32.5	D	12.33	D	28.72	C	159.5	D	10.09	D
	90 kg/fed. (potassium sulfate)		16.83	C	36.44	C	13.78	C	33	B	186.7	C	13.15	C
	120 kg/fed. (potassium sulfate)		18.89	B	41	B	15.33	B	34.56	B	239.3	B	15.29	B
	150 kg/fed.(potassium sulfate)		20.31	A	45.17	A	17.11	A	39.33	A	298.8	A	17.21	A
K-Doses application	2		17.27	C	37.33	C	14.08	B	33.25	A	210.8	C	13.20	C
	3		17.81	B	38.92	B	14.58	B	33.79	A	219.5	B	13.86	B
	4		18.27	A	40.08	A	15.25	A	34.67	A	232.8	A	14.74	A

Values followed by the same letter (s) are not significantly different at 5 %

Table 2b: Effect of the interaction treatments between sowing date, potassium levels and number of doses application on fresh ear yield and quality of sweet corn in the second season (2010/2011).

Treatments			Ear length (cm)		Ear diameter (mm)		Number of rows/ear		Number of kernels/row		Ear weight (g)		Total yield (ton/fed.)	
Sowing date	K-Level application (kg/fed.) Potassium sulfate	Number of K-Doses application												
15th August	60	2	16	jkl	34.67	kl	12	h	30.67	ghi	172.7	ij	11.77	n
		3	16.83	ijk	36.33	jkl	12.67	gh	32	fghi	187.3	hi	13.54	l
		4	17.5	hij	37	ijk	13.33	fgh	32.67	fgh	187.7	hi	14.29	k
	90	2	19.17	efgh	38	ij	13.33	fgh	35.67	def	205.3	gh	14.88	j
		3	20.5	bcdef	39	hi	14	efg	34.33	defg	209.0	gh	15.85	i
		4	21	abcde	41	gh	14.67	def	35.67	def	227.7	fg	17.37	g
	120	2	20	cdefg	42.33	fg	15.33	cde	35.33	def	248.3	def	18.30	f
		3	21	abcde	44.67	def	16	bcd	36	def	268.3	cde	19.17	e
		4	21.67	abc	46.33	cd	17.33	ab	37.33	cde	292.7	c	20.01	d
	150	2	21.33	abcd	48	c	17.33	ab	42	ab	335.3	b	20.87	c
		3	22.5	ab	50.33	b	18	a	44.33	a	361.7	a	21.56	b
		4	23	a	54	a	18	a	44.67	a	371.0	a	23.20	a
15th September	60	2	13	mn	31	m	13.33	fgh	28.33	i	153.7	j	8.99	p
		3	12.67	n	32	m	13.33	fgh	30	hi	162.0	ij	10.64	o
		4	13.17	mn	34.33	l	14	efg	30	hi	170.3	ij	11.35	n
	90	2	13.5	mn	37	ijk	14	efg	33.33	efgh	174.0	ij	11.90	n
		3	14.17	lmn	37.33	ij	15.33	cde	34.33	defg	187.7	hi	12.81	m
		4	14.83	klm	39.33	hi	16	bcd	35.33	def	189.0	hi	14.22	k
	120	2	16.17	jkl	43.67	ef	16	bcd	34.67	defg	209.0	gh	15.10	j
		3	16.33	jk	44.67	def	17.33	ab	35	def	229.0	fg	15.91	i
		4	16.83	ijk	45.67	cde	17.33	ab	34.67	defg	241.7	ef	16.68	h
	150	2	18	ghij	46	cde	16.67	abc	38.33	bcd	257.3	de	17.49	g
		3	18.67	fghi	46.33	cd	18	a	38	cd	273.7	cd	18.13	f
		4	19.33	defgh	46	cde	18	a	40.33	bc	275.0	cd	19.67	de
Sowing date	15th August		20.04	A	42.64	A	15.17	A	36.72	A	255.6	A	17.57	A
	15th September		15.56	B	40.28	B	15.78	A	34.36	A	210.2	B	14.41	B
K-Level application	60 kg/fed. (potassium sulfate)		14.86	D	34.22	D	13.11	D	30.61	C	172.3	D	11.76	D
	90 kg/fed. (potassium sulfate)		17.19	C	38.61	C	14.56	C	34.78	B	198.8	C	14.50	C
	120 kg/fed. (potassium sulfate)		18.67	B	44.56	B	16.56	B	35.5	B	248.2	B	17.53	B
	150 kg/fed. (potassium sulfate)		20.47	A	48.44	A	17.67	A	41.28	A	312.3	A	20.15	A
K-Doses application	2		17.15	B	40.08	C	14.75	C	34.79	B	219.5	C	14.91	C
	3		17.83	A	41.33	B	15.58	B	35.5	AB	234.8	B	15.95	B
	4		18.42	A	42.96	A	16.08	A	36.33	A	244.4	A	17.10	A

Values followed by the same letter (s) are not significantly different at 5 %

Nutritive value of sweet corn kernel i.e. Non-reducing sugar (sucrose), reducing sugar, total sugar, total soluble solids (TSS) and dry matter (%).

Effect of sowing date:

Data in Tables (3a & 3b) show that the nutritive value of sweet corn kernel were significantly increased by sowing at 15th August, except for dry matter (%) in the first season, which variances failed to reach the level of significance. However, an opposite trend was found in reducing sugar, i.e. the highest values were recorded with sowing at 15th September as compared with sowing at 15th August.

Effect of potassium level application:

Results in Table 3a & 3b indicate that the nutritive value of sweet corn kernel were gradually and significantly increased by increasing the level of potassium application from 60, 90, 120 and 150 kg potassium sulphate/fed. This result were true in both growing seasons, with no significance differences on reducing sugar between plants received 60 or 90 kg potassium sulphate/fed.

Effect of number of potassium doses application:

Obtained results indicate that the nutritive value of sweet corn kernel was gradually and significantly increased with increasing the number of doses application from 2, 3 up to 4-doses. These results were true in both growing seasons, except for reducing sugar on both growing seasons which variances between those received 2 or 3 and 3 or 4 doses failed to reach the level of significance. As for TSS results showed that the variances between those received 2 or 3 and 3 or 4 doses failed to reach the level of significance in the first season, however in the second season no significant differences were found between those received 3 or 4 doses of potassium application. Respecting, the dry matter (%) data in the first season showed that no significant differences were found between those received 2 or 3-doses of potassium application.

Treatments interaction:

The effect of the treatments interaction i.e. sowing date and potassium fertilization either quantity applied and application doses on nutritive value of sweet corn i.e. non-reducing sugar (sucrose), reducing sugar, total sugar, total soluble solids (TSS) and dry matter (%) showed a significant correlation, where the highest values of

non-reducing sugar (sucrose), total sugar, total soluble solids (TSS) and dry matter (%) were recorded by sowing at 15th August with application the highest level of potassium application (150 kg potassium sulphate/fed.) as 4-doses application. However, the lowest values were recorded by sowing at 15th September with application the lowest level of potassium application (60 kg potassium sulphate/fed.) as 2-doses application.

As for, reducing sugar data clear that highest values were recorded by sowing at 15th September with application the highest level of potassium application (150 kg potassium sulphate/fed.) as 4-doses application. However, the lowest values were recorded by sowing at 15th September with potassium application at 90 kg potassium sulphate/fed. as 4-doses application or sowing at 15th August with potassium application at 90 kg potassium sulphate/fed.) as 3-doses application in the first season.

These results were in agreement with what reported by many investigators who reported that, increasing the K-application gave the best quality of sweet corn ear i.e. water soluble sugar content of fresh grains were increased with increasing K-application (Chen *et al*., 1993); increasing in protein, cysteine and methionine content and reduction in starch content (Yuying Li *et al*., 2003) and promote crude protein content (Chen-YiBing *et al*., 2005).

Table 3a: Effect of the interaction treatments between sowing date, potassium levels and number of doses application on nutritive value on sweet corn kernel of sweet corn in the first season (2009/2010).

Treatments			Non reducing sugar (sucrose) (g/100g FW)		Reducing Sugar (g/100 g FW)		Total Sugar (g/100g FW)		Total soluble solids (TSS)		Dry matter (%)	
Sowing date	K-Level application (kg/fed.) Potassium sulfate	Number of K-Doses application										
15th August	60	2	3.59	i	0.91	i	4.41	mn	11.33	gh	21.33	kl
		3	3.64	i	1.00	hi	4.62	kl	11.33	gh	21.50	jk
		4	3.79	hi	1.00	hi	4.76	jk	11.67	fgh	22.50	hij
	90	2	3.85	ghi	1.00	hi	4.82	j	11.67	fgh	23.17	fgh
		3	4.10	efg	0.87	i	4.93	ij	12.00	fgh	23.33	efgh
		4	4.35	e	1.08	hi	5.06	hi	12.33	efg	23.67	cdefg
	120	2	4.74	d	0.99	hi	5.71	g	12.33	efg	23.83	bcdef
		3	5.04	c	1.23	fghi	6.23	f	12.67	def	24.00	bcdef
		4	5.40	b	1.42	efgh	6.76	e	13.33	cde	24.33	abcde
	150	2	5.93	a	1.64	def	7.41	c	14.33	abc	24.50	abcd
		3	6.13	a	1.60	defg	7.63	b	14.67	ab	24.83	ab
		4	6.14	a	1.95	bcd	8.00	a	15.00	a	25.33	a
15th September	60	2	2.86	k	1.15	ghi	3.96	p	10.00	i	20.33	l
		3	2.89	k	1.27	efghi	4.12	op	11.00	hi	21.17	kl
		4	3.06	jk	1.26	efghi	4.25	no	11.33	gh	22.00	ijk
	90	2	3.23	j	1.12	hi	4.30	n	11.33	gh	22.50	hij
		3	3.29	j	1.15	ghi	4.41	mn	11.67	fgh	22.67	ghi
		4	3.76	hi	0.86	i	4.50	lm	12.00	fgh	23.17	fgh
	120	2	3.97	fgh	1.29	efghi	5.17	h	12.33	efg	23.33	efgh
		3	4.15	efg	1.71	cde	5.73	g	12.67	def	23.50	defgh
		4	4.27	ef	2.08	abc	6.21	f	12.67	def	23.83	bcdef
	150	2	4.65	d	2.27	ab	6.85	e	13.67	bcd	24.33	abcde
		3	5.11	c	2.16	ab	7.15	d	14.00	abc	24.50	abcd
		4	5.14	bc	2.44	a	7.49	bc	14.33	abc	24.67	abc
Sowing date	15th august		4.72	A	1.23	B	5.86	A	12.72	A	23.53	A
	15th September		3.87	B	1.56	A	5.34	B	12.25	B	23.00	A
K-Level application	60 kg/fed. (potassium sulfate)		3.31	D	1.10	C	4.36	D	11.11	D	21.47	D
	90 kg/fed. (potassium sulfate)		3.76	C	1.01	C	4.67	C	11.83	C	23.08	C
	120 kg/fed. (potassium sulfate)		4.60	B	1.46	B	5.97	B	12.67	B	23.81	B
	150 kg/fed. (potassium sulfate)		5.52	A	2.01	A	7.42	A	14.33	A	24.69	A
K-Doses application	2		4.10	C	1.30	B	5.33	C	12.13	B	22.92	B
	3		4.29	B	1.37	AB	5.60	B	12.50	AB	23.19	B
	4		4.49	A	1.51	A	5.88	A	12.83	A	23.69	A

Values followed by the same letter (s) are not significantly different at 5 %

Table 3b: Effect of the interaction treatments between sowing date, potassium levels and number of doses application on nutritive value on sweet corn kernel of sweet corn in the second season (2010/2011).

Treatments			Non reducing sugar (sucrose) (g/100g FW)		Reducing sugar (g/100 g FW)		Total sugar (g/100g FW)		Total soluble solids (TSS)		Dry matter (%)	
Sowing date	K-Level application (kg/fed.) Potassium sulfate	Number of K-Doses application										
15th August	60	2	3.59	i	0.87	hij	4.46	mn	11.33	h	21.67	jk
		3	3.64	i	1.02	ghij	4.66	klm	11.67	gh	21.83	ijk
		4	3.79	hi	1.00	ghij	4.79	jkl	11.67	gh	22.67	hi
	90	2	3.85	ghi	1.02	ghij	4.86	jk	12.00	fgh	23.67	efg
		3	4.10	efg	0.86	hij	4.96	ij	12.33	efg	23.67	efg
		4	4.35	e	0.80	j	5.15	hi	12.67	def	24.00	def
	120	2	4.74	d	1.03	ghij	5.77	g	12.67	def	24.17	def
		3	5.04	c	1.24	efghi	6.28	f	13.00	cde	24.50	cde
		4	5.40	b	1.42	defg	6.82	e	13.33	cd	24.67	bcd
	150	2	5.93	a	1.56	def	7.49	c	14.67	a	25.17	abc
		3	6.13	a	1.60	de	7.73	b	15.00	a	25.50	ab
		4	6.14	a	2.01	bc	8.15	a	15.00	a	25.67	a
15th September	60	2	2.86	k	1.16	fghij	4.02	p	10.33	i	21.00	k
		3	2.89	k	1.27	defgh	4.16	op	11.33	h	21.83	ijk
		4	3.06	jk	1.16	fghij	4.22	op	11.67	gh	22.50	hij
	90	2	3.23	j	1.16	fghij	4.39	no	11.67	gh	22.67	hi

		3	3.29	j	1.21	efghij	4.50	mn	12.00	fgh	23.00	gh
		4	3.76	hi	0.84	ij	4.60	lmn	12.33	efg	23.50	fg
	120	2	3.97	fgh	1.26	defgh	5.23	h	12.67	def	23.67	efg
		3	4.15	efg	1.64	cd	5.79	g	13.00	cde	23.83	defg
		4	4.27	ef	2.00	bc	6.27	f	13.33	cd	24.33	cdef
	150	2	4.65	d	2.26	ab	6.91	e	13.67	bc	24.33	cdef
		3	5.11	c	2.15	ab	7.26	d	14.33	ab	24.67	bcd
		4	5.14	bc	2.39	a	7.54	bc	14.67	a	25.17	abc
Sowing date	15^{th} august		4.72	A	1.20	B	5.93	A	12.94	A	23.93	A
	15^{th} September		3.87	B	1.54	A	5.41	B	12.58	B	23.38	B
K-Level application	60 kg/fed. (potassium sulfate)		3.31	D	1.08	C	4.39	D	11.33	D	21.92	D
	90 kg/fed. (potassium sulfate)		3.76	C	0.98	C	4.74	C	12.17	C	23.42	C
	120 kg/fed. (potassium sulfate)		4.60	B	1.43	B	6.03	B	13.00	B	24.19	B
	150 kg/fed. (potassium sulfate)		5.52	A	2.00	A	7.51	A	14.56	A	25.08	A
K-Doses application	2		4.10	C	1.29	B	5.39	C	12.38	B	23.29	C
	3		4.29	B	1.37	AB	5.67	B	12.83	A	23.60	B
	4		4.49	A	1.45	A	5.94	A	13.08	A	24.06	A

Values followed by the same letter (s) are not significantly different at 5 %

Generally increased the number of potassium doses application caused improving of fresh ear quality. This opinion is agreement with those reported by Kalpana and Anbumani, 2003 and Ganesaraja *et al*. 2009. Moreover, the application of K at 50 kg ha applied in 3 splits as basal treatment and at 15 and 30 days after sowing. This treatment also significantly improved cob and stover yields, N and K uptake and crude protein content as reported by Kalpana and Anbumani (2003).

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