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EFFECT OF SOME GROWTH ACTIVATORS ON GROWTH AND YIELD OF SOME SUGAR CANE VARIETIES

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ABSTRACT

Two field experiments were performed at Kom Ombo Agricultural Research Station, Aswan Governorate , Egypt during 2009/2010 and 2010/2011 seasons, to study the effect of four growth activators and tap water as Control , Stimulate at the concentration of 1% , Agrispon at the concentration of 5cm / Litter and Quick grow at the concentration of 1%.) on growth and yield of three sugar cane varieties (Variety G.T.C_9, Variety G.47/84 and Variety pH80/13).

The obtained results indicated that sugar cane varieties significantly differed in stalk length, sucrose percentage, number of millable stalks / fed net cane yield /fed and sugar yield /fed in both seasons. On the contrary, they differed insignificantly in stalk diameter and purity percentage in both seasons. Variety G.T C9 gave the tallest stalk, while variety G.47/84 gave the highest sucrose percentage, but variety pH80/13 gave the highest net cane yield and sugar yield / fed in both seasons.

Results indicated that growth activators had a significant effect on all studied traits in both seasons. Sugar cane plants treated by stimulate as growth activator gave the tallest stalk, thickest stalk, greatest sucrose percentage, number of millable stalks / fed net cane yield and sugar yield / fed, while the highest values of purity percentage resulted from plants treated by Agrispon growth activators as compared with the other activators in both seasons.

Results revealed that the interaction effect between sugar cane varieties and growth activators was significant for all the studied characters in both seasons. Treating variety G.T. C_9 with growth activator stimulate gave the tallest stalk and purity percentage, while treating variety pH80/13 by stimulate gave the thicker stalk. However variety G. 47/84 gave the highest values of sucrose percentage, number of millable stalks / fed net cane yield and sugar yield /fed when it treated with stimulate activator compared to other treatments in both seasons.

Generally, it could be recommended that treating setts of sugar cane variety G.47/84 by stimulate as a growth activator gave the highest yields of net cane and sugar / fed at Kom Ombo, Aswan Governorate, Egypt.

Key words: *growth activators, growth and yield, varieties, sugar cane varieties.*

1. INTRODUCTION

Sugar cane (*Saccharum* sp. L) is considered the main crop for sugar production in Egypt and in the world. Nowadays, increasing sugar production through increasing unit area productivity is the first important step of the Egyptian strategy to bridge the jab between sugar production and consumption. Such increase is likely achieved by growing high yielding varieties combined by optimizing various agricultural practices *i.e.* seed treatment with some chemical substances such as growth activators to hasten seedling emergence and increasing the number and growth of seedlings which will lead to increasing millable cane and sugar yield.

Patil *et al.* (1977), Gascho *et al.*(1986), Singh and Singh (1993), Fergany (1997), Andyen *et al.* (1997) showed that varieties F156, Hoanam and My 55-14 produced significantly more edible biomass, sucrose%, stalk yield /ha and sugar yield/ha than the traditional variety POJ 30-16.

Also, El-Ghareib *et al.* (1999) reported that sugar cane varieties (G.T.54/9 and G.85/37) significantly differed in number of millable cane, stalk length, stalk fresh weight, stalk diameter, sucrose percentage, purity percentage, net cane

yield/fed and sugar yield/fed.

Buenaventura and Rosario (1978) showed that canes soaked in 75% coconut water and sprayed by Embark at 1.2 kg a.i./ ha gave the highest number of accumulated tillers. The former had the lowest and the latter had the highest percentage of tiller mortality. Also, they observed significant differences in the tiller survival and plant height of plants sprayed with Embark . Chaudry and Yousaf (2001) found that the highest stripped cane yield of 77.28 t-ha-1 was obtained with control treatment (untreated) followed by water soaked treatment (73.07 t/ha-1).Cane yield components like cane length , cane diameter and stripped cane weight significantly affected by soaking in micro nutrient solution .Sucrose and commercial cane sugar were maximum using 0.25% $Mnso_4$.

Therefore, the present investigation aimed to study the effect of some growth activators on growth and yield of some sugar cane varieties under Aswan Governorate conditions, Egypt.

2. MATERIALS AND METHODS

Two field experiments were performed at Kom Ombo Agricultural Research Station, Aswan Governorate during 2009/2010 and 2010/2011 seasons, to study the effect of four growth activators on growth and yield of three sugar cane varieties .The experimental treatments were as follows:

A – Sugar cane varieties:

The three sugar cane varieties studied were:

1- Variety G.T. C_9 2- Variety G. 47/84 3- Variety pH80/13

Setts of the three sugar cane varieties were soaked 12 houres before planting in growth activator solutions with the previously mentioned concentration for each activator.

The experiments were laid out in a randomize complete block design in factorial arrangement with three replications.

The plot area was $35m^2$ (5 ridges x 7m long x 1m width). Setts were planted by using one half drills of three budded sugar cane cuttings.

Physical and chemical analysis of the soil at the experimental sites in 2009/2010 and 2010/2011 seasons are shown in (Table 1).

The soil at the experimental site was prepared as usual for sugar cane crop. Phosphorus fertilizer was applied prior seed bed preparation at the rate of 60kg P_2O_5/fed as calcium superphosphate (15.5%P_2O_5). Potassium fertilizer was applied at the rate of 72 kg K_2O as potassium sulphate (48% K_2O) at 60 days after sowing .Nitrogen fertilizer at the rate of 200 kg N/fed in the from of Urea (46%N) was applied at two equal doses, the first dose was applied at 60 days after sowing and the second one at 120 days after sowing in both seasons.

All the other agronomic practices were followed as usually done for the sugar cane crop.

At harvest time after one year the plants were harvested from the middle four rows of each plot for measuring the following data:

1- Stalk length (cm), was measured from the soil surface to the visible dewlap.
2- Stalk diameter (cm), was measured at the middle part of the stalk.

List of pedigree for sugar cane varieties studied

Variety	Features	Origin	Source
G.T.54/9	N.Co. 310x F337/925 (P.S.A32xF861)	Giza	Selected from hybrid seeds from Taiwan
PH 80/ 13	CAC 71-312 x PH642227	Giza	Philippines
G.47/84	N.Co 310 x	Giza	Hybrid seeds

B- Growth activators:

The four growth activators used were as follows:

1- Control (tap water).
2- Stimulate (7% plant extract including plant hormones IAA, Cytokinen and Gebbrelllic acids) at the concentration of 1%.
3- Agrispon (plant extracts including Purine, Adinine and Zeatine) at the concentration of 5cm / Litre.
4- Quick grow (2% N + 3% K) at the concentration of 1%.

3- Sucrose percentage, was measured by sacharometer.
4- Purity percentage, was calculated according to the following formula:

$$\text{Purity \%} = \frac{\text{Sucrose \%}}{\text{Brix \%}} \times 100$$

5- number of millable stalks / fed
6- Net cane yield / fed (ton).
7- Sugar yield /fed (ton), estimated by multiplying net cane yield / fed by sucrose percentage.

The data were statistically analyzed as described by Gomez and Gomez (1984).

Table (1) : Physical and chemical analysis of the soil at the experimental sites in 2009/2010 and 2010/2011 seasons.

Season		2009/2010	2010/2011
Physical analysis	Fine sand	33.4	33.9
	Silt	32.5	31.5
	Clay	34.1	35.6
Soil texture		Clay Loom	Clay Loom
PH		6.6	7.2
N available (ppm)		26.0	27.31
Co3 Meq/100g		-	-
HCo3 Meq/100g		0.29	0.24
Cl Meq/100g		0.17	0.19
So4 Meq/100g		0.76	0.61
Ca Meq/100g		0.62	0.5
Mg Meq/100g		0.55	0.42
Na Meq/100g		0.41	0.25
K Meq/100g		0.23	0.21

3. RESULTS AND DISCUSSION

Average stalk length, stalk diameter, sucrose percentage, purity percentage, number of millable stalks/fed, net cane yield /fed and sugar yield /fed of three sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons are shown in Tables (2-8) .

The results show clearly that sugar cane varieties significantly differed in stalk length, sucrose percentage, number of millable stalks/ fed, net cane yield /fed and sugar yield/fed in both seasons. On the contrary, they differed insignificantly in stalk diameter and purity percentage in both seasons. Sugar cane variety G.T. C 9 gave the tallest stalks 278.8 and 277.1 cm, while variety G. 47/84 gave the highest sucrose percentage 19.3 and 19.7 %, but variety pH80/13 gave the highest number of millable stalks / fed (42075 and 40225 stalks), net cane yield /fed (42.0 and 42.7 tons) and sugar yield/ fed (7.45 and 8.13 tons) as compared with other studied varieties in 2009/2010 and 2010/2011 seasons, respectively.

The differences between sugar cane varieties in growth and yield characters may be attributed to its genetic variation. The increase in sugar yield /fed caused by variety pH80/13 might be attributed to the highest number of millable stalks / fed which led to increasing net cane yield / fed which led to increased sugar yield / fed. These

Table (2): Average stalk length (cm) of some sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons .

Sugar cane varieties	2009/2010 season				Mean	2010/2011 season				Mean
	Germination activators					Germination activators				
	Control	Stimulate	Agrispon	Quick grow		Control	Stimulate	Agrispon	Quick grow	
C9	237.0	309.7	271.7	296.7	278.8	263.0	296.7	281.7	268.3	277.4
47/84	246.7	295.3	272.0	272.3	271.6	247.7	289.7	285.7	265.3	269.9
Ph80/ 13	248.3	293.0	262.3	278.7	270.6	248.7	288.3	278.0	289.3	271.1
Mean	244.0	299	268.7	282.3		253.1	291.6	281.6	274.3	

LSD at 5% for:

Varieties(V)	5.5	4.8
Activators (A)	10.1	9.0
Interaction (VXA)	13.2	12.5

Table (3): Average stalk diameter (cm) of some sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons.

Sugar cane varieties	2009/2010 season					2010/2011 season				
	Germination activators				Mean	Germination activators				Mean
	Control	Stimulate	Agrispon	Quick grow		Control	Stimulate	Agrispon	Quick grow	
C9	2.6	2.7	2.5	2.7	2.7	2.2	2.5	2.4	2.6	2.4
47/84	2.6	2.7	2.7	2.6	2.7	2.1	2.4	2.3	2.5	2.3
Ph80/13	2.3	2.8	2.7	2.5	2.7	2.2	2.7	2.4	2.4	2.4
Mean	2.5	2.8	2.6	2.6		2.2	2.5	2.4	2.5	
LSD at 5% for:										
Varieties(V)					NS					NS
Activators (A)					0.1					0.1
Interaction (VXA)					0.2					0.2

Table (4): Average sucrose percentage of some sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons.

Sugar cane varieties	2009/2010 season					2010/2011 season				
	Germination activators				Mean	Germination activators				Mean
	Control	Stimulate	Agrispon	Quick grow		Control	Stimulate	Agrispon	Quick grow	
C9	17.6	19.6	19.0	19.8	19.0	18.1	20.4	19.1	20.1	19.4
47/84	17.9	20.1	19.8	19.4	19.3	18.0	21.3	19.6	20.0	19.7
Ph80/13	17.0	19.0	18.8	18.3	18.3	17.1	19.9	19.6	19.2	19.0
Mean	17.5	19.6	19.2	19.2		17.7	20.5	19.4	20.1	
LSD at 5% for:										
Varieties(V)					0.5					0.3
Activators (A)					0.3					0.3
Interaction (VXA)					0.9					0.7

Table (5): Average purity percentage of some sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons .

Sugar cane varieties	2009/2010 season					2010/2011 season				
	Germination activators				Mean	Germination activators				Mean
	Control	Stimulate	Agrispon	Quick grow		Control	Stimulate	Agrispon	Quick grow	
C9	83.7	89.3	87.1	88.6	86.6	85.5	90.5	90.1	88.4	88.6
47/84	81.2	88.3	89.0	84.8	85.8	84.0	88.1	89.0	88.1	87.3
Ph80/13	83.7	85.5	85.5	88.1	85.7	79.8	83.6	90.3	89.1	85.7
Mean	82.9	87.0	87.2	87.2		83.1	87.4	89.9	88.5	
LSD at 5% for:										
Varieties(V)					NS					NS
Activators (A)					4.0					4.0
Interaction (VXA)					6.0					5.5

Table (6): Average number of millable stalks / fed of some sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons .

Sugar cane varieties	2009/2010 season					2010/2011 season				
	Germination activators				Mean	Germination activators				Mean
	Control	Stimulate	Agrispon	Quick grow		Control	Stimulate	Agrispon	Quick grow	
C9	36200	43100	39400	42800	40375	37900	42800	38700	40600	40000
47/84	32500	46200	37800	40500	39250	31500	45300	37300	39500	38400
Ph80/13	39300	45000	42100	41900	42075	37400	44200	40900	38400	40225
Mean	36000	44766	39766	41733	40566	35600	44100	38966	39500	39541
LSD at 5% for:										
Varieties(V)					875					1110
Activators (A)					1570					1350
Interaction (VXA)					2010					1935

Table (7): Average net cane yield / fed (ton) of some sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons.

Sugar cane varieties	2009/2010 season					2010/2011 season				
	Germination activators				Mean	Germination activators				Mean
	Control	Stimulate	Agrispon	Quick grow		Control	Stimulate	Agrispon	Quick grow	
C9	33.9	43.9	35.3	42.7	39.0	37.1	44.2	46.3	37.9	41.4
47/84	31.6	53.5	32.9	40.5	39.6	30.9	49.7	32.6	37.7	37.7
Ph80/13	33.1	51.8	49.5	34.0	42.0	36.4	46.9	46.7	40.7	42.7
Mean	32.9	49.7	39.2	39.1		34.8	46.9	41.9	38.8	
LSD at 5% for:										
Activators (A)					0.9					0.7
Varieties(V)					2.1					1.8
Interaction (VXA)					2.7					2.2

Table (8): Average sugar yield /fed (ton) of some sugar cane varieties as affected by some growth activators in 2009/2010 and 2010/2011 seasons .

Sugar cane varieties	2009/2010 season					2010/2011 season				
	Germination activators				Mean	Germination activators				Mean
	Control	Stimulate	Agrispon	Quick grow		Control	Stimulate	Agrispon	Quick grow	
C9	5.96	8.60	6.71	8.45	7.43	6.72	9.02	8.84	7.61	8.01
47/84	5.66	10.75	6.51	7.86	7.70	5.56	10.59	6.39	7.54	7.52
Ph80/13	5.63	9.84	9.31	6.22	7.75	6.22	9.33	9.15	7.81	8.13
Mean	5.79	9.73	7.51	7.51		6.17	9.65	8.13	7.65	
LSD at 5% for:										
Varieties(V)					0.20					0.23
Activators (A)					0.28					0.50
Interaction (VXA)					0.61					0.65

results are in harmony with those of Singh and Singh (1993), Fergany (1997) and El-Ghareib *et al.* (1999).

Results recorded in Tables (2-8) indicate that growth activators had a significant effect on all studied traits in both seasons .Sugar cane plants treated by Stimulates as growth activator gave the tallest stalks (299.3 and 291.6 cm), thickest stalks (2.8 and 2.5 cm), highest sucrose percentage (19.6 and 20.5 %) , higher number of millable stalks / fed (44766 and 44100 stalks) greatest net cane yield / fed (49.7 and 46.9 tons) and sugar yield / fed (9.73 and 9.65 tons) , while the highest values of purity percentage (87.2 and 89.8 %) recorded with plants treated by Agrispon growth were activator as compared with other activators in 2009/2010 and 2010/2011 seasons, respectively.

The enhancement of sugar yield / fed owing to Stimulate activator may be due to the active and increment effect of Stimulate on stalk length , stalk diameter , sucrose percentage number of millable stalks / fed and net cane yield /fed (Tables 1, 2, 3 and 5), therefore sugar yield / fed increased .These results are in agreement with those of Chaudry and Yousaf (2001).

Results recorded in Tables (2-8) indicated that the interaction effect between sugar cane varieties and growth activators was significant on all studied characters in both seasons. Treated variety G.T. C9 with growth activator of stimulate gave the tallest stalk (309.7 and 296.7 cm) and purity percentage (89.9 and 90.5 %), while treating variety pH80/13 by stimulate gave the thicker at stalks (2.8 and 2.7 cm) compared to other treatments in 2009/2010 and 2010/2011 seasons, respectively. The interaction between variety G. 47/84 and stimulate activator gave the highest values of sucrose percentage (20.1 and 21.3 %) number of millable stalks / fed (46200 and 45300 stalks), net cane yield / fed (53.5 and 49.7 tons) and sugar yield /fed (10.75 and 10.59 tons) compared to other treatments in the first and second seasons, respectively.

Generally, it could be recommended that treating setts of sugar cane variety G. 47/84 by Stimulate as growth activators produced the greatest yields of net cane and sugar / fed at Kom Ombo, Aswan Governorate, Egypt.

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تأثير بعض منشطات النمو على نمو ومحصول بعض أصناف قصب السكر

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ملخص

أجريت تجربتان حقليتان فى محطة البحوث الزراعية بكوم إمبو بمحافظة أسوان فى موسمي ٢٠٠٩/٢٠١٠ & ٢٠١٠/٢٠١١ لدراسة تأثير أربع منشطات للنمو (ماء الصنبور كمعاملة للمقارنة , ستيميوليت بتركيز ١% ،أجريسبون بتركيز (٥ سم/ لتر وكويك جرو بتركيز ١%) على نمو ومحصول ثلاثة أصناف من قصب السكر(صنف G.T. C_9، صنف G.47/48 ، صنف PH80/13) .

أوضحت النتائج أن أصناف قصب السكر اختلفت معنويا فى طول الساق والنسبة المئوية للسكروز وعدد السيقان القابلة للعصير / فدان ومحصول السيقان / فدان ومحصول السكر / فدان فى كلا موسمي الدراسة . وعلى العكس من ذلك لم تكن هناك اختلافات معنوية بين الأصناف فى صفتي قطر الساق والنسبة المئوية للنقاوة فى كلا الموسمين . أعطى الصنف G.T. C_9أطول السيقان ولكن سجل الصنف PH 80/13 أعلى عدد من السيقان القابلة للعصير / فدان وأعلى محصول من السيقان / فدان وأعلى محصول سكر / فدان فى كلا موسمي الدراسة .

أظهرت النتائج بوضوح أن منشطات النمو أثرت معنويا على كل الصفات المدروسة فى كلا موسمي الدراسة . فقد أعطت معاملة النباتات بمنشط النمو ستيميوليت أعلى القيم لكلا من طول وقطر الساق والنسبة المئوية للسكروز وعدد السيقان القابلة للعصير / فدان ومحصول السيقان / فدان ومحصول السكر/ فدان ، بينما سجلت النباتات المعاملة بالأجريسبون أعلى قيمة للنسبة المئوية للنقاوة فى كلا موسمي الدراسة .

دلت النتائج بوضوح أن تأثير التفاعل بين الأصناف ومنشطات النمو كان معنويا على كل الصفات المدروسة فى كلا الموسمين . فقد أعطت معاملة الصنف G.T.C_9 بمنشط الإنبات ستيميوليت أعلى القيم لطول الساق والنسبة المئوية للنقاوة بينما أعطى التفاعل بين الصنف PH80/13 والاستيميوليت أعلى قيمة لقطر الساق وسجل التفاعل بين الصنف G.47/84 ومحفز الإنبات استيميوليت أعلى القيم للنسبة المئوية للسكروز وعدد السيقان القابلة للعصير / فدان ومحصول السيقان / فدان ومحصول السكر / فدان مقارنة بالمعاملات الأخرى فى كلا موسمي الدراسة.

عموما : توصي الدراسة أن نقع عقل التقاوي لصنف قصب السكر G. 47/84 فى محلول منشط النبات ستيميوليت بتركيز ١% أدى إلى زيادة محصول السيقان / فدان ومحصول السكر / فدان تحت ظروف محافظة أسوان.

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