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Effect of capillin foliar spray on productivity and quality of sugar beet varieties.

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ABSTRACT

Capillin produced from Artemisia monosperma family Asteraceae. Capillin has strong antifungal activity, and it is possibly antitumor. Capillin exhibits cytotoxic activity and causes apoptosis of certain tumor cells. The aim of the investigation is to study the effect of Capillin foliar spray on productivity and quality of sugar beet varieties under stress of salinity and lack of chemical fertilizers.In these trials no urea, no hormones no pesticides, no fungicides were used. More long shelf life of vegetables and fruits because plants treated with capillin are organic.

The experimental design was split-plot in (RCBD) with four replications. The main plots were devoted to varieties, whereas Capillin levels treatments were in sub-plots. The performance of four sugar beet varieties (cvs.); Samba, Pleno, Poly belga and Gloria was studied to estimate sugar yield and quality under the four Capillin levels .

The effect of Capillin levels was significant. Samba variety at 500 ppm Capillin level had the highest sugar extraction as well as sugar yield/fed. Using Capillin attained high productivity, ratio of sucrose productivity achieved up to 239 %.

KEYWORDS: Capillin, sugar percentage, yield, Salinity, sugar beet, *Beta vulgaris L.*

1. Introduction

Sugar beet is considered one of the most familiar sugar crops it is a temperate crop; however, it can be grown in a wide range of climatic level. Sugar beet contains sucrose up to 21% (Memon *et al.*, 2004). Sugar beet root yield varied between 5000-9000 kg/ha (Feddan (fed) = 0.42 hectare (ha)) and sugar content varied between 12 and 16% according to growing level and climate changes (Turgut, 2012). The importance of sowing sugar beet is not only confined to sugar production, but also to its wide adaptability to be grown in poor, saline, alkaline and calcareous soils. Also, increasing sugar productivity could be achieved through developing appropriate new technical package for growing sugar beet that included management agronomic practices to improve yield and quality of sugar beet (*Beta vulgaris L.*) such as fertilization program, which are the most important factors that affect the quantity and quality (Azzazy *et al.*, 2007). Capillin increases rate of mitosis of stem cells with consequent increase in leaf surface area which leads to more photosynthesis and more carbohydrate and energy production that counteracts high osmotic pressure of saline water. Capillin is a friend of environment, it is used as antimicrobial, antioxidant, cytotoxic, insecticidal, antivenomous, and many other pharmacological effects(Whelan and Ryan, 2004).. The imbalanced continuous use of synthetic fertilizers may result in micronutrient deficiencies, which is becoming a major, constrain for productivity, stability and sustainability of soil health. Thus, the advantages need to integrate use of inorganic, organic and biofertilizer in order to make optimum use of each and achieve balanced nutrient management for optimum crop growth (Selim and Al-Jawhara, 2017).

Keeping in consideration the previous researches that previously mentioned, the present study aims to evaluate the effect of Capillin as growth regulators on the growth rate of sugar beet varieties under North Sinai conditions.

2. Materials and Methods

Field experiment was carried out at the Experimental Farm, Faculty of Environmental Agricultural Sciences (FEAS), EL-Arish, Arish University, North Sinai Governorate during two winter seasons of 2017-18 and 2018-19. Sugar beet multi germ sugar beet Samba, Pleno, Polybelga and Gloria were sown on the fifth October in the first and second seasons (at rate of 4 kg fed^{-1}). Seeds were obtained from Sugar Crops Research Institute, Agric., Research Center, Ministry of Agric, Egypt. The experimental design was split-plot in randomized complete block design (RCBD) with four replications. Plot area was 8 m2 (1/500 fed-1) containing 4 rows of 4 m length (50 cm between rows and 20 cm between plants). Main plot were used varieties (Samba, Pleno, Polybelga and Gloria).

Sub- plot were used four Capillin treatments (Without Capillin (control), 250,375 and 500 ppm). Capillin were used as foliar application for 4 times in both seasons, One month intervals.

The first one after 60 days from sowing was spared. The previous crop was sowing in same area in the summer guar *(Cyamopsis tetragonoloba)* in the first and second seasons, respectively Seeds After one month, the plants were thinned to two plants per hill, and then were singled to one plant per hill after 45 days from sowing. Drip irrigation system was used. The experiment site was irrigated immediately just after seeding and thereafter, irrigation every 6 days by underground saline water (3550 ppm) pumped from a well from sowing was applied. All The other cultural practices were practiced as recommended for cultivation in North Sinai sugar beet. Before commencement experiments, Samples of soil sites and irrigation water were taken analysis according the methods described by (Richard, 1954).

Table 1: show the experiment treatments.

main plot	**sub plot**
Samba	Without Capillin (Control)
	Capillin (250 ppm)
	Capillin (375ppm)
	Capillin (500 ppm)
Pleno	Without Capillin (Control)
	Capillin (250 ppm)
	Capillin (375ppm)
	Capillin (500 ppm)
Gloria	Without Capillin (Control)
	Capillin (250 ppm)
	Capillin (375ppm)
	Capillin (500 ppm)
Polybelga	Without Capillin (Control)
	Capillin (250 ppm)
	Capillin (375ppm)
	Capillin (500 ppm)

Table 2: Chemical analyses of the irrigation water in season 2017/2018.

pH	**EC**		**Soluble ions (mq/l)**							
			Cations				**Anions**			
	d.sm^{-1}	**Ppm**	**Ca^{++}**	**Mg^{++}**	**Na^{+}**	**K^{+}**	**Cl^{-}**	**Hco$_3^{-}$**	**Co$_3^{--}$**	**So$_4^{--}$**
6.6	**5.55**	**3550**	17.22	19.17	17.29	2.31	37.51	5.21	-	13.27

Table 3: Chemical analyses of the irrigation water in season 2018/2019.

pH	**EC**		**Soluble ions (mq/l)**							
			Cations				**Anions**			
	d.sm^{-1}	**Ppm**	**Ca^{++}**	**Mg^{++}**	**Na^{+}**	**K^{+}**	**Cl^{-}**	**Hco$_3^{-}$**	**Co$_3^{--}$**	**So$_4^{--}$**
6.6	5.63	٣٥٥٠	19.21	18.87	14.87	2.14	39.51	2.41	-	13.09

During seed bed preparation, 60 kg P2O5per fed was added in the form of super phosphate (15.5% P2O5). Moreover, 60 kg N /fed was added in the form of ammonium nitrate (33.5% N) in two equal doses (after thinning, which was done at 4- leaves stage to one plant per hill) and four weeks later. Moreover, 50 kg K2O per fed was applied with the 1st nitrogen dose in the form of potassium sulfate (48 % K2O). Other agronomic practices were carried out as recommended in sugar beet fields.

The following characters were studied:

2. 1. Juice Quality:

At harvest, sample of thirty roots was taken at random from each plot and sent to Sugar factories to determine the following parameters:

2.1.1. Impurities characteristics:

2.1.1.1. Potassium and sodium percentages were determined in the digested solution using "Flamephotometer" according to the method described by Brown and Lilliand (1964) and Sirsat et al. (2017).

2.1.1.2. Alpha amino nitrogen percentage was determined using "Hydrogenation" method described by Carruthers et al. (1962) and Mousa et al. (2015). 2.1.2. Quality traits**.**

2.1.2.1 Sucrose percentage (Pol. %) was polar metrically determined in a lead acetate extract of fresh minced root according to AOAC` (1995) and Aly and Khalil (2017.**(**

2.1.2.2 Purity percentage, which was calculated according the following equation (Devillers) 1988, Abashadyet al.,2011**.**

Table 4. physical and Chemical analysis of the experimental soil during the two seasons.

Soil properties	Season 2017/2018	Season 2018/2019
Coarse sand %	60.28	58.26
Fine sand %	19.66	17.74
Silt %	11.39	14.36
Clay %	8.67	9.64
soil texture	Loamy sand	Loamy sand
Organic matter %	0.21	0.22
Chemical analysis in extraction soil		
a) Cations (mq/l)		
Ca++	3.01	3.03
Mg++	2.22	2.21
Na+	3.82	3.75
K+	0.45	0.51
b) Anion (mq/l)		
HCO3	2.12	2.11
Cl-	2.23	2.17
SO4	3.27	3.33
CaCO3 %	1.78	1.79
EC (ds/m) (1:5)	4.05	4.25
pH (1:2.5)	8.2	8.15

Purity% = 99.36 - 14.27 (Na + K+α-amino N)/sucrose %.

2.1.2.3. Sugar lost to molasses percentage (SM %) was determined using the following equation described by Devillers (1988) and Abashady et al. (2011):

Sugar lost to molasses (SM %) = 0.14 (Na+K) + 0.25 (α-amino N) + 0.50

2.1.2.4 Extractable sugar percentage, which was calculated according the equation of Dexter et al. (1967)and Abashadyet al. (2011) as follows:

Extractable sugar (%) = sucrose (%) - SM% – 0.6

2.1.2.5. Extractability percentage, which was determined the equation shown by Dexter et al. (1967) and Abashady et al. (2011):

Extractability (%) = Sugar extraction/Sucrose (%)

2.2. Sugar beet yields:

At harvest, all plants in each plot were uprooted, separated into roots and tops and weighed to estimate the following:

1. Root yield/fed (ton).
2. Sugar yield/fed (ton), which was calculated according to the following equation:

Sugar yield = root yield/fed (ton) x extractable sugar (%).

3. Sugar yield ratio, which was calculated according to the following equation:

Sugar yield ratio (%) =Sugar yield/control treatment x100

2.3. Statistical analysis:

Split-plot in randomized complete block design (RCBD) with four replications was used. The obtained data was subjected to statistical analysis of variance according to (Snedecor and Cochran, 1990). A combined analysis for the studied levels and seasons was done according to Gomez and Gomez (1984). The treatment means were compared using LSD values at 5% level of significance. Data analysis was performed by SPSS Computer Statistically Analysis Program V.20.

3. Results and Discussion

3.1. Juice quality

3.1.1.Characteristics of impurities:

It is well known from the industrial view that there is an inverse relationships between juice quality and the values of impurities in terms of percentages of potassium (K %), sodium (Na %) and α – Amino nitrogen. In the following we will study the values of impurities percentages to throw some light on juice quality.

3.1.1.1. Potassium percentage (K %) in roots:

Results in Table (5) show the effect of the four Capillin levels (Control, 250, 375 and 500 ppm) on root potassium percentage of four sugar beet varieties in 2017/2018 and 2018/2019 seasons. The results in Table (5) cleared that growing sugar beet at Control Capillin level resulted in roots contained significantly higher potassium percentage compared to those grown at 375 and 500 ppm. This result may

Table 5. Potassium percentage (K %) of four sugar beet varieties as affected by Capillin level in 2017/2018 and 2018/2019 seasons.

Season / Variety	2017/2018				2018/2019			
	Capillin levels							
	Control	250	375	500	Control	250	375	500 ppm
Samba	3.14	3.14	2.73	2.00	3.27	3.09	2.90	2.09
Pleno	**3.25**	3.16	2.82	3.08	**3.33**	3.04	2.76	2.04
Gloria	2.96	3.04	2.64	2.88	3.14	2.93	2.72	2.03
Polybelga	2.79	2.65	**2.56**	2.67	3.07	2.82	2.57	2.02
L.S.D at 0.05%								
Capillin levels (L)	0.130				0.080			
Varieties (V)	0.180				0.110			
L x V	0.310				0.190			

be attributed to potassium percentage content of soil. Similar results were reviewed by Abd El-Razek et al. (2006), Aly (2006), Allam et al. (2007) and Khalil et al. (2019.(

The maximum potassium (3.25 %) was recorded by Pleno sugar beet variety under control Capillin level, while the minimum potassium (2.00%) was reported by Samba sugar beet variety under 500 ppm Capillin level **.**

The results showed significant differences among the tested sugar beet varieties in potassium percentage in roots. Pleno variety recorded the highest value of this trait. On the other hand, samba variety had the lowest potassium percentage in the first season (2.00%), while Polybelga variety had the lowest potassium percentage in the second season (2.02%), when they treated with 500 ppm.capillin

The results are in agreement with those of Abd El-Kader (2011) stated that the effect of growth regulators application(Mepiquate Chloride (pix) and Indole acetic acid (IAA)) on decreasing potassium percentage under nitrogen fertilization equal 70 kg fed-1 and soil salinity equal 900 ppm at 200 ppm IAA potassium percentage (3.08%). Pix at (2000 ppm) under nitrogen fertilization equal 70 kg fed-1 and soil salinity equal 900 ppm attained (2.6190 %) potassium percentage. On the other hand, 500 ppm Capillin recoded the lowest potassium percentage (2.00%) under nitrogen fertilization equal 60 kg fed-1, soil salinity equal 2720 ppm and water of irrigation salinity equal 3550 ppm.

3.1.1.2. Sodium percentage (Na %) in roots:

Results in Table (6) show the effect of the four Capillin levels (Control, 250, 375 and 500 ppm) on sodium percentage in roots of four sugar beet varieties in 2017/2018 and 2018/2019 seasons. The results obtained pointed out that the values of sodium percentage significantly affected by different Capillin levels. These differences may be attributed to soil properties. It could be noted that values of sodium Percentage in 500 ppm Capillin level was lower than those of 250 and 375 ppm levels. This result is in agreement with Allam et *al*. (2007) and Khalil *et al.* (2019).

Table 6. Sodium percentage of four sugar beet varieties as affected by Capillin level in 2017/2018and 2018/2019 seasons.

Season / Variety	2017/2018				2018/2019			
	Capillin levels							
	Control	250	375	500	Control	250	375	500 ppm
Samba	2.76	2.38	1.52	1.22	2.38	2.22	2.15	1.84
Pleno	2.63	2.23	1.37	1.08	2.35	2.30	2.07	1.57
Gloria	2.56	2.22	1.25	1.01	2.25	2.02	1.94	1.55
Polybelga	2.78	2.37	1.54	1.22	2.44	2.28	2.15	1.73
L.S.D at 0.05%								
Capillin levels (L)	0.090				0.080			
Varieties (V)	0.010				0.110			
L x V	0.210				0.190			

Polybelga and Samba varieties recorded the highest value of this trait. On the other hand, Gloria variety had the lowest sodium percentage in roots. The highest value of this trait was recorded by sowing Polybelga variety at Control Capillin level**.**

The results are in agreement with those of Abd El-Kader (2011) who stated that the effect of growth regulators application pix and IAA on decreasing Sodium percentage. At 200 ppm IAA attained Sodium percentage (1.68%). Pix at 2000 ppm attained Sodium percentage (1.82 %). on the other hand, 500 ppm Capillin recoded the lowest Sodium percentage (1.01%).

3.1.1.3. Alfa amino –nitrogen root percentage:

Results in Table (7) show the effect of the four Capillin levels (Control, 250, 375 and 500 ppm) on Alfa amino-nitrogen percentage in roots of four sugar beet varieties in 2017/2018 and 2018/2019 seasons.

Results obtained cleared that there was a significant influence on the values of Alfa amino-nitrogen percentage due to the growing Capillin levels. The results revealed that roots of sugar beet grown at Control contained higher Alfa amino-nitrogen percentage compared to those grown at 250 and 375ppm. These findings are in accordance with Shalaby (2003), Allam et al. (2007) and Khalil et al. (2019). The maximum Alfa amino-nitrogen (%) was recorded by Pleno sugar beet variety under Control Capillin levels, while the minimum Alfa amino-nitrogen (%) was reported by Samba sugar beet variety under 375 ppm Capillin level in both seasons.

Table 7. Alfa amino -nitrogen percentage of four sugar beet varieties as affected by Capillin levels in 2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
	Capillin levels							
Variety	Control	250	375	500	Control	250	375	500 Ppm
Samba	2.21	1.87	1.79	1.96	2.25	2.05	1.85	2.05
Pleno	2.29	1.89	1.82	2.00	2.23	2.10	1.92	2.08
Gloria	2.06	2.04	1.85	1.98	2.16	2.00	1.87	2.01
Polybelga	2.26	2.17	2.00	2.14	2.23	2.10	1.95	2.09
L.S.D at 0.05%								
Capillin levels (L)	0.090				0.040			
Varieties (V)	0.130				0.050			
L x V	0.220				0.090			

3.1.2. Quality traits:

3.1.2.1. Sucrose percentage:

Results in Table (8) show the effect of the four Capillin levels (Control, 250, 375 and 500 ppm) on sucrose percentage of four sugar beet varieties in 2017/2018 and 2018/2019 seasons. The highest mean values of sucrose percentage was obtained from 500 ppm Capillin level for samba variety and polybelga in the first season and for samba variety in the second season (24.26, 24.33 and 24.92%), respectively. These differences in sucrose percentage may be due to the growing Capillin levels. Differences among varieties in sucrose percentage were significant (Table 8).

The results are in agreement with those of Abd El-Kader (2011) stated that the effect of growth regulators application pix and IAA on increasing sucrose percentage. At 200 ppm IAA sucrose percentage (17.7%). Pix at 2000 ppm attained sucrose percentage (22.13%). On the other hand, 500 ppm Capillin recorded the highest sucrose percentage (24.92%).

Table 8. Sucrose (%) of four sugar beet varieties as affected by Capillin levels in 2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
	Capillin levels							
Variety	Control	250	375	500	Control	250	375	500 ppm
Samba	21.34	22.78	23.67	24.26	21.33	22.43	22.99	24.92
Pleno	19.29	20.45	21.64	22.46	19.22	21.43	21.77	23.14
Gloria	19.00	20.15	20.54	21.56	19.19	20.22	20.83	22.75
Polybelga	20.88	22.35	23.77	24.33	20.51	21.52	21.75	23.26
L.S.D at 0.05%								
Capillin levels (L)	0.371				0.256			
Varieties (V)	0.525				0.363			
L x V	0.200				0.219			

There is a positive correlation between juice purity and sucrose content. These findings are in accordance with Ismail *et al*. (2007), Shalaby *et al*. (2008), El-Sheikh *et al*. (2009) and Khalil *et al*. (2019).The results in Table (9) show that purity percentage of root was significantly affected by the interaction between Capillin levels and varieties. These results could be indicating to the relative importance of the Capillin levels on juice quality. The results in table 9 pointed to a significant difference in purity percentage at the four Capillin levels. This result may be due to higher sucrose percentage (Table 8) and lower α- Amino N and potassium in root. This result is in agreement with the findings of El-Hinnawy *et al*. (2003), Aly (2006) and Khalil *et al*. (2019).

3.1.2.2. Sugar loss to molasses percentage:

Results in Table (10) show the effect of the four Capillin levels (Control, 250, 375 and 500 ppm) on percentage of sugar loss to molasses of four sugar beet varieties in 2017/2018 and 2018/2019 seasons. The results pointed out that growing under Capillin levels had a significant effect on percentage of sugar lost to molasses. Spray sugar beet at 500 ppm resulted in less sugar loss to molasses percentage, compared to that sown at Control and250 ppm Capillin levels. This result could be attributed to higher sucrose percentage (Table 8), lower α – Amino N in roots (Table 7), higher purity percentage (Table 9) at 500 ppm compared to those recorded at Control and 250 ppm. Pleno variety recorded the highest value of this trait. On the other hand, samba had the lowest sugar loss to molasses percentage.

Table 9. Purity % of four sugar beet varieties as affected by Capillin levels in 2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
	Capillin levels							
Variety	Control	250	375	500	Control	250	375	500 ppm
Samba	**93.94**	**94.73**	**95.72**	**96.31**	**94.07**	**94.68**	**95.08**	**95.94**
Pleno	**93.32**	**94.28**	**95.4**	**95.45**	**93.49**	**94.41**	**94.94**	**95.85**
Gloria	**93.67**	**94.19**	**95.37**	**95.47**	**93.75**	**94.46**	**94.89**	**95.85**
Polybelga	**94.01**	**94.77**	**95.7**	**95.82**	**93.97**	**94.59**	**94.98**	**95.78**
L.S.D at 0.05%								
Capillin levels (L)	0.150				0.104			
Varieties (V)	0.212				0.147			
L x V	375				0.256			

Table 10. Sugar loss to molasses% of four sugar beet varieties as affected by Capillin levels in 2017/2018 and 2018/2019 seasons.

Season	2017/2018				/2018/2019			
	Capillin levels							
Variety	Control	250	375	500	Control	250	375	500 ppm
Samba	**1.88**	**1.74**	**1.54**	**1.44**	**1.85**	**1.76**	**1.67**	**1.56**
Pleno	**1.90**	**1.73**	**1.54**	**1.58**	**1.85**	**1.77**	**1.66**	**1.53**
Gloria	**1.79**	**1.75**	**1.51**	**1.54**	**1.79**	**1.69**	**1.62**	**1.50**
Polybelga	**1.84**	**1.75**	**1.57**	**1.58**	**1.83**	**1.74**	**1.65**	**1.55**
L.S.D at 0.05%								
Capillin levels (L)	0.032				0.018			
Varieties (V)	0.045				0.025			
L x V	0.070				0.435			

3.1.2.3. Extractable sugar percentage:

Results in Table (11) show the effect of the four Capillin levels (Control, 250, 375 and 500 ppm) on extractable sugar percentage of four sugar beet varieties in 2017/2018 and 2018/2019 seasons.

Extractable sugar was significantly affected by studied Capillin levels. Foliar spray of sugar beet by 500 ppm Capillin resulted in higher mean value extractable sugar percentage compared to Control and 250 ppm Capillin levels in both seasons. This result could be attributed to higher sucrose percentage (Table 8), lower α – Amino N in roots (Table 7) and higher purity percentage (Table 9) at 500 ppm Capillin levels. These results are in line with those reported by Allam *et al* (2007) and Khalil *et al*. (2019). Samba variety recorded the highest value of this trait. On the other hand, Gloria variety had the lowest extractable sugar percentage. The difference among varieties in this trait may be due to Capillin levels. These results are in agreement with Ramadan and Nassar (2004), Hoffmann et al. (2002), Aly (2006), Nasser, (2006), Ismail et al. (2007),Refay (2010)and Khalil et al. (2019). The highest value of this trait was given by spraying Samba variety by 500 ppm in both seasons.

Table 11. Extraction sugar (%) of four sugar beet varieties as affected by Capillin levels in 2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
	Capillin levels							
Variety	Control	250	375	500	Control	250	375	500 ppm
Samba	**18.86**	**20.44**	**21.53**	**22.22**	**18.88**	**20.07**	**20.72**	**22.76**
Pleno	**16.79**	**18.12**	**19.50**	**20.28**	**16.77**	**19.06**	**19.51**	**21.01**
Gloria	**16.61**	**17.80**	**18.43**	**19.42**	**16.8**	**17.93**	**18.61**	**20.65**
Polybelga	**18.44**	**20.00**	**21.6**	**22.15**	**18.08**	**19.18**	**19.5**	**21.11**
L.S.D at 0.05%								
Capillin levels (L)			0.369		0.257			
Varieties (V)			0.521		0.363			
L x V			0.91 0		0.630			

3.1.2.4. Extractability percentage:

Results presented in Table (12) show the influence of four Capillin levels (Control, 250, 375 and 500 ppm) on extractability percentage of four sugar beet varieties. The results revealed that extractability percentage significantly affected by Capillin levels. 500 ppm Capillin level surpassed Control and 250 ppm Capillin levels in this respect. This result could be attributed to higher sucrose percentage (Table 8), lower α – Amino N in roots (Table 7) and higher purity percentage (Table 9) at 500 ppm Capillin levels. These results are in line with those obtained by Allam *et al* (2007) and Khalil *et al.* (2019).

Samba variety recorded the highest value of this trait. On the other hand, Gloria variety had the lowest extractability percentage. These results are in agreement with that given by Aly (2006), Ismail *et al*. (2007), Shalaby *et al*. (2008) and Zaki *et al*. (2018).

Table 12. Extractability % of four sugar beet varieties as affected by Capillin levels in2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
	Capillin levels							
Variety	Control	250	375	500	Control	250	375	500 ppm
Samba	**88.39**	**89.73**	**90.95**	**91.59**	**88.5**	**89.5**	**90.13**	**91.32**
Pleno	**87.06**	**88.62**	**90.1**	**90.28**	**87.24**	**88.93**	**89.64**	**90.82**
Gloria	**87.43**	**88.36**	**89.74**	**90.08**	**87.52**	**88.66**	**89.34**	**90.75**
Polybelga	**88.29**	**89.51**	**90.85**	**91.04**	**88.16**	**89.13**	**89.66**	**90.77**
L.S.D at 0.05%								
Capillin levels (L)	0.003				0.002			
Varieties (V)	0.004				0.003			
L x V	0.204				0.443			

3.2. – Yield:

3.2.1. Root yield (ton/fed.):

Results in Table (13) presented the effect of Capillin levels (Control, 250, 375 and 500 ppm) and sugar beet varieties and their interaction on root yield per feddan in 2017/2018 and 2018/2019 seasons.

Table 13. Root yield (ton/fed) of four sugar beet varieties as affected by Capillin levels in2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
	Capillin levels							
Variety	Control	250	375	500	Control	250	375	500 ppm
Samba	23.67	36.34	38.77	43.93	25.72	37.30	39.33	43.33
Pleno	21.25	35.44	36.40	42.03	20.54	34.53	38.84	40.84
Gloria	25.27	35.40	40.20	43.62	24.27	39.40	40.25	40.25
Polybelga	22.73	36.30	39.17	41.40	22.15	36.80	37.44	39.44
L.S.D at 0.05%								
Capillin levels (L)	0.262				0.320			
Varieties (V)	0.369				0.460			
L x V		0.643			0.790			

Average root yield ton/fed was maximized when sugar beet treated by 500 ppm Capillin level compared with that treated by 250 and 375 ppm Capillin.

The highest mean values of root yield (43.93 and 43.33 ton/fed) were found as a result of 500 ppm Capillin level for samba variety in the first and second seasons, respectively, while the lowest mean values of root yield (21.25 and 20.54 ton/fed), respectively, resulted from pleno variety under Control Capillin level **.**

Results in Table (13) show that sugar beet varieties differed significantly in root yield/fed, in both seasons

The results are in agreement with those of Abd El-Kader (2011) stated that the effect of growth regulators application pix and IAA on increasing root yield ton/fed. At 200 ppm IAA attained (28.3) root yield ton/fed. Pix at 2000 ppm attained (25.9) root yield ton/fed. On the other hand, 500 ppm Capillin recorded the highest (43.93) root yield ton/fed.

3.2.2. Sugar yield (ton/fed):

Results in Table (14) show sugar yield/fed of four sugar beet varieties as affected by the four Capillin levels (Control, 250, 375 and 500 ppm) in 2017/2018 and 2018/2019seasons. The results showed significant differences between the four Capillin levels in their effect on sugar yield/fed. It was found that sugar beet grown under 500 ppm attained the highest mean value of sugar yield/fed. These results are in line with Abd El-Razek *et al*. (2006), Aly (2006), Allam *et al*. (2007), Abd El-Razek (2012), El-Sheikh (2012) and Khalil *et al*. (2019). These results pointed to a significant variance among the tested sugar beet varieties in sugar yield ton/fed. Samba variety recorded the highest sugar yield per feddan producing (10.66) and (10.80) ton/fed in first and second seasons respectively. The superiority of Samba variety in sugar yield is results of producing highest root yield/fed and recording the greatest value of sucrose percentage and purity percentage in juice. The differences among the tested sugar beet varieties in sugar yield could be due to their root yield amount which is attributed to their quality structure i.e. (Na, K and Alfa amino-nitrogen percentage) and Capillin levels as a suitable to all of varieties**.**

Table 14. Sugar yield (ton/fed) of four sugar beet varieties as affected by Capillin levels in2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
Variety	Capillin levels							
	Control	250	375	500	Control	250	375	500 ppm
Samba	**5.05**	**8.28**	**9.18**	**10.66**	**4.85**	**8.37**	**9.04**	**10.80**
Pleno	**4.10**	**7.25**	**7.88**	**9.44**	**3.95**	**7.40**	**8.46**	**9.45**
Gloria	**4.80**	**7.13**	**8.26**	**9.40**	**4.66**	**7.97**	**8.38**	**9.16**
Polybelga	**4.75**	**8.11**	**9.31**	**10.07**	**4.54**	**7.92**	**8.14**	**9.17**
L.S.D at 0.05%								
Capillin levels (L)	1.09				1.13			
Varieties (V)	1.53				1.60			
L x V	2.50				2.79			

The interaction between Capillin levels and sugar beet varieties exhibited significant effects on sugar yield per feddan. Samba variety treated with 500 ppm Capillin level attained the highest mean value of sugar yield in both seasons**.**

The results are in agreement with those of Abd El-Kader (2011) stated that the effect of growth regulators application pix and IAA on increasing Sugar yield ton/fed. At 200 ppm IAA sugar yield ton/fed (5.02). Pix at 2000 ppm attained (5.75) Sugar yield ton/fed. On the other hand, 500 ppm Capillin recorded the highest (10.80) Sugar yield ton/fed.

3.2.3. Sugar ratio.

Results in Table (15) show sugar ratio of four sugar beet varieties as affected by the four Capillin levels (Control, 250, 375 and 500 ppm) in2017/2018 and 2018/2019seasons. The results showed significant differences between the four Capillin levels in their effect on sugar ratio. Growing sugar beet Pleno variety gave the highest ratio under 500 ppm Capillin level attained (230.24 and 239.24%) in both seasons, respectively, compared with Control in Table (8).

The results are in agreement with those of Abd El-Kader (2011) stated that the effect of growth regulators application pix and IAA on increasing sugar ratio. IAA at 200 ppm recoded (145.5%). Pix at 2000 ppm recoded (166.6%).On the other hand, 500 ppm Capillin recoded the highest sucrose ratio (239.24%).

Table 15. Sugar ratio four sugar beet varieties as affected by Capillin levels in 2017/2018 and 2018/2019 seasons.

Season	2017/2018				2018/2019			
	Capillin levels							
Variety		250	375	500	250	375	500	ppm
Samba		163.96	181.78	211.09	172.58	186.39	222.68	
Pleno		176.83	192.20	230.24	187.34	214.18	239.24	
Gloria		148.54	172.08	195.83	171.03	179.83	196.57	
Polybelga		170.74	196.00	212.00	174.45	179.30	201.98	
L.S.D at 0.05%								
Capillin levels (L)	11.09				11.13			
Varieties (V)	11.53				11.60			
L x V	22.50				22.79			

4. Conclusion

The increase of yields of top, root and sugar yields per fed due to increasing Capillin spray rate may be attributed to the favorable effects of Capillin on increasing leaf area per plant which led to increasing photosynthetic activity**.**

Generally, it could be recommended that fertilized sugar beet plants with 60 kg N/ fed and sprayed by Capillin at the concentration of 500 ppm increased root and sugar yields/ fed under soil salinity equal 2720 ppm and water of irrigation salinity equal 3550 ppm at Arish , North Sinai Governorate conditions.

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الملخص العربي

تاثير رش الكابللين علي انتاجية وجودة بعض اصناف بنجر السكر

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تستخلص مادة الكابللين من نبات العادر ويعتبر الكابللين من المواد المضادة للفطريات والسرطان ومن المواد التي تعمل كمنظم نمو للنباتات لانها تساعد علي انقسام وزيادة حجم الخلايا

أجريت تجربة حقلية بالمزرعة البحثية بكلية العلوم الزراعية البيئية بالعريش خلال موسمي الزراعة ٢٠١٧-٢٠١٨ و٢٠١٨-٢٠١٩ بهدف دراسة تأثير الرش بارع تركيزات من الكابللين على اربعة اصناف من بنجر السكر، علي النمو والمحصول والجودة لبنجر السكر واستخدم تصميم قطاعات كاملة العشوائية في ثلاث مكررات. أعطى الرش بالكابللين بتركيز ٥٠٠ جزء في المليون اعلى قيم للمواد الصلبة الذائبة الكلية فى الموسم الاول، ومحصول السكر فى الموسم الثانى، ونسبة السكروز ونسبة النقاوة فى الموسمين.

- اعطي الصنف سامبا على محصول السكر فى الموسم الثانى بينما أثر على نسبة النقاوة ونسبة السكروز والمواد الصلبة الذائبة الكلية فى الموسمين.
- أعطى التفاعل بين الصنف سامبا وتركيز الكابللين ٥٠٠ جزء في المليون تأثيراً معنويا محصول السكر فى الموسم الاول، وأثر على نسبة النقاوة ونسبة السكروز و المواد الصلبة الذائبة الكلية فى الموسمين.

نستخلص من النتائج المتحصل عليها أن زراعة بنجر السكر الصنف سامبا والرش بالكابللين بتركيز ٥٠٠ جزء في المليون يمكن أن يوصي بها لزيادة محصول وجودة بنجر السكر تحت ظروف الاراضى الرملية.