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INFLUENCE OF SOIL MOISTURE DEFICIT AND POTASSIUM FERTILIZATION ON WATER RELATIONS AND PRODUCTIVITY OF SOME SUGARCANE VARIETIES

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ABSTRACT

Two field experiments were carried out at Shandaweel Research Station, Sohag Governorate in 2008/2009 and 2009/2010 seasons to study the influence of twenty-seven treatments representing the combinations of three irrigation regimes (applying irrigation water at 75-80, 60-65 and 45-50% of field capacity), three potassium fertilization levels (48, 72 and 96 kg K_2O/fed.) and three sugarcane varieties (the commercial, G.T.54-9 variety and two promising ones *viz.* Ph.8013 and G.84-47). A split-split plot design with three replications was used.

The results showed that irrigating sugarcane at 60-65 % FC resulted in the tallest and thickest cane stalks, the highest number of millable canes and cane and sugar yields/fed., while the highest percentages of brix, sucrose and sugar recovery were recorded at 45-50 % FC. Water consumptive use (CU) was 8307.1 and 7621.4 m^3/fed., when sugarcane was irrigated at 75-80% and 45-50% FC, respectively. The highest CU was recorded by Ph.8013, while the highest WUE was recorded by G. 84-47.

Sugarcane G.84-47 variety showed significant superiority over the other ones in the number of millable canes, cane and sugar yields/fed as well as brix%, sucrose% and sugar recovery%.

Raising K-fertilization level from 48 to 72 and 96 kg K_2O/fed. led to a gradual increase in stalk height and diameter, number of millable canes, and cane and sugar yields/fed. as well as brix%, sucrose% and sugar recovery%.

Under the conditions of the present investigation, planting G.84-47 sugarcane variety fertilized with 72 kg K_2O/fed. and irrigated at 60-65% FC can be recommended to obtain the highest cane and sugar yields/fed.

Key words: *Potassium fertilization, productivity, soil moisture deficit, sugar cane, water relations.*

1. INTRODUCTIOIN

Irrigation is a major factor affecting, germination, tillering, boom stage, sugar accumulation and hence cane and sugar yields. In this respect, sugar cane is adversely affected by water logging which creates some problems including leaching of water by percolation and available nutrients beyond root zone, lodging, pests and diseases and harvesting difficulties. In addition, excessive application of water causes inadequate soil aeration and low water potential. As for soil moisture effect on sugarcane, Altaf Ur-Rahman *et al*. (1998) found that when sugarcane was irrigated at 40, 60 and 80% available soil moisture (ASM), sugar yield decreased with decreasing water availability, while juice quality increased. Abdel Wahab (2005) found that irrigating at 55-60% ASM depletion gave the highest cane yield. Ibrahim (2006) tested three sugarcane irrigation treatments M1: irrigating sugarcane when 40-50 % of ASM was depleted; M2: irrigating sugarcane when 80-90% ASM was depleted and M3: irrigating sugarcane when 90-100% ASM was depleted. He mentioned that irrigation treatments significantly affected the length of the irrigation intervals, number of irrigations, cane and sugar yields and sucrose recovery%. He added that M1 gave the highest cane yield and that delaying irrigation beyond 70% depletion of ASM is detrimental to the growth of sugarcane and will result in economic losses of sugar yield.

It is known that the differences among genotypes and varieties are attributed to the variation in foliage size (leaf area), number of stomata on both sides of leaves, thickness of cuticle (wax layer). Most references emphasized that the potential of cane variety is the corner stone in the recoverable sugar yield per unit area. Potassium fertilizer plays a direct effect on juice quality of sugarcane. Potassium has a function as an activator in protein metabolism and for several enzymes in carbohydrate metabolism. It is also involved in turgor control in specialized cells, and in turn the water balance status of plants. The balance between the applied water and the recommended dose of nitrogen and potassium given to sugarcane could be changed specially under the various varieties. Concerning varietal differences, El-Shafai and Ismail (2006) showed that the commercial sugarcane cv. G.T.54-9 was superior in stalk height, number of millable cane and cane and sugar yields/fed. compared with Phil.8013, G.95-19 and G.95-21 varieties. El-Sogheir *et al.* (2007) found that cvs. Phil.8013, G. 84-47 and G.98-28 in a descending order could be cultivated with and/or replaced with the main cane variety G.T.54-9 which yielded the best cane yield, juice quality and hence sugar yield per unit area. Ismail *et al.* (2008) showed that the tested sugarcane varieties significantly differed in all the studied traits except purity% ,cane and sugar yields. The commercial cv. G.T.54-9 showed superiority in stalk length, purity %, sugar recovery% and sugar yields/fed. Ismail and El-Sogheir (2008) reported that sugarcane varieties significantly differed in stalk length, stalk diameter, number of millable canes/m, cane yield/fed., sucrose%, sugar recovery% and sugar yield. The highest cane yield was recorded by G.98-28 variety in both seasons. Ahmed *et al.* (2008) cleared that sugarcane variety G.84-47 surpassed the other two varieties (Phil.8013 and G.98-28) in millable cane number/m^2, stalk height, sugar recovery% and cane yield, meanwhile sugarcane variety Phli.8013 attained the highest value of stalk diameter, brix, sucrose and sugar yield.

Concerning potassium effect, it was reported that applying potassium fertilizer at 48 and 72 kg K_2O/fed. recorded the highest millable cane and recoverable sugar yields (Abo El-Wafa *et al.*, 2006; Bekheet, 2006; Elamin *et al*., 2007; Mahmoud *et al.*, 2008 and Mokadem *et al*., 2010).

The aim of the present work was to find out the optimum soil moisture and K-fertilization levels for the tested sugarcane varieties to get the highest cane and sugar yields/fed.

2. MATERIALS AND METHODS

Two field experiments were carried out in Shandaweel Agricultural Research Station, at Sohag Governorate in 2008/2009 and 2009/2010 seasons to study the influence of soil moisture deficit and potassium fertilization levels on the water relations and productivity of some sugarcane varieties. Each field trial included twenty-seven treatments representing the combinations between three irrigation treatments, three potassium fertilizer levels and three sugarcane varieties.

2.1. Irrigation treatments (A)

1-Irrigation at 75-80 % field capacity (FC). (a total number of 19 irrigation with an average interval of 17 days between irrigations).

2-Irrigation at 60-65 % field capacity (FC). (a total number of 17 irrigation with an average interval of 19 days between irrigations).

3-Irrigation at 45-50% field capacity (FC). (a total number of 15 irrigation with an average interval of 22 days between irrigations).

Soil moisture at the field capacity (FC) was determined as follows:

A plot area of 1.5 x 1.5 m^2 was watered for 6 hours until it was fully saturated and covered with a plastic sheet. Soil samples were taken every 12 hours to determine soil moisture %. The moisture % that the soil keeps against gravity after 48 hours represents FC.

Irrigation water was applied when the soil moisture content reached the defined field capacity in each treatment. Borders of 1.5-m width were ditched to prevent seepage among irrigation treatments. The application of irrigation treatments began after planting and the 1st post-planting irrigations. Irrigation was withheld one month before harvesting.

2.2. Sugarcane varieties (B)

The promising varieties *viz.* Ph.8013 and G.84-47 sugarcane varieties, in addition to the commercial cultivar G.T.54-9 as a control, were used.

2.3. Potassium fertilizer levels (C)

Potassium was applied at the rate of 48, 72 and 96 kg K_2O/fed. as potassium sulphate (48% K_2O) with the second addition of nitrogen fertilizer at age of three months from planting.

A split-split plot design with three replications was used in both growing seasons. Irrigation treatments were allocated in the main plots. Sugarcane varieties were randomly distributed in the sub plots, while potassium levels were distributed in the sub-sub plots. The experimental unit area was 21 m^2, including 6 ridges of 3.5 m in length and 1.0 m apart. Sugarcane varieties were planted during the 2nd week of March and harvested after 12 months in both experiments.

Phosphorus was applied at the rate of 30 kg P_2O_5 during seed bed preparation as calcium super phosphate (15% P_2O_5). Nitrogen, as urea (46%N) was added at the rate of 210 kg N/fed. in two equal doses, after 50 and 90 days from planting. The previous crop was sesame followed by fallow. Laser land levelling was practiced at 0.05 m/100 m to control water supply. All other agricultural practices were carried out as recommended.

Soil moisture constants of the experimental site are presented in Table (1).

Table (1): Field capacity, available soil moisture,welting point and bulk density of the experimental site.

Soil depth (cm)	Field capacity (%)	Welting point (%)	Available soil moisture (%)	Bulk density (g/cm^3)
0 – 15	34.50	18.50	16.00	1.19
15 – 30	33.00	17.30	15.50	1.24
30 – 45	31.50	16.40	15.10	1.28
45 – 60	30.00	15.45	14.55	1.35

Chemical and physical properties of the experimental soil are presented in Table (2).

Table (2):Soil physical and chemical properties of the upper 45 cm of the experimental sites.

Physical analysis	sand %	25.46
	Silt %	43.45
	Clay %	31.09
Soil texture		Clay loam
	Total N (%)	0.196
	$CaCO_3$%	1.26
	Soluble ions {meq/100 g soil (1:5)}	
	CO_3^-	-
	HCO_3^-	0.30
	Cl^-	0.88
	$SO_4^=$	1.02
	Ca^{++}	0.52
	Mg^{++}	0.26
	Na^+	1.26
	K^+	0.16
	EC (ds/m)	0.263
	pH (1:1)	7.3

Soil analysis was done according to the method described by Jackson (1973).

The recorded data

At harvest, 20 plants were randomly collected from each sub-sub plot to determine the following traits:

Growth traits

1. Stalk height (cm) was measured from soil surface to the top visible dewlap;
2. Stalk diameter (cm) was measured at the middle part of stalks.

Millable cane and cane yield/fed.

Plants of the four guarded rows were harvested, cleaned, topped and weighed to estimate the following parameters:

3. Number of millable canes/fed.
4. Cane yield (ton/fed.).

Quality traits

5. Brix percentage (total soluble solids, TSS %) in juice was determined using Brix Hydrometer standardized at 20 ^oC.
6. Sucrose/100 cm^3 juice was determined using Saccharemeter according to A.O.A.C. (1995).

Purity % = sucrose % / brix % x 100

7. Sugar recovery percentage was calculated according to the equation outlined by Yadav and Sharma (1980):

Sugar recovery % = [sucrose % - 0.4 (brix % - sucrose %)] x 0.73.

8. Sugar yield (ton/fed.) was computed according to the following equation:

Sugar yield = cane yield (tons/fed.) x sugar recovery %.

Water relations

Water consumptive use (CU)

It was estimated by using the soil sampling method and calculated according to the technique used and according to the equation of Israelsen and Hansen (1962).

$CU = D \times B_d \times (Q2-Q1) /100$

Where:

CU= water consumptive use (cm) in the effective root zone (60 cm).

D = Soil layer depth.

B_d = Soil bulk density (g/cm^3).

Q_1 = Soil moisture %, before irrigation.

Q_2 = Soil moisture %, 48 hours after irrigation.

Water use efficiency (WUE)

It was calculated on cane and sugar basis as shown by Vites (1965) as follows:

1. WUE (kg cane/m^3 water) = cane yield (kg/fed.)/water consumptive use (m^3/fed.).
2. WUE (kg sugar/m^3 water) = sugar yield (kg/fed.)/water consumptive use (m^3/fed.).

The collected data were statistically analyzed as mentioned by Gomez and Gomez (1984) using "MSTAT-c" computer software package according to Freed *et al*. (1989).

3. RESULTS AND DISCUSSIONS

3.1. Stalk height and diameter

Results in Table (3) clear that irrigating sugarcane at 60-65% FC significantly resulted in the tallest and thickest cane stalks in both seasons. Applying irrigation at 45-50% FC gave the shortest stalks in the 1st season. On the other hand, it was found that applying irrigation at 75-80% FC gave the lowest mean value of stalk diameter, while irrigating sugarcane at 45-50% FC produced medium values of this trait, in the 1st season. In the 2nd one, insignificant differences were detected in cane stalk height and diameter in case of applying irrigation water using the 1st irrigation regime (at 75-80% FC) or the 3rd one (45-50% FC). These results are in agreement with those reported by Ibrahim (2006).

The tested sugarcane varieties varied significantly in stalk height and diameter in both seasons. The commercial G.T.54-9 variety had the highest stalks among the three varieties, followed by G.84-47 and Ph.8013 which recorded the lowest values in this trait. However, the difference between G.84-47 and Ph.8013 varieties in stalk height was insignificant in the 2nd season. On the other hand, Ph.8013 variety had the thickest stalks, while G.84-47 variety recorded the lowest value of this growth character. Meantime, G.T.54-9 had moderate stalk diameter. The variance among cane varieties in these traits may be due to their gene make-up. El-Shafai and Ismail (2006); El-Sogheir *et al.* (2007); Ismail *et al.* (2008) and Ahmed *et al.* (2008) recorded differences among the tested cane varieties in stalk height and diameter.

Raising potassium fertilization level from 48 to 72 and 96 kg K_2O/fed. attained significant increases in both stalk height and diameter in the 1st and 2nd seasons. These results may be due to the role of potassium in cell division, in addition to its role in activating protein synthesis and enzymes of carbohydrate building-up. These results are in agreement with those mentioned by Abo El-Wafa, *et al.* (2006); Bekheet (2006); Elamin *et al*. (2007); Mahmoud *et al.* (2008) and Mokadem *et al*. (2010).

Except for the interaction between irrigation and potassium levels in the 1st season, stalk height was insignificantly influenced by the interactions among the studied factors in both seasons. Stalk diameter was affected by the interaction between irrigation and cane varieties in the 2*nd* season.

3.2.Number of millable canes and cane yield/fed.

Numbers of millable canes and cane yield/fed. were significantly affected by the studied irrigation regimes (Table 4). Adding irrigation water to sugarcane at 60-65% FC attained the highest values of the two traits, while applying irrigation at 45-50% FC gave the lowest records, in both seasons. Irrigation at 60-65% FC attained 2.38 and 2.93 thousand stalks/fed. as well as 3.00 and 4.00 tons of canes/fed. higher than those obtained with irrigation at 75-80% FC and 45-50% FC, respectively, in the 1*st* and the 2*nd* seasons, successively. It can be noticed that the higher values of cane stalk height, diameter and number of millable canes recorded at applying irrigation at 60-65% FC compared to that given 75-80 % FC and/or 45-50% FC (Table 3 and 4) participated in getting the highest cane yield/fed.. These findings are in accordance with those found by Abdel Wahab (2005) and Ibrahim (2006).

Sugarcane G.84-47 variety significantly surpassed the other two varieties in the number of millable canes (in both seasons) and cane yield/fed. (in the 1st season), while Ph.8013 recorded the lowest values of the two traits in both seasons. The difference among cane varieties in these traits could be due to their gene make-up. El-Shafai and Ismail (2006), El-Sogheir *et al.* (2007), Ismail *et al.* (2008) and Ahmed *et al.* (2008) recorded differences among the tested cane varieties in these characters.

Gradual and significant increases in both number of millable canes and cane yield/fed. were gained by increasing the dose of potassium fertilizer in both seasons. Raising K-dose to 96 kg K_2O/fed. increased the number of millable canes by 2.10 and 0.60 thousand/fed. In the 1st season and by 2.11 and 0.77 thousand/fed. in the 2nd one, correspond with those obtained by 48 kg K_2O/fed. As well as cane yield was increased by 2.91 and 0.11 ton/fed. in the 1st season and 2.50 and 0.10 ton/fed., in the 2nd one, respectively. These results are probably due to the positive and beneficial role of K element which increased all of cane stalk height, diameter and number of millable canes, and hence increased the harvestable cane yield/fed. These results are in agreement with those reported by Abo El-Wafa *et al.* (2006), Bekheet (2006), Elamin *et al*. (2007), Mahmoud *et al.* (2008) and Mokadem *et al*. (2010).

Concerning the interaction effects, the number of millable canes and cane yield/fed. were significantly affected by the interaction between irrigation and both of potassium and cane varieties in both seasons. The interaction between cane varieties and K levels had a significant effect on the number of millable canes, in the 1*st* season. Meantime,the number of millable canes/fed. was

Table (3): Effect of irrigation, varieties, potassium levels and their interactions on stalk height and diameter (cm) in 2008/2009 and 2009/2010 seasons.

Irrigation (A)	Sugar cane varieties (B)	Stalk height (cm)								Stalk diameter (cm)							
		2008/2009 season				2009/2010 season				2008/2009 season				2009/2010 season			
		Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean
		48	72	96		48	72	96		48	72	96		48	72	96	
At 75-80% FC	Ph 8013	278.33	280.00	282.00	**280.11**	274.00	278.00	281.33	**277.78**	2.70	2.73	2.74	**2.72**	2.67	2.71	2.79	**2.72**
	G.T.54-9	280.00	282.33	285.33	**282.56**	276.33	277.67	281.67	**278.56**	2.62	2.66	2.70	**2.66**	2.58	2.60	2.64	**2.61**
	G. 84-47	279.33	281.33	282.67	**281.11**	274.33	277.00	277.67	**276.33**	2.47	2.49	2.51	**2.49**	2.45	2.48	2.51	**2.48**
Mean		**279.22**	**281.22**	**283.33**	**281.26**	**274.89**	**277.56**	**280.22**	**277.56**	**2.60**	**2.63**	**2.65**	**2.62**	**2.57**	**2.60**	**2.65**	**2.61**
At 60-65% FC	Ph 8013	279.00	282.00	283.67	**281.56**	278.00	279.67	282.33	**280.00**	2.77	2.79	2.81	**2.79**	2.72	2.75	2.77	**2.75**
	G.T.54-9	282.00	286.67	288.13	**285.60**	279.00	282.00	284.33	**281.78**	2.71	2.72	2.74	**2.72**	2.69	2.71	2.74	**2.71**
	G. 84-47	280.00	283.00	285.33	**282.78**	280.00	282.00	282.33	**281.44**	2.55	2.57	2.59	**2.57**	2.48	2.52	2.57	**2.52**
Mean		**280.33**	**283.89**	**285.71**	**283.31**	**279.00**	**281.22**	**283.00**	**281.07**	**2.68**	**2.70**	**2.71**	**2.70**	**2.63**	**2.66**	**2.69**	**2.66**
At 45-50% FC	Ph 8013	275.00	275.67	277.00	**275.89**	270.00	276.67	277.00	**274.56**	2.70	2.71	2.75	**2.72**	2.64	2.67	2.70	**2.67**
	G.T.54-9	279.67	280.33	281.00	**280.33**	277.00	278.67	280.00	**278.56**	2.62	2.65	2.68	**2.65**	2.59	2.61	2.66	**2.62**
	G. 84-47	278.00	279.00	280.00	**279.00**	272.00	276.33	280.00	**276.11**	2.45	2.47	2.51	**2.48**	2.44	2.47	2.48	**2.46**
Mean		**277.56**	**278.33**	**279.33**	**278.41**	**273.00**	**277.22**	**279.00**	**276.41**	**2.59**	**2.61**	**2.65**	**2.62**	**2.55**	**2.58**	**2.61**	**2.58**
Average of varieties	Ph 8013	277.44	279.22	280.89	**279.19**	274.00	278.11	280.22	**277.44**	2.72	2.74	2.77	**2.75**	2.67	2.71	2.75	**2.71**
	G.T.54-9	280.56	283.11	284.82	**282.83**	277.44	279.44	282.00	**279.63**	2.65	2.68	2.71	**2.68**	2.62	2.64	2.68	**2.65**
	G. 84-47	279.11	281.11	282.67	**280.96**	275.44	278.44	280.00	**277.96**	2.49	2.51	2.53	**2.51**	2.45	2.49	2.52	**2.49**
Mean of potassium		**279.04**	**281.15**	**282.79**		**275.63**	**278.67**	**280.74**		**2.62**	**2.64**	**2.67**		**2.58**	**2.61**	**2.65**	

LSD at 0.5 level for:

		Stalk height 2008/2009	Stalk height 2009/2010	Stalk diameter 2008/2009	Stalk diameter 2009/2010
Irrigation	**(A)**	**0.66**	**2.54**	**0.03**	**0.01**
Varieties	**(B)**	**1.17**	**1.76**	**0.02**	**0.01**
Potassium levels	**(C)**	**0.56**	**1.04**	**0.01**	**0.01**
(A) x (B)		**NS**	**NS**	**NS**	**0.02**
(A) x (C)		**0.97**	**NS**	**NS**	**NS**
(B) x (C)		**NS**	**NS**	**NS**	**NS**
(A) x (B) x (C)		**NS**	**NS**	**NS**	**NS**

Table (4): Effect of irrigation, varieties, potassium levels and their interactions on number of millabe cane (thousand/fed) and cane yield (ton/fed) in 2008/2009 and 2009/2010 seasons.

Irrigation (A)	Sugar cane varieties (B)	Millable cane (thousand/fed)								Cane yield (ton/fed)							
		2008/2009 season				2009/2010 season				2008/2009 season				2009/2010 season			
		Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean
		48	72	96		48	72	96		48	72	96		48	72	96	
At 75-80% FC	Ph 8013	44.78	45.65	45.96	**45.46**	44.48	45.09	45.52	**45.03**	52.06	53.51	54.89	**53.49**	51.68	52.62	53.03	**52.44**
	G.T.54-9	46.48	47.08	47.65	**47.07**	46.03	46.67	47.36	**46.69**	52.77	53.98	55.04	**53.93**	52.98	53.62	54.29	**53.63**
	G. 84-47	46.54	47.21	47.91	**47.22**	46.73	47.60	48.17	**47.50**	51.82	53.86	54.59	**53.42**	52.84	53.18	54.12	**53.38**
Mean		**45.93**	**46.65**	**47.17**	**46.58**	**45.75**	**46.45**	**47.02**	**46.41**	**52.22**	**53.78**	**54.84**	**53.61**	**52.50**	**53.14**	**53.81**	**53.15**
At 60-65% FC	Ph 8013	45.51	46.41	48.39	**46.77**	45.12	47.85	48.87	**47.28**	52.75	55.66	56.22	**54.88**	51.97	54.83	57.14	**54.65**
	G.T.54-9	47.68	50.75	50.98	**49.80**	47.40	49.00	50.30	**48.90**	53.22	57.77	57.90	**56.30**	54.32	57.31	58.88	**56.84**
	G. 84-47	48.15	51.26	51.50	**50.30**	47.48	50.48	51.49	**49.82**	54.38	56.97	58.22	**56.52**	54.39	58.09	58.41	**56.96**
Mean		**47.11**	**49.47**	**50.29**	**48.96**	**46.67**	**49.11**	**50.22**	**48.67**	**53.45**	**56.80**	**57.45**	**55.90**	**53.56**	**56.75**	**58.14**	**56.15**
At 45-50% FC	Ph 8013	44.17	45.51	45.97	**45.22**	43.84	44.91	45.08	**44.61**	51.47	52.75	53.40	**52.54**	50.57	51.92	52.26	**51.58**
	G.T.54-9	45.00	46.39	46.78	**46.06**	44.21	45.08	46.06	**45.12**	51.84	53.10	54.12	**53.02**	51.22	52.69	53.38	**52.43**
	G. 84-47	45.64	47.13	47.71	**46.83**	45.53	46.20	46.97	**46.23**	52.48	53.16	54.63	**53.42**	52.07	52.15	53.08	**52.43**
Mean		**44.94**	**46.34**	**46.82**	**46.03**	**44.53**	**45.40**	**46.04**	**45.32**	**51.93**	**53.00**	**54.05**	**52.99**	**51.29**	**52.25**	**52.91**	**52.15**
Average of varieties	Ph 8013	44.82	45.86	46.77	**45.82**	44.48	45.95	46.49	**45.64**	52.09	53.97	54.84	**53.63**	51.41	53.12	54.14	**52.89**
	G.T.54-9	46.39	48.07	48.47	**47.64**	45.88	46.92	47.91	**46.90**	52.61	54.95	55.68	**54.41**	52.84	54.54	55.52	**54.30**
	G. 84-47	46.77	48.53	49.04	**48.12**	46.58	48.09	48.88	**47.85**	52.90	54.66	55.81	**54.46**	53.10	54.47	55.20	**54.26**
Mean of potassium		**45.99**	**47.49**	**48.09**		**45.65**	**46.99**	**47.76**		**52.53**	**54.53**	**55.44**		**52.45**	**54.05**	**54.95**	

LSD at 0.5 level for:		Millable cane 2008/2009	Millable cane 2009/2010	Cane yield 2008/2009	Cane yield 2009/2010
Irrigation	**(A)**	**0.47**	**0.43**	**0.49**	**0.48**
Varieties	**(B)**	**0.26**	**0.31**	**0.24**	**0.33**
Potassium levels	**(C)**	**0.42**	**0.28**	**0.39**	**0.23**
(A) x (B)		**0.45**	**0.54**	**0.42**	**0.56**
(A) x (C)		**0.35**	**0.49**	**0.69**	**0.40**
(B) x (C)		**0.35**	**NS**	**NS**	**NS**
(A) x (B) x (C)		**0.61**	**NS**	**NS**	**0.69**

significantly influenced by the 2nd order interaction among the three studied factors, in the 1st season. Cane yield/fed. was significantly affected by the interaction among the three factors in the 2nd season.

The highest number of millable canes and cane yield/fed. were mostly obtained by irrigating any of the tested sugarcane varieties at 60-65 % FC and fertilizing them with 96 kg K_2O/fed..

3.3. Brix and sucrose percentages

Results in Table (5) indicate that brix and sucrose percentages were significantly affected by the applied irrigation regimes. Irrigating sugarcane at 45-50 % FC resulted in the highest values of these quality characteristics, followed by irrigation at 60-65 % FC and irrigated at 75-80 % FC, in both seasons, *i.e.* the more frequency of the irrigation the lower the values of brix and sucrose. This result may be due to the fact that keeping water content in cane stalks in a high level, decreases brix (total soluble solids) and/or sucrose, expressed as a percentage. These findings are in accordance with those found by Altaf Ur-Rahman, *et al*. (1998).

Sugarcane G.84-47 variety significantly exceeded G.T.54-9 and Ph.8013 varieties, while the 2nd and 3rd rank in brix and sucrose percentages were alternatively replaced by G.T.54-9 and Ph.8013, in the 1st and 2nd seasons. The difference among cane varieties in these traits could be due to their genetic structure. El-Shafai and Ismail (2006), El-Sogheir *et al.* (2007), Ismail *et al.* (2008) and Ahmed *et al.* (2008) recorded differences among the tested cane varieties in these characters.

Brix and sucrose percentages were gradually and significantly increased accompanying the increase in potassium fertilization level given to sugarcane from 48 to 72 and 96 kg K_2O/fed. in both seasons. These results may be attributed to the role of K element as an activator in building-up some enzymes participating in carbohydrate structure, in addition to its important role in transportation and storage of sugars in cane stalks. These results are in agreement with those reported by Abo El-Wafa *et al.* (2006), Bekheet (2006), Elamin, *et al*. (2007), Mahmoud *et al.* (2008) and Mokadem *et al*. (2010).

Brix percentage was significantly affected by the interaction between sugarcane varieties and K levels, in both seasons. However, sucrose % was markedly influenced by this interaction in the 1st one only.

3.4. Sugar recovery percentage and sugar yield/fed.

The results in Table (6) manifest that the used irrigation regimes significantly affected sugar recovery percentage and sugar yield/fed. in both seasons. The highest mean values of sugar recovery percentage was obtained by irrigating sugarcane at 45-50% FC, while the lowest ones were recorded by irrigation at 75-80% FC in both seasons. Sugar recovery percentage was mainly affected by sucrose% (Table 5), which had the same trend as responded to the studied watering regimes. Supplying sugarcane with irrigation water at 60-65% FC attained the highest sugar yield/fed., while adding irrigation at 75-80% FC recorded the lowest one in both seasons. Irrigating sugarcane at 60-65% FC gave 0.46 and 0.22 ton of sugar/fed. in the 1st season, and 0.54 and 0.30 ton in the 2nd one, over that produced by irrigating sugarcane at 75-80% FC and 45-50% FC, respectively. These results proved that cane yield (Table 4) is the most important component affecting sugar yield which had the same tendency as affected by the applied irrigation regimes. These findings are in accordance with those found by Altaf Ur-Rahman *et al*. (1998).

Sugarcane G.84-47 variety surpassed significantly G.T.54-9 and Ph.8013 varieties in sugar recovery percentage and sugar yield/fed. in both seasons. Meanwhile, Ph.8013 variety recorded the lowest ones. Sugarcane G.84-47 variety produced 0.49 and 0.64 ton of sugar/fed., in the 1st season and 0.25 and 0.41 ton of sugar/fed. in the 2nd one higher than those given by G.T.54-9 and Ph.8013 varieties, successively. Moreover, it can be noticed that the difference between G.T.54-9 and Ph.8013 varieties in sugar recovery % was insignificant in the 2nd season. The difference among cane varieties in these traits could be due to their genetic structure. El-Shafai and Ismail (2006), El-Sogheir *et al.* (2007), Ismail *et al.* (2008) and Ahmed *et al.* (2008) recorded differences among the tested cane varieties in these characters.

Sugar recovery percentage and sugar yield/fed. were gradually and significantly increased as a result of raising potassium fertilization level added to sugarcane from 48 to 72 and 96 kg K_2O/fed. in both seasons. Sugarcane fertilized with 96 kg K_2O/fed. produced 0.55 and 0.19 ton of sugar/fed., in the 1st season and 0.64 and 0.29 ton/fed. In the 2nd one higher than those obtained when sugarcane was supplied with 48 and 72 kg K_2O/fed., respectively. These results may be attributed to the role of K element which similarly contributed in increasing cane yield

Table (5): Effect of irrigation, varieties, potassium levels and their interactions on birx and sucrose percentages in 2008/2009 and 2009/2010 seasons.

Irrigation (A)	Sugar cane varieties (B)	Birx%								Sucrose%							
		2008/2009 season				2009/2010 season				2008/2009 season				2009/2010 season			
		Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean
		48	72	96		48	72	96		48	72	96		48	72	96	
At 75-80% FC	Ph 8013	19.53	19.96	20.13	**19.87**	19.17	19.41	19.71	**19.43**	16.82	17.28	17.38	**17.16**	16.37	16.57	16.94	**16.63**
	G.T.54-9	19.74	20.15	20.27	**20.05**	19.11	19.72	19.94	**19.59**	16.98	17.46	17.58	**17.34**	16.32	16.92	17.39	**16.88**
	G. 84-47	20.81	21.40	22.04	**21.42**	19.78	19.99	21.03	**20.27**	17.88	18.42	19.00	**18.43**	17.16	17.23	18.27	**17.55**
Mean		**20.03**	**20.50**	**20.81**	**20.45**	**19.35**	**19.71**	**20.22**	**19.76**	**17.23**	**17.72**	**17.98**	**17.64**	**16.62**	**16.91**	**17.53**	**17.02**
At 60-65% FC	Ph 8013	19.80	20.41	20.60	**20.27**	19.60	20.02	20.44	**20.02**	17.12	17.57	17.83	**17.51**	17.00	17.32	17.66	**17.32**
	G.T.54-9	20.28	20.49	20.70	**20.49**	19.46	19.98	20.35	**19.93**	17.48	17.56	17.90	**17.68**	16.80	17.36	17.61	**17.26**
	G. 84-47	21.82	22.77	22.99	**22.53**	19.98	20.47	20.95	**20.46**	18.87	19.63	19.91	**19.47**	17.28	17.80	18.33	**17.80**
Mean		**20.64**	**21.22**	**21.43**	**21.10**	**19.68**	**20.15**	**20.58**	**20.14**	**17.82**	**18.28**	**18.54**	**18.22**	**17.03**	**17.49**	**17.87**	**17.46**
At 45-50% FC	Ph 8013	20.19	20.68	20.92	**20.60**	20.10	20.52	21.32	**20.65**	17.68	17.88	18.05	**17.87**	17.41	17.83	18.57	**17.94**
	G.T.54-9	20.60	20.95	21.11	**20.89**	19.97	20.40	20.58	**20.31**	17.82	18.17	18.14	**18.04**	17.15	17.74	17.93	**17.61**
	G. 84-47	22.55	22.93	23.16	**22.88**	20.34	21.54	22.09	**21.32**	19.45	19.75	20.12	**19.77**	17.63	18.67	19.10	**18.47**
Mean		**21.11**	**21.52**	**21.73**	**21.45**	**20.13**	**20.82**	**21.33**	**20.76**	**18.31**	**18.60**	**18.77**	**18.56**	**17.40**	**18.08**	**18.53**	**18.00**
Average of varieties	Ph 8013	19.84	20.35	20.55	**20.25**	19.62	19.98	20.49	**20.03**	17.20	17.58	17.75	**17.51**	16.93	17.24	17.72	**17.30**
	G.T.54-9	20.21	20.53	20.69	**20.48**	19.51	20.03	20.29	**19.94**	17.43	17.76	17.87	**17.69**	16.76	17.34	17.65	**17.25**
	G. 84-47	21.73	22.36	22.73	**22.28**	20.03	20.67	21.35	**20.68**	18.73	19.26	19.68	**19.22**	17.36	17.90	18.56	**17.94**
Mean of potassium		**20.59**	**21.08**	**21.32**		**19.72**	**20.23**	**20.71**		**17.79**	**18.20**	**18.43**		**17.01**	**17.49**	**17.98**	

LSD at 0.5 level for:

Irrigation	**(A)**	**0.26**	**0.18**	**0.22**	**0.11**
Varieties	**(B)**	**0.39**	**0.31**	**0.32**	**0.30**
Potassium levels	**(C)**	**0.10**	**0.16**	**0.10**	**0.16**
(A) x (B)		**NS**	**NS**	**NS**	**NS**
(A) x (C)		**NS**	**NS**	**NS**	**NS**
(B) x (C)		**0.17**	**0.28**	**0.18**	**NS**
(A) x (B) x (C)		**NS**	**NS**	**NS**	**NS**

Table (6): Effect of irrigation, varieties, potassium levels and their interactions on sugar recovery% and sugar yield (ton/fed.) in 2008/2009 and 2009/2010 seasons.

Irrigation (A)	Sugar cane varieties (B)	Sugar recovery%								Sugar yield (ton/fed)							
		2008/2009 season				2009/2010 season				2008/2009 season				2009/2010 season			
		Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean
		48	72	96		48	72	96		48	72	96		48	72	96	
At 75-80% FC	Ph 8013	10.90	11.26	11.28	**11.15**	10.54	10.67	10.96	**10.72**	5.68	6.02	6.19	**5.96**	5.45	5.61	5.82	**5.63**
	G.T.54-9	11.08	11.37	11.45	**11.30**	10.52	10.93	11.41	**10.95**	5.85	6.14	6.30	**6.10**	5.57	5.86	6.20	**5.88**
	G. 84-47	11.52	11.86	12.23	**11.87**	11.21	11.17	11.89	**11.42**	5.97	6.39	6.67	**6.34**	5.92	5.94	6.43	**6.10**
Mean		**11.17**	**11.50**	**11.65**	**11.44**	**10.76**	**10.92**	**11.42**	**11.03**	**5.83**	**6.18**	**6.39**	**6.13**	**5.65**	**5.81**	**6.15**	**5.87**
At 60-65% FC	Ph 8013	11.14	11.35	11.59	**11.36**	11.10	11.27	11.48	**11.29**	5.87	6.32	6.52	**6.24**	5.77	6.18	6.56	**6.17**
	G.T.54-9	11.32	11.42	11.61	**11.45**	10.93	11.34	11.45	**11.24**	6.03	6.59	6.72	**6.45**	5.94	6.50	6.74	**6.39**
	G. 84-47	12.19	12.60	12.83	**12.54**	11.24	11.61	12.19	**11.68**	6.63	7.18	7.47	**7.09**	6.12	6.75	7.12	**6.66**
Mean		**11.55**	**11.79**	**12.01**	**11.78**	**11.09**	**11.41**	**11.71**	**11.40**	**6.18**	**6.70**	**6.90**	**6.59**	**5.94**	**6.48**	**6.81**	**6.41**
At 45-50% FC	Ph 8013	11.63	11.60	11.67	**11.64**	11.34	11.63	12.10	**11.69**	5.99	6.12	6.24	**6.11**	5.74	6.04	6.33	**6.03**
	G.T.54-9	11.56	11.80	11.69	**11.68**	11.08	11.59	11.73	**11.47**	5.99	6.27	6.32	**6.20**	5.68	6.11	6.26	**6.02**
	G. 84-47	12.50	12.66	12.99	**12.72**	11.48	12.11	12.33	**11.97**	6.56	6.73	7.10	**6.80**	5.98	6.31	6.54	**6.28**
Mean		**11.90**	**12.02**	**12.12**	**12.01**	**11.30**	**11.78**	**12.05**	**11.71**	**6.18**	**6.37**	**6.55**	**6.37**	**5.80**	**6.15**	**6.38**	**6.11**
Average of varieties	Ph 8013	11.22	11.40	11.51	**11.38**	10.99	11.19	11.52	**11.23**	5.85	6.15	6.31	**6.10**	5.65	5.94	6.23	**5.94**
	G.T.54-9	11.32	11.53	11.58	**11.48**	10.84	11.29	11.53	**11.22**	5.96	6.33	6.45	**6.25**	5.73	6.16	6.40	**6.10**
	G. 84-47	12.07	12.37	12.68	**12.38**	11.31	11.65	12.14	**11.69**	6.39	6.77	7.08	**6.74**	6.01	6.33	6.70	**6.35**
Mean of potassium		**11.54**	**11.77**	**11.93**		**11.05**	**11.37**	**11.73**		**6.06**	**6.42**	**6.61**		**5.80**	**6.15**	**6.44**	

LSD at 0.5 level for:

Irrigation	**(A)**	**0.15**	**0.05**	**0.18**	**0.08**
Varieties	**(B)**	**0.19**	**0.19**	**0.11**	**0.13**
Potassium levels	**(C)**	**0.09**	**0.11**	**0.07**	**0.06**
(A) x (B)		**NS**	**NS**	**0.20**	**NS**
(A) x (C)		**NS**	**NS**	**0.12**	**0.11**
(B) x (C)		**0.16**	**NS**	**0.12**	**NS**
(A) x (B) x (C)		**NS**	**NS**	**NS**	**NS**

Table (7): Effect of irrigation, varieties, potassium levels their interactions on water consumptive use m^3/fed., water use efficiency on cane and sugar yields basis (kg cane stalk/m^3 water consumed) in 2008/2009 and 2009/2010 seasons.

Irrigation (A)	Sugar cane varieties (B)	Water consumptive use m^3/fed.								water use efficiency on cane yield basis (kg cane stalk/m^3 water consumed)								water use efficiency on sugar yield basis (kg sugar/m^3 water consumed)							
		2008/2009 season				2009/2010 season				2008/2009 season				2009/2010 season				2008/2009 season				2009/2010 season			
		Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean	Potassium kg K_2O fed. (C)			Mean
		48	72	96		48	72	96		48	72	96		48	72	96		48	72	96		48	72	96	
At 75-80% FC	Ph 8013	8790.4	8638.5	8238.6	**8555.8**	8810.5	8638.7	8524.0	**8657.7**	5.92	6.19	6.66	**6.25**	5.87	6.09	6.22	**6.06**	0.65	0.70	0.75	**0.70**	0.62	0.65	0.68	**0.65**
	G.T. 54-9	8500.8	8370.6	8140.5	**8337.3**	8560.7	8128.1	7890.6	**8193.1**	6.21	6.45	6.72	**6.46**	6.19	6.60	6.80	**6.55**	0.69	0.73	0.77	**0.73**	0.65	0.72	0.78	**0.72**
	G. 84-47	8210.7	8000.9	7890.6	**8034.1**	8260.6	8070.8	7880.4	**8070.6**	6.31	6.73	6.92	**6.65**	6.40	6.59	6.87	**6.61**	0.73	0.80	0.85	**0.79**	0.72	0.74	0.82	**0.76**
Mean		**8500.6**	**8336.7**	**8089.9**	**8309.1**	**8543.9**	**8279.2**	**8090.3**	**8307.1**	**6.14**	**6.45**	**6.78**	**6.45**	**6.14**	**6.42**	**6.65**	**6.40**	**0.69**	**0.74**	**0.79**	**0.74**	**0.66**	**0.70**	**0.76**	**0.71**
At 60-65% FC	Ph 8013	8330.4	8178.5	7778.0	**8095.6**	8354.8	8198.3	8088.7	**8213.9**	6.33	6.81	7.23	**6.78**	6.22	6.69	7.06	**6.65**	0.71	0.77	0.84	**0.77**	0.69	0.75	0.81	**0.75**
	G.T. 54-9	8060.8	7930.9	7755.9	**7915.9**	8115.3	7945.3	7840.4	**7967.0**	6.60	7.28	7.47	**7.11**	6.69	6.21	7.51	**7.13**	0.75	0.83	0.87	**0.81**	0.73	0.82	0.86	**0.80**
	G. 84-47	7840.7	7690.2	7534.5	**7688.5**	8005.5	7890.6	7806.7	**7900.9**	6.94	7.41	7.73	**7.36**	6.79	7.36	7.48	**7.21**	0.86	0.93	0.99	**0.92**	0.76	0.86	0.91	**0.84**
Mean		**8077.3**	**7933.2**	**7689.5**	**7900.0**	**8158.5**	**8011.4**	**7911.9**	**8027.3**	**6.62**	**7.16**	**7.47**	**7.08**	**6.56**	**7.08**	**7.35**	**6.99**	**0.77**	**0.84**	**0.90**	**0.83**	**0.73**	**0.81**	**0.86**	**0.80**
At 45-50% FC	Ph 8013	7950.4	7773.6	7653.5	**7792.5**	7980.1	7835.3	7727.2	**7847.5**	6.47	6.79	6.98	**6.74**	6.34	6.63	6.76	**6.57**	0.75	0.79	0.81	**0.78**	0.72	0.77	0.82	**0.77**
	G.T. 54-9	7740.3	7598.8	7492.9	**7610.7**	7690.8	7535.9	7427.7	**7551.5**	6.69	6.99	7.22	**6.94**	6.66	6.99	7.19	**6.94**	0.77	0.83	0.84	**0.81**	0.74	0.81	0.84	**0.80**
	G. 84-47	7560.7	7401.4	7275.4	**7412.5**	7590.9	7446.7	7358.4	**7465.5**	6.94	7.18	7.51	**7.21**	6.86	7.00	7.21	**7.02**	0.87	0.91	0.98	**0.92**	0.79	0.85	0.89	**0.84**
Mean		**7750.5**	**7591.3**	**7473.9**	**7605.2**	**7753.9**	**7605.9**	**7504.4**	**7621.4**	**6.68**	**6.98**	**7.23**	**6.97**	**6.61**	**6.87**	**7.05**	**6.81**	**0.82**	**0.84**	**0.88**	**0.84**	**0.77**	**0.81**	**0.85**	**0.81**
Average of varieties	Ph 8013	8357.1	8196.9	7890.0	**8109.6**	8381.8	8224.1	8113.3	**8239.7**	6.23	6.58	6.95	**6.58**	6.13	6.46	6.67	**6.42**	0.70	0.75	0.80	**0.75**	0.67	0.72	0.77	**0.72**
	G.T. 54-9	8100.6	7966.8	7796.4	**7953.7**	8122.3	7869.8	7767.6	**7919.9**	6.49	6.90	7.14	**6.84**	6.51	6.93	7.15	**6.86**	0.74	0.79	0.83	**0.79**	0.71	0.78	0.82	**0.77**
	G. 84-47	7870.7	7697.5	7954.6	**7711.7**	7952.3	7802.7	7681.8	**7812.3**	6.72	7.10	7.38	**7.06**	6.68	6.98	7.19	**6.94**	0.81	0.85	0.94	**0.87**	0.76	0.81	0.87	**0.81**
Mean of potassium		**8109.6**	**7953.7**	**7751.1**		**8152.1**	**7965.5**	**7854.2**		**6.48**	**6.86**	**7.15**		**6.43**	**6.78**	**6.49**		**0.75**	**0.81**	**0.85**		**0.71**	**0.77**	**0.82**	

(Table 4) and sugar recovery% (Table 6), which are the components of sugar yield. These results are in agreement with those reported by Abo El-Wafa *et al.* (2006), Bekheet (2006), Elamin *et al*. (2007), Mahmoud *et al.* (2008) and Mokadem *et al*. (2010).

Sugar yield/fed. was significantly affected by the interaction between irrigation regimes and cane varieties in the 1st season. Moreover, this trait was significantly influenced by the interaction between irrigation treatments x K fertilization levels in both seasons. Sugar recovery percentage and sugar yield/fed. were significantly affected by cane varieties x K levels interaction in the 1st season.

The highest sugar yield/fed. was produced by planting G.84-47 variety, irrigated at 60-65 % FC and fertilized with potassium at the rate of 96 kg K_2O/fed..

3.5. Water consumptive use

The results in Table (7) point out that sugarcane water consumptive use increased by 409.1 and 703.9 m^3 of water in the case of applying irrigation at 75-80% FC compared with that irrigated at 60-65% FC and/or 45-50% FC in the 1st season, corresponding to 279.8 and 685.7 m^3 water, in the 2nd one, respectively.

The highest water consumptive use was recorded by Ph.8013 variety which exceeded G.T.54-9 and G.84-47 sugarcane varieties by 193.4 and 436.3 m^3 water in the 1st season and 319.8 and 427.4 m^3 water, in the 2nd one, successively.

Raising potassium fertilization level 48 to 72 and 96 kg K_2O/fed. decreased the amount of water consumed by sugarcane plants by 155.9 and 358.5 m^3 water in the 1st season, corresponds 186.6 and 297.9 m^3 water, in the 2nd one, respectively. These results may be due to the fact that high concentrations of K element occur in meristematic tissues and stomatal guard cells and that potassium is involved in turgor control in specialized cells in the leaves (Anderson and Bowen, 1990), which may led to a reduction in the amount of water lost to the air by transpiration from plant foliage surface.

3.6. Water use efficiency:

The results in Table (7) indicate that water use efficiency (WUE) calculated on cane-yield basis reached its maximum value when irrigation was given to sugarcane at 60-65 % FC followed by that applied at 45-50% and 75-80% FC. These results could be due to the same tendency of cane yield obtained corresponding to the respective irrigation levels, respectively (Table 4). In the case of calculating of WUE on sugar-yield basis, it was found that WUE values correspond the 1st and 2nd irrigation treatments (applying irrigation at 70-75 % FC and 60-65 % FC) had the same trend of sugar yield (Table 6). However, WUE values were the highest when irrigation was applied at 45-50 % FC which might be attributed to that the amounts of water consumed by cane plants were the lowest at this regime (Table 7).

In conclusion, under the conditions of the present work, irrigating sugarcane variety G.84-47 at 60-65 % FC and fertilizing it with potassium at the rate of 72 kg K_2O/fed. cane are recommended to get the highest cane and sugar yields/fed.

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تأثير نقص رطوبة التربة والتسميد البوتاسى على العلاقات المائية وإنتاجية بعض أصناف قصب السكر

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ملخص

أُجريت تجربتان حقليتان بمحطة البحوث الزراعية بشندويل محافظة سوهاج فى موسمي 2009/2008 و2010/2009 لدراسة تأثير نقص رطوبة التربة والتسميد البوتاسى على العلاقات المائية وإنتاجية بعض أصناف قصب السكر . اشتملت الدراسة على 27 معاملة تمثل التوافقات بين مستويات ثلاثة عوامل هى الري (عند 75-80 و60-65 و45-50% من السعة الحقلية) وثلاثة مستويات من التسميد البوتاسى (48 و 72 و 96 كجم بو$_2$أ/فدان) وثلاثة أصناف من قصب السكر (الصنف التجارى جيزة 54-9 والصنفين المبشرين بى إتش8013 وجيزة 84-47). أستخدم تصميم القطع المنشقة مرتين، حيث وُضِعت معاملات الرى فى القطع الرئيسية والأصناف فى القطع المنشقة الأولى، ووزعت معدلات التسميد البوتاسى عشوائياً فى القطع المنشقة الثانية .

أوضحت النتائج أن رى قصب السكر عند 60-65% (متوسط 19 يوماً بين الريات) من السعة الحقلية نتج عنه أطول العيدان وأكثرها قطراً ، وأكبر عدد عيدان قابلة للعصر، وأعلى محصول عيدان وسكر/فدان – فى حين أعطى الرى عند 45-50% (متوسط 22 يوم بين الريات) من السعة الحقلية أعلى نسبة مئوية لكلٍ من البركس والسكروز وناتج السكر .

بلغ الإستهلاك المائى لقصب السكر 8307.1 و 7621.4 م3 /فدان عندما تم الرى عند 75-80% (متوسط 17 يوم بين الريات) و45-50% (متوسط 22 يوماً بين الريات) من السعة الحقلية على الترتيب - وسجل الصنف بى إتش8013 أعلى قيمة للإستهلاك المائى ، فى حين سجل الصنف جيزة 84-47 أعلى قيمة لكفاءة إستعمال للماء .

أدى رفع مستوى التسميد البوتاسى من 48 الى 72 ثم إلى 96 كجم بو $_2$أ للفدان الى زيادة تدريجية فى إرتفاع العيدان وقطرها وعدد العيدان القابلة للعصر ومحصولى العيدان والسكر والنسبة المئوية للبركس والسكروز وناتج السكر .

أظهر الصنف جيزة 84-47 تفوقاً معنوياً على الصنفين الآخرين فى عدد العيدان القابلة للعصر ومحصولى العيدان والسكر والنسبة المئوية للبركس والسكروز وناتج السكر.

يمكن تحت ظروف هذا البحث، التوصية بزراعة صنف القصب جيزة 84-47 مسمداً ب 72 كجم بو $_2$أ للفدان وريه عند 60-65% (متوسط 19 يوماً بين الريات) من السعة الحقلية للحصول على أعلى محصول من العيدان والسكر.

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