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EFFECT OF POTASSIUM FERTILIZATION ON RECOVERING DROUGHT HAZARDS ON SUGAR BEET CULTIVARS AT LATE SEASON

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ABSTRACT

Two field experiments were carried out during 2003 / 2004 and 2004/2005 growing seasons at Sakha Agric. Res. Station, Kafr El-Sheikh Governorate to study yield and quality characters and some water relations of two sugar beet cultivars; Mezanopoly and Top as affected by three irrigation regime treatments W_1 full irrigation which received planting plus seven irrigations, W_2 withholding one irrigation and w_3 withholding two irrigations at late season and three levels of potassium fertilization 24, 48 and 72 Kg K_2O /fed. It aimed at maximizing sugar beet production and water use efficiency. The experiments were conducted in split-split plot design, with four replicates. The observed results can be summarized as follows:

Water consumptive use was the highest with the treatment under full irrigation regime, where it was 63.99 and 66.92 cm in 2004 and 2005. While it was the lowest with the W_3 treatment, 51.34, and 53.35 cm in 2004 and 2005. The daily water consumptive use gradually increased to reach its maximum at Apr. 0.53 and 0.55 cm/day in 2004 and 2005 which was obtained with irrigation treatments of W_1 and W_2.

The highest values of W.U.E. for root yield 9.56 and (9.37 kg root beet/ m^3 water in 2004 and 2005) were obtained with Top cultivar under irrigation treatment W_3 and applying of 48 kg K_2O/fed and W.U.E. for gross sugar yield (1.16 and 1.30 kg sugar /m^3 water in 2004 and 2005) was found with Top cultivar under irrigation treatment W_2 and using 48 Kg K_2O /fed.

The highest values of root yield; 60.67 and 62.18 ton/ha in 2004 and 2005 were obtained with Top cultivar under irrigation treatment W_1 and adding 24 kg K_2O/fed. The highest values of sucrose 15.25 and 16.75 % in 2004 and 2005 and the highest values of Purity % (66.69 and 68.20 % in 2004 and 2005) were obtained with Mezano-poly variety under irrigation treatment W_1 and 57 Kg K_2O/ha. The greatest gross sugar yield; 7.57 and 8.56 ton/ha in 2004 and 2005 was obtained with Mezano-poly cultivar under irrigation treatment W_1 and adding 24 Kg K_2O / fed. in the two seasons. The highest values of white sugar yield (10.16 and 11.66 % in 2004 and 2005) were obtained with Mezano-poly cultivar under full irrigation and using 24 Kg K_2O /fed. The data indicated that optimum potassium decreased the hazards effects of drought on sugar beet crop at late growing season under the field studied conditions.

Keywords: Sugar beet crop, Potassium fertilization, Drought.

INTRODUCTION

The need for water by different plant species depend on how much moisture stress they are able to tolerate at any particular stage of plant growth. Economic irrigation requires application of water at the proper time and suitable amount to meet the needs of the growth crop, to prevent salt accumulation in the soil and to prevents the excessive waste of water.

Sugar beet could be extensively grown under Egyptian conditions because of its adaptation to a wide range of climate and tolerance to salinity and its productivity which makes it a good chash crop.

Increasing sugar production from land unit area is considered one of the important national target in Egypt to minimize sugar gap between production and consumption. Nowadays great effects are spent to increase sugar production by increasing production of sugar beet on presently cultivated land areas. One way of increasing production of sugar beet is by proper utilization of the irrigation water and increasing the efficiency of added NPK fertilizer. On the other hand, potassium is an essential element for plant growth not only in regard to its concentration in plant tissues, but also with respect to its physiological and biochemical functions.Potassium is necessary for activating the starch synthetase enzyme (Nitoses and Eveus, 1969). Sugar beet is reasonably drought tolerant with yield roughly proportional to total water use Coner *et al.*, (1980), Miler and Aarstad (1976), Nicholson *et al.*, (1974) and Winter, (1980).

Water stress in almost cases decrease fresh root of sugar beet weight Gouda *et al.*, (1993) and Abd El-Wahab and Nemeat Alla (2002). The current work was carried out to study the effect of K fertilization on recovering drought periods at late season on the yield and quality characters and some water relations of two sugar beet cultivars.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Sakha Agric. Res. Station during the two successive seasons of 2003 /2004 and 2004 / 2005. The work aimed to study the influence of three irrigation water regimes, W_1 full irrigation which received planting plus seven irrigations, W_2 withholding one irrigation at late season which received planting plus six irrigations and W_3 withholding two irrigations at late season which received planting plus five irrigations and three levels of potassium fertilization 24, 48 and 72 Kg K_2O/fed. on yield and qualit / of sugar beet (*Beta vulgarsl)*. Two cultivars of sugar beet were experimented which were Mezano-poly and Top.

Also some water relations of sugar beet were studied. The experiments were conducted in a split – split –plot design with four replicates. The main plots were randomly assigned to irrigation water treatments, the sub-plot was to two sugar beet cultivars and sub-sub plot was to three levels of potassium fertilization.

The area of each plot was 2.4 x 7= 16.8 square meter. All plots of the experiment were treated with 15 Kg P_2O_5 /fed. as a super phosphate fertilizer (15.5 % P_2O_5). 75 Kg N/fed. in the form of urea, 46 % N, was splited in two equal doses. The first dose was added at thinning (after 40 days from planting) and the second dose was after 40 days later. The K fertilizer in the form of K_2SO_4 (48% K_2O) was applied after 40 days from planting.

About 3 seeds were sown in each hill (20 cm between hills). Seeds were sown at 5th and 7th of Dec. in 2003 and 2004, respect vely. Plants were

thinned to one plant per hill after 40 days from planting. The sugar beet was harvested on 9th June , and 11th in 2004 and 2005.

Representative samples of sugar beet roots were taken at the same time of harvesting to determine sugar beet constituents such as sucrose %, white sucrose % , sugar losses %, purity %, K , Na and Alfa amino- N in me/100g fresh root of sugar beet. These parameters were determined polarimetorically by means of an automatic sugar polarimeter as described by McGinnus (1971). Gross sugar yield (ton/ha) was calculated from root yield (ton/ha) x sucrose %. White sugar yield (ton/ha) was calculated from root yield (ton/ha) x white sucrose %.

Water consumptive use (C.U.) by sugar beet plant was computed as the difference between soil moisture content in the soil samples taken before and after each irrigation. Moisture content in the soil samples were determined gravimeterically and calculated on oven dry basis. Transformation to water depths was computed with the aid of bulk density and thickness of soil layer. Water consumptive use (C.U.) in each irrigation was calculated according to (Israelson and Hansen, 1962) as follows :

$$C.U. = \sum_{i=1}^{i=n} \frac{Pw_2 - Pw_1}{100} \times D_{bi} \quad X\ Di$$

where :

C.U. = Water consumption use in cm.
Pw_2 = Soil moisture percent after irrigation in the i th layer
Pw_1 = Soil moisture percent before next irrigation in the i th layer
D_{bi} = Bulk density in g/cm^3 of the i th layer of soil
D_i = Depth of the i th layer of the soil, cm
i = Number of soil layer sampled in the root zone depth (D).

Water consumptive use was computed for all irrigation from planting until harvesting.

Water use efficiency (W.U.E.) was calculated according to Doorenbos and Pruitt (1977) as follows :

$$W.U.E. = \frac{\text{Root sugar yield (ton/ha)}}{\text{Actual evapotroanspiration } (m^3/ha)}$$

Statistical analysis:

Data are subjected to statistical analysis according to Snedecor and Cochran (1980). The soil characteristics of the two experimental sites are presented in Table (1).

Table (1): Some chemical and physical properties of the soil surface layer (0-30 cm) before planting

Year	Soil* pH 1 :2.5 susp.	Ec ds/m at 25°C	Soluble cations meq/L				Soluble anions me/L				Availble nutrients mg/Kg soil			O.M %	Total Carbonate %	S.P. %	Particle size Distribution %			Texture
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl-	SO_4-	N	P	K				Clay %	Silt %	Sand %	
2003	8.08	3.39	8.96	5.97	18.11	0.86	-	2.96	11.88	19.06	22	9	350	1.61	3.09	79	50.11	25.12	24.77	clayey
2004	7.92	2.91	6.90	5.95	15.90	0.35	-	3.25	9.90	15.95	19	11	340	1.80	2.95	81	51.50	26.00	22.5	Clayey

* 1 : 2.5 soil : water suspension

Field capacity, wilting point, available soil moisture and bulk density for the experimental fields are presented in Table (2).

Table (2) : Field capacity , wilting point, available soil moisture and bulk density for the soil of the experiments field.

Season	Soil layer (cm)	Field capacity (%)	Wilting point %	Available soli moisture(%)	Bulk Density (g/cm3)
2003-2004	0-15	43.41	23.40	20.01	1.22
	15-30	41.10	22.48	18.53	1.26
	30-45	39.70	21.55	18.15	1.36
	45-60	37.60	20.46	17.14	1.43
	Average	40.43	21.97	18.46	1.32
2004-2005	0-15	44.50	24.02	20.48	1.18
	15-30	41.46	22.70	18.76	1.25
	30-45	40.60	22.19	18.41	1.36
	45-60	37.79	20.41	18.38	1.42
	Average	41.09	22.33	18.76	1.30

RESULTS AND DISCUSSION

1- Yield of sugar beet cultivars as affected by irrigation water regimes and potassium fertilization levels :

Root yield:

Data in Table (3) show that in two years experiment root yield of sugar beet cultivars was affected significantly by potassium application and irrigation regimes. The highest values of root yield 60.67 and 62.18 ton/ha in 2004 and 2005 were obtained under full irrigation treatment when potassium was applied at 57 kg K_2O /ha and with Top cultivar. These results were supported by the data obtained by El-Yamani (1999) who concluded that the highest value of root yield of sugar beet was obtained under full irrigation treatment. The results also show that the root yield decreased under full irrigation treatment when potassium level was increased over 57 K_2O /ha. While it was increased when the potassium application levels was raised up to 114 kg K_2O/ha under withholding two irrigations at late season. It is interesting to indicate that the beneficial effect of added potassium at drought conditions as it strengthens plants against drought. These results were agreement with the data obtained by El-Yamanni (1999) and El-Kammah (1995). It is importance to note that the root yield of sugar beet was significantly higher with Top cultivar than with Mezanopoly cultivar at the different irrigation regime treatments and at the different levels of potassium fertilization. Khalifa *et al.*(1995) reported that yield and sugar yield of sugar beet significantly increased by increasing K-rates up to 114 kg K_2O/ha.

Shoot yield :

Data in Table (3) showed that shoot yield of sugar beet cultivars was affected significantly by potassium application and irrigation regimes. The

highest values of shoot yield 14.80 and 16.30 ton/ha in 2004 and 2005 were obtained under withholding on irrigation at late season treatment with Mezanoploy variety and by the application of 114 K_2O /ha in two seasons. The results show that shoot yield was affected significantly by potassium application . The effect of potassium in shoot yield was more pronounced with Mezanopoly cultivar than with Top cultivar under all irrigation treatments. Similar results were reported by Ibrahim *et al.*, (2002) who found that shoot yield of kawemira sugar beet cultivar was highly significant affected by potassiu n fertilization until 228.5 kg K_2O/ha.

Root/Shoot (Ratio) :

The results in Table (3) show that root /shoot (ratio) was affected significantly by potassium fertilization levels, irrigation regime treatments and with sugar beet cultivars. The highest values of root /shoot (ratio) 6.49 and 5.57 in 2004 and 2005 were obtained under withholding two irrigations at late season treatment, with Top cultivar and by application of 114 Kg K_2O/ha in the two seasons.

The results also show that the effect of potassium on root /shoot (ratio) of sugar beet cultivars was more pronounced under withholding two irrigations at late season treatment and with Top cultivar, than the other irrigation regime treatments. These results were concordance with results obtained by El-Yamani (1999) on Raspoly and Kaemira sugar beet cultivars.

2- Yield quality of sugar beet is affected by irrigation water regimes and potassium fertilization levels.

Sucrose percentage :

Data in Table (4) show that with two years experiment sucrose % was affected significantly by potassium application, irrigation regimes and with sugar beet cultivars. The highest values of sucrose % 15.25 and 16.75 % were obtained with Mezanopoly cultivar under full irrigation and by application of 57 kg K_2O /ha. Similar results were reported by Winter (1980), Carter *et al.* (1980) and Fuehring and Finker (1973) who found that water stress several weeks before harvest increased sucrose and juice purity percentage due to the dehyduration of sugar beet toops and roots.

Gross sugar yield :

The data in Table (4) show that with two years trial gross sugar yield was affected significantly by potassium application, irrigation regime treatments and with sugar beet cultivars. The maximum values of gross sugar yield 7.57 and 8.56 ton/ha in 2004 and 2005 were obtained with Mezanopoly cultivar, under full irrigation regime treatment and by application of 57 kg K_2O/ha in the two seasons. The results indicated that highest sugar yield was obtained where adequate water is available for the crop during the last weeks of the sugar beet growth period. These results are in agreement with those obtained by Ibrahim *et al.* (2002) who found that increasing the rates of potassium fertilization significantly increased the sucrose percentage whereas studing the yield and quality of Kawemera sugar beet cultivar as affected by the deferent periods of drought.

Table (3) : Effect of irrigation water regime and Potassium fertilization levels on root and shoot yields and root / shoot ratio of two sugar beet cultivars

Treatments		Rook yield (ton/ha)				Shoot yield (ton/ha)				Root / Shoot ratio			
		2003/2004		2004/2005		2003/2004		2004/2005		2003/2004		2004/2005	
Irrigation regime	K_2O Kg/ha	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy
W_1	57	60.76a	49.60a	62.18a	51.10a	11.94a	10.95a	13.44a	12.17a	4.51	4.53	4.63	4.20
	114	39.09c	34.25c	40.54c	35.75c	10.39b	7.55b	11.89b	9.04b	3.76	4.54	3.41	3.95
	171	50.03b	37.58b	51.53b	39.08b	8.60c	6.66c	9.85c	8.17c	5.82	5.64	5.23	4.78
W_2	57	38.28a	50.42a	39.66a	51.92a	6.36a	11.01b	7.86ab	12.25b	6.02	4.56	5.05	4.24
	114	30.08b	50.31a	31.58b	52.06a	6.99a	14.80a	8.24a	16.30a	4.30	3.40	3.83	3.19
	171	26.53c	42.33b	28.03c	43.83b	5.67b	11.05b	7.42b	12.54b	3.68	3.83	3.78	4.50
W_3	57	47.44a	34.92a	48.94a	36.42a	7.65a	5.56b	9.15a	6.81b	6.20	6.28	5.26	5.35
	114	48.06a	30.29b	49.56a	31.54b	7.40a	5.41b	8.90a	6.91b	6.49	5.60	5.57	4.56
	171	35.23b	30.13b	36.73b	31.63b	7.30a	6.88a	8.80a	8.38a	4.83	4.38	4.17	3.77

In a column under each w, means followed by a common letter are not significantly different at the 5% level by DMRT.

Table (4) : Effect of irrigation water regime and Potassium fertilization on sucrose %, gross sugar yield and purity % of two sugar beet varieties.

Treatments		Gross sugar (ton/ha)				Sucrose %				Purity %			
		2003/2004		2004/2005		2003/2004		2004/2005		2003/2004		2004/2005	
Irrigation regime	K_2O Kg/ha	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy	Top	Mezano ploy
W_1	57	7.35 a	7.57 a	8.46 a	8.56 a	12.11b	15.25a	13.61b	16.75a	50.7c	66.69a	52.2c	68.2a
	114	5.36 c	4.27 c	6.17 c	4.99 c	13.70a	12.45c	15.20a	13.95c	56.5b	55.80c	58.0b	57.30b
	171	6.80 b	4.94 b	7.78 b	5.73 b	13.60a	13.14b	15.10a	14.64b	61.9a	57.60b	63.4a	59.1b
W_2	57	5.06 a	6.13 b	5.83 a	7.09 b	13.20c	12.15c	14.70c	13.65b	61.3a	54.00b	62.8a	55.5ab
	114	4.07 b	6.45 a	4.74 b	7.45 a	13.50b	12.80a	15.00b	14.30a	59.5b	51.90c	61.0a	53.4b
	171	3.72 c	5.33 c	4.35 c	6.18 c	14.00a	12.60b	15.50a	14.10a	61.7a	55.78a	63.2a	57.28a
W_3	57	5.67 a	5.01 a	6.59 a	5.78 a	11.95b	14.36a	13.70b	15.86a	56.3b	63.50a	57.8a	65.0a
	114	5.73 a	4.10 b	6.66 a	4.75 b	11.93b	13.55b	13.43c	15.05b	52.8c	63.30a	54.3b	62.30b
	171	4.56 b	3.62 b	5.26 b	4.60 b	12.95a	13.05c	14.33a	14.55c	57.9a	55.60b	59.4a	57.10c

In a column under each w, means followed by a common letter are not significantly different at the 5% level by DMRT.

Purity % :

The results in Table (4) show that purity % was affected significantly by potassium application, irrigation regime treatments and with sugar beet cultivars over the two seasons. The highest values of purity 66.69 and 68.20 % in 2004 and 2005 were obtained with Mezano-poly cultivar, full irrigation regime and by application of 57 kg K_2O/ha. The results indicates that heavy potassium dressing often produce higher quality of sugar beet cultivars. Similar results were reported by Winter (1980), Carter *et al.* (1980) and El-Kammah (1995) who found that sugar purity increased with increasing K under the same water depletion.

White sucrose % :

Data in Table (5) show also that white sucrose percentage was affected significantly by potassium application, irrigation regime treatments and with sugar beet cultivars. The highest values of white sucrose 10.16 and 11.66% in 2004 and 2005 were obtained with Mezano-poly cultivar under full irrigation and 57 Kg K_2O/ha . Similar results were recorded by Ibrahim *et al.* (2002) and El-Kammah (1995) who found that white sucrose % significantly increased by increasing K fertilizer rates.

Sugar losses % :

The results in Table (5) Show that the highest values of sugar losses 6.16 and 7.16% in 2004 and 2005 were obtained with Mezano- poly cultivar with holding one irrigation at late season and by application of 114 kg K_2O /ha. Similar results were agreement with those obtained by of Carter (1985), Khalifa and Ibrahim (1995) and El-Rammady (1997).

White sugar yield :

The white sugar yield is an important yield parameter of sugar beet because of it is the final useful from of sugar that the consumer use. The results in Table (5) show that with two years trial white sugar yield was affected significantly by potassium application, irrigation regime treatments and with sugar beet cultivars. The highest values of white sugar yield 5.04 and 5.96 ton/ha in 2004 and 2005 were obtained with Mezano-poly cultivars, under full irrigation regime and by application of 57 Kg K_2O /ha. Similar results were reported by El-Kammah and Ali (1996) who found that the white sugar yield was increased by increasing K fertilizer rates up to 100 Kg K_2O/ha. Ibrahim *et al.* (2002) concluded that application of 228.5 K_2O/ha, with irrigation withholding 9 weeks before harvesting results in the highest root and sugar yields of sugar yield of sugar beet crop.

Concentration of K in fresh root (me/100g) :

The results in Table (6) clear that the concentration of K in fresh root was affected significantly by potassium application, irrigation regime treatments and with sugar beet cultivars. The highest values 8.11 and 9.61 me /100 g fresh root in 2004 and 2005 were obtained under withholding one irrigation at late season by application of 114 kg K_2O/ha and with Mezano poly cultivar in the two seasons. The obtained results were in general agreement with those of Carter (1980), Ibrahim (2002) and Kariem *et al.* (2002).

Table (5) : Effect of irrigation regime and potassium fertilization on white sucrose %, white sugar yield (ton/ha) and sugar losses % of two sugar beet cultivars

Treatments		White sucrose %				Sugar losses %				White sugar ton/ha			
Irrigation regime	K_2O Kg/ha	2003/2004		2004/2005		2003/2004		2004/2005		2003/2004		2004/2005	
		Top	Mezano poly	Top	Mezano poly	Top	Mezano poly	Top	Mezano poly	Top	Mezano poly	Top	Mezano poly
W_1	57	6.16c	10.16a	7.65c	11.66a	5.99a	5.19b	7.49 a	6.69 b	3.74b	5.04a	4.76b	5.96a
	114	7.78b	6.93c	9.28b	8.43c	5.95ab	5.50a	7.45 a	7.08 a	3.04c	2.37c	3.77c	3.01c
	171	8.42a	7.58b	9.92a	9.09b	5.89b	5.57a	7.39 a	7.07 a	4.21a	2.85b	5.11a	3.55b
W_2	57	8.10b	5.56c	9.60b	7.06c	5.10b	5.59c	6.60 b	7.09 b	3.10a	2.80c	3.81a	3.67b
	114	8.04b	6.64b	9.54b	8.14b	5.46a	6.16a	6.96 a	7.16 b	2.42b	3.34a	3.01b	4.24a
	171	8.63a	7.02a	10.13a	8.52a	5.37a	5.98b	6.87 a	7.48 a	2.29c	2.97b	2.84c	3.73b
W_3	57	6.73b	9.11a	8.20b	10.61a	5.33c	5.24b	6.83 c	6.74 b	3.19a	3.18a	4.01a	3.75a
	114	6.28c	5.58c	7.78 c	7.08c	5.63b	4.97c	7.13 b	6.47 c	3.02b	1.69c	3.86b	2.23c
	171	7.51a	7.26b	9.01 a	8.76b	5.96a	5.79a	7.46 a	7.29 a	2.65c	2.19b	3.31c	2.77b

In a column under each w, means followed by a common letter are not significantly different at the 5% level by DMRT.

Table (6) : Effect of irrigation regime and potassium fertilization of the concentration of K, Na and Amino-N in fresh root of two sugar beet cultivars

Treatments		K (me/100 g)				Na (me/100 g)				Alfa – amino-N (me/100 g)			
Irrigation regime	K_2O Kg/ha	2003/2004		2004/2005		2003/2004		2004/2005		2003/2004		2004/2005	
		Top	Mezano poly	Top	Mezano poly	Top	Mezano poly	Top	Mezano poly	Top	Mezano poly	Top	Mezano poly
W_1	57	6.86 b	6.86 b	9.25 a	8.36 b	6.63 a	5.81 c	8.13 a	7.31 c	8.12b	4.78 c	9.62b	6.28 c
	114	6.53 c	6.53 c	8.90 b	8.03 c	6.57 a	6.50 a	8.07 a	8.00 a	9.29a	7.62 a	10.79a	9.12 a
	171	7.29 a	7.29 a	7.79 c	8.79 a	6.43 b	6.37 b	7.92 b	7.87 b	5.71c	6.44 b	7.21 c	7.94 b
W_2	57	7.07 b	7.07 b	8.05 c	8.57 b	5.84 b	6.55 a	7.34 b	8.05 a	5.98c	6.67 c	7.48 c	8.17 c
	114	8.11 a	8.11 a	8.37 b	9.61 a	6.39 a	6.51 a	7.89 a	8.01 a	6.70b	9.10 a	8.20b	10.60a
	171	6.94 c	6.94 c	8.79 a	8.44 c	5.58 c	6.52 a	7.08 c	8.02 a	7.06a	7.20 b	8.56 a	8.70 b
W_3	57	6.65 b	6.65 b	8.04 c	8.15 b	6.36 b	5.99 b	7.86 b	7.49 b	4.44c	6.51 b	6.44 c	7.26 c
	114	6.58 b	6.58 b	8.26 b	8.08 b	6.57 a	5.25 c	8.07 a	6.75 c	8.00a	6.67 b	9.51 a	8.17 b
	171	7.37 a	7.37 a	8.60 a	8.90a	5.91 c	6.48 a	7.42 c	7.98 a	7.43b	7.90 a	9.00 b	9.40 a

In a column under each w, means followed by a common letter are not significantly different at the 5% level by DMRT.

Concentration of Na in fresh root (me/100g) :

Data in Table (8) show that the concentration of Na was affected significantly by potassium application and irrigation regime treatments. The highest values of Na 6.63 and 8.13 me/100 g fresh root in 2004 and 2005 were obtained by application of 57 Kg K_2O/ha, full irrigation and with Top cultivar in the two seasons. Similar results were reported by Ibrahim *et al.* (2002).

Concentration of Alfa – amino – N in fresh root (me/100g) :

The results in Table (6) show that the concentration of Alfa-amino- N was affected significantly by potassium application, irrigation regime treatments and with sugar beet cultivars. The highest values of α - amino N 9.29 and 10.79 me / 100g fresh root in 2004 and 2005 were obtained with Top cultivar, under full irrigation regime and by application of 114 Kg K_2O /ha in the two seasons. similar results were obtained by El-Yamani, (1999) who found that the concentration of Alfa – amino – N was affected significantly by potassium application, irrigation regime treatments and with sugar beet varieties (Kawamira and Raspoly).

Table (7) : Daily and monthly water consumptive use (cm) for two sugar beet cultivars under three different regime treatments

Irrigation	Rates	Months							Seasonal	
		Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Cm	M^3/ha
W_1	Monthly	4.42	5.58	5.80	13.64	15.90	15.50	3.15	63.99	6399
	daily	0.17	0.18	0.20	0.44	0.53	0.50	0.35	0.35	35
W_2	Monthly	4.42	5.58	5.80	13.64	15.90	9.61	2.61	57.56	5756
	daily	0.17	0.18	0.20	0.44	0.53	0.31	0.29	0.31	31
W_3	Monthly	4.42	5.58	5.80	13.64	15.90	7.75	2.25	51.34	5134
	daily	0.17	0.18	0.20	0.44	0.53	0.25	0.25	0.28	28
2004/2005										
W_1	Monthly	4.32	5.89	5.88	14.88	16.8	15.19	3.96	66.92	6692
	daily	0.18	0.19	0.21	0.48	0.56	0.49	0.39	0.36	36
W_2	Monthly	4.32	5.89	5.88	14.88	16.80	8.68	2.97	59.42	5942
	daily	0.18	0.19	0.21	0.48	0.56	0.28	0.27	0.32	32
W_3	Monthly	4.32	5.89	5.88	14.88	12.30	7.44	2.64	53.35	5335
	daily	0.18	0.19	0.21	0.48	0.41	0.24	0.24	0.29	29

Data of planting 5 / 12 / 2003 and 7 / 12 / 2004
Data of harvesting 11/ 6 / 2004 and 11/6/ 2005

3- Irrigation water relations :

Water consumptive use by sugar beet plant : Monthly and seasonal water consumptive use as affected by irrigation regime, K fertilization levels and with sugar beet cultivars are presented in Table (7). The results show that the highest values of water consumptive use 63.99 and 66.92 cm in 2004 and 2005 were obtained under full irrigation regime treatment. While the lowest values 51.34 and 53.35 cm in 2004 and 2005 were obtained withholding two irrigations at late seasons W_3. Whereas medium values 57.56 and 59.42 cm in 2004 and 2005 were obtained withholding one irrigation at late seasons W_2. From data obtained it was obvious that water consumptive use of sugar beet was increased with increasing the number of irrigation during the growing season of sugar beet crop. This findings concode these results obtained by El-Yammani, 1999.

Daily and monthly water consumptive use (cm) for sugar beet :

The average values of seasonal water consumptive use rate cm/day for beet plant in the two growing seasons were 0.35, 0.31 and 0.28 cm/day in 2004 and 0.36, 0.32 and 0.29 cm/day in 2005, for the treatments W_1, W_2 and W_3, respectively. The results show that the daily consumptive, use by sugar beet plant was low during the beginning of the season, then increased during crop development and reach its maximum at Apr. 0.53 and 0.56 cm/day in 2004 and 2005 which consider the critical period in the demeaned for water by sugar beet, then it is followed by dropping during ripening period June. Similar results were reported by Sayed *et al.*, (1998) and El-Yamani, 1999).

Water use efficiency (W.U. E.):

Water use efficiency values of root and grass sugar yields Kg /m^3 of water consumed as influenced by irrigation regimes, K fertilization levels and sugar beet cultivars were listed in Table 8. The results show that the maximum values of W.U.E. for root and gross sugar yields 9.56 and 9.37 kg root/m^3 water and 1.16 and 1.30 Kg gross sugar/ m^3 water in 2004 and 2005 respectively were obtained withholding two irrigations at late season by application of 114 Kg /ha and with Top cultivar. The results indicate that W.U.E. for root and gross sugar yields were more efficiency under withholding two irrigations at late seasons than at full irrigation and withholding one irrigation at late seasons. Similar results were reported by El-Kammah (1995), Abd El-Wahab *et al.*, (1996) Sayed *et al.*, (1998).

It can be concluded that adequate water and optimum potassium for the crop during the last weeks of the sugar beet period (Full irrigation treatment) resulted in higher root, shoot, gross sugar and white sugar yields. These parameters were more pronounced with Top cultivar. Whereas under soil moisture stress withholding two irrigations at late season the greatest values of sucrose %, purity % were obtained by heavy potassium dressing. Potassium fertilization replenish the reduction of Sugar beet yield resulted from the drought for a long period before harvesting Also, a pronounced increase in the water use efficiency under the same irrigation treatment.

Table (8) : Water use efficiency (W.U.E.) as affected by irrigation regime, Potassium fertilization and two sugar beet cultivars in 2003/2004 and 2004/2005 seasons.

Treatments		W.U.E. (Kg root/m^3 water)				W.U.E. (Kg Sugar /m^3 water)			
Irrigation regime	K_2O Kg/ha	2003/2004		2004/2005		2003 / 2004		2004 / 2005	
		Top	Mezano poly	Top	Mezano poly	Top	Mezano poly	Top	Mezano poly
W_1	57	9.48	7.75	9.35	7.69	1.15	1.18	1.27	1.29
	114	6.11	5.35	6.11	5.38	0.83	0.67	0.93	0.75
	171	7.82	5.87	7.75	5.88	1.06	0.77	1.17	0.86
W_2	57	6.65	8.76	6.74	8.82	0.88	1.07	0.99	1.20
	114	5.23	8.74	5.36	8.84	0.71	1.12	0.81	1.27
	171	4.61	7.35	4.76	7.44	0.65	0.93	0.73	1.05
W_3	57	9.24	6.80	9.26	6.89	1.10	0.98	1.25	1.09
	114	9.56	5.90	9.37	5.96	1.16	0.80	1.30	0.90
	171	6.86	5.87	6.95	5.98	0.88	0.76	0.99	0.87

W.U. E. Kg yield /m^3 water

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تأثير التسميد البوتاسى على تقليل أضرار الجفاف فى مراحل النمو المتأخرة على بنجر السكر

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أجريت تجربتين حقليتين فى المزرعة البحثية – محطة البحوث الزراعية بسخا – محافظة كفر الشيخ لدراسة تأثير ثلاثة نظم لمعاملات الرى (W_1) رى كامل تشمل ريه الزراعة بالإضافة إلى ٧ ريات ، (W_2) تعطيش ريه واحدة فى نهاية الموسم تشمل رية الزراعة بالإضافة إلى ٦ ريات ، (W_3) تعطيش ريتين فى نهاية الموسم تشمل ريه الزراعة بالإضافة إلى ٥ ريات ، وثلاثة مستويات من التسميد البوتاسى ٢٤، ٤٨، ٧٢ كجم بو٢أ / للفدان على المحصول وجودته لصنفى بنجر السكر توب وميزانوبولى من أجل تعظيم إنتاج المحصول والكفاءة الإستعمالية لمياه الرى.

أقيمت التجربة فى تصميم قطع منشقة مرتين مع أربعة مكررات ويمكن تلخيص النتائج المتحصل عليها كما يلى :

- أعلى إستهلاك مائى تم الحصول عليه تحت المعاملة رى كامل وكان ٦٣,٩٩ ، ٦٦,٩٢ سم فى عامى ٢٠٠٤ ، ٢٠٠٥ على التوالى بينما أقل قيمة إستهلاك مائى كانت تحت المعاملة تعطيش ريتين فى نهاية الموسم وكان ٥١,٣٤ ، ٥٣,٣٥ سم فى عامى ٢٠٠٤ ، ٢٠٠٥ على التوالى.
- زاد الإستهلاك المائى اليومى تدريجيا حتى وصل أعلى قيمة فى شهر إبريل ٠,٥٣ ، ٠,٥٦ سم / يوم فى عامى ٢٠٠٤ ، ٢٠٠٥ على التوالى ثم الحصول عليها من المعاملة (W_1) , (W_2) .
- أعلى كفاءة استعمالية لمياه الرى لمحصول الجذور ٩,٥٦ ، ٩,٣٧ كجم جذور / م٣ ماء فى عامى ٢٠٠٤ ، ٢٠٠٥ على التوالى تم الحصول عليها مع الصنف توب تحت المعاملة (W_3) وبإضافة ١١٤ كجم بو٢أ / هكتار. وكانت الكفاءة الإستعمالية لمياه الرى لمحصول السكر الخام ١,١٦ ، ١,٣٠ كجم سكر خام / م٣ ماء تم الحصول عليها مع الصنف توب تحت المعاملة (W_3) وبإضافة ١١٤ كجم بو٢أ / هكتار فى عامى ٢٠٠٤ ، ٢٠٠٥ على التوالى.
- كانت أعلى قيمة لمحصول الجذور ٦٠,٦٧ ، ٦٢,١٨ طن / هكتار فى عامى ٢٠٠٤ ، ٢٠٠٥ تم الحصول عليها مع الصنف توب تحت المعاملة (W1) وبإضافة ٢٤ كجم بو٢أ /فدان.
- كانت أعلى قيمة للنسبة المئوية للسكروز ١٥,٢٥ ، ١٦,٧٥ % فى عامى ٢٠٠٤ ، ٢٠٠٥ وكانت أعلى قيمة لنسبة النقاوة ٦٦,٦٩ ، ٦٨,٢٠ % فى عامى ٢٠٠٤ ، ٢٠٠٥ تم الحصول على هذه القيمة مع الصنف ميزانوبولى تحت المعاملة (W1) وبإضافة ٢٤ كجم بو٢أ /فدان.
- كانت أعلى قيمة لمحصول السكر الخام ١٠,١٦ ، ١١,٦٦ طن سكر خام / هكتار تم الحصول عليها مع الصنف ميزانوبولى تحت المعاملة (W1) وبإضافة ٢٤ كجم بو٢أه / فدان فى كلا الموسمين.
- كانت أعلى قيمة لمحصول السكر الأبيض ٥,٠٤ ، ٥,٩٦ طن سكر أبيض / هكتار فى عامى ٢٠٠٤ ، ٢٠٠٥ تم الحصول عليها مع الصنف ميزانوبولى تحت المعاملة (W1) وبإضافة ٢٤ كجم بو٢أ٥ / فدان.
- وقد أوضحت النتائج أن الإضافة المثلى من البوتاسيوم خفضت من التأثير الضار للجفاف فى المراحل المتأخرة من نمو بنجر السكر وذلك تحت ظروف الحقل التجريبية.