Sugar Beet Yield and Quality As Affected by Growth Regulators, Mineral and Bio-Fertilization in Nubaria Region

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ABSTRACT

Two field experiments were carried out at Nubaria Region during 2017/2018 and 2018/2019 seasons, to study the effect of mineral, biofertilizer and growth regulators on sugar beet plant var Kowemira. Two field experiments were conducted at a split plot design in three replications, where the main plots were assigned to growth regulators (water, Gibberellin, Kainten, Indole acetic acid=IAA), while the mineral and biofertilizer treatments were distributed at random with the sub plots i.e., (100% mineral-N (T1), 75% mineral- N + Cerealine(T2), 75% mineral N + Nitrobine(T3), 50% mineral N + Cerealine + Nitrobine (T4)). The results showed that there was significant effect of growth regulators, combination mineral and biofertilizer and their interaction. The results demonstrated that using growth regulators (IAA or Kainten) as foliar application with combination with 50% mineral fertilizer and biofertilizers (Cerealine and Nitrobine) or 75% mineral fertilizer with biofertilizer (Nitrobine) achieved the highest yield, yield components and quality of sugar beet crop.

Keywords: Sugar beet, growth regulators, mineral, biofertilizer, yield.

INTRODUCTION

The importance of sugar beet crop to agriculture is not confined only to sugar production, but also it is adapted to saline, sodic and calcareous soils. It may be coming in the same importance as main source of sugar production with sugar cane in Egypt. About 40 % of the world sugar production is obtained from sugar beet. Mineral, biofertilizer and growth regulators are considered as main factors affecting sugar production from sugar beet. Improving sugar beet yield and quality are the main goals of the Egyptian governmental policy to enhance sugar production in order to gradually cover the gap between sugar consumption and production by sowing the suitable variety under suitable conditions (FAO 2018).

Growth regulators regulate growth under normal or stress conditions, indole acetic acid (IAA) plays a main role in maintaining plant growth under stress conditions including salt stress. Growth regulators in sugar beet are used to improve biological values of seed and growth regulation and development of the vegetation to increase the yield of roots and their sugar content. The possibilities of impact of intensive formation of new leaves in spring period or deposition of reserve substances into root in autumn, increase of sugar content and sugar production were examined. Regulation of the process of creation of white sugar yield is very difficult. Double treatment with the growth regulators Atonik or Rastim 30 DKV increases root yield/ha by 3 to 5% and that it does not affect significantly the sugar content of sugar beet yield should be added by the fact that in yielding. The rate of respiration was reduced after treated sugar beet by the growth regulator. Its improved sugar production and it decreases storage losses of sugar before its technological processing by lower respiration during storage. Foliar application of IAA (15 mg/l) considerably ameliorated the adverse effects of salt on these plants (Gulnaz *et al*., 1999, Synkova *et al*. 2004, Ashraf, 2009, Egamberdieva, 2009, Guru Devi *et al*., 2012 and Tognetti *et al*., 2012).

Sugar beet root yield was increased due to seed inoculation treatments with biofertilizers over control treatment. Other yield and yield components were also increased especially by biofertilization. While, increases in yield and yield components were lower than or comparable to mineral fertilizer application. Finally, they showed that microbial inoculation of seeds with *Bacillus polymyxa and Bacillus megaterium var. phosphaticum*, alone or in dual combinations, may substitute costly NP fertilizers in sugar beet production (Cakmakci *et al*., 1999). Inoculation of sugar beet seeds with *Azotobacterin* significantly increased root length and diameter, TSS %, sucrose %, and root yield as well as sugar yield/fed. Also, Ramadan *et al.* (2003) revealed that biofertilization treatments had significant effect on root length, root diameter, root yield, top yield and sugar yield/fed. On the other wise, biofertilization treatments exhibited insignificant effect in sucrose and purity percentages (Sultan *et al.,* 1999).

Biofertilizers are microbial inoculants used for application to either seeds for increasing soil fertility with aim of increasing the number of such micro-organisms and to accelerate certain microbial processes. Such microbiological processes can change unavailable forms of nutrients into available ones that can be easily assimilated by plants (Subba, 2001). Seed inoculation of

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sugar beet with Cerealine or Phosphorine or both significantly affected root yield (Nemeat Alla, 2004). Biofertilizers recorded the highest root weight and diameter (Abou-Atteia and Abdelaal, 2007, Alaa *et al*. (2009) and Amin *et al*., 2013).

Bio-fertilizers are low cost, effective and renewable source of plant nutrients to supplement chemical or mineral fertilizers (Boraste *et al*., 2009). Biofertilizers are useful substitutes to inorganic fertilizers which improve soil quality and it is a natural product carrying living microorganisms derived from the root or cultivated soil (Attarde *et al*., 2012). Application of bio-fertilizer + 50% of the recommended dose N led to significant increase in diameter of the main stem, thickness of epidermis, cortex, secondary xylem, secondary phloem and pith diameter of flax plants. Anatomical studies of sugar beet root showed that bio-fertilizers increased the thickness of growth rings of sugar beet roots and average diameter of xylem vessels (Agamy *et al*., 2013).

Inoculation seeds of sugar beet with bio-fertilizer + 60 kg N/ha produced the highest mean values of root weight/plant and per hectare compared with fertilizing plants with 100 kg N/ha alone (Favilli *et al*., 1993).Yield and quality of sugar beet increased with fertilizing with 100 kg N/fed inoculated with mixture of bio-fertilizer and sprayed with macronutrients (Amin *et al*., 2013). Also, Abdelaal and Tawfik (2015) cleared the significant increase in root length, and root diameter as well as root yield/fed in treated sugar beet with combination of bio-fertilizers and 105 kg mineral N. However, Abdelaal (2015) pointed out that the combined treatments of Cerealine with 75% of the recommended dose of N and phosphorine, and cerealine with 50% of the recommended dose of N showed the highest values of root length and diameter, shoot and root fresh weights, TSS, and sucrose percentage as well as root and sugar yield/fed in both growing seasons in comparison with using each treatment alone as well as 100% mineral N. However, the highest values of sucrose% was resulted from treatment of phosphorine, and cerealine with adding 50% N.

The aim of this investigation is to study the effect of biofertilizer and growth regulators on sugar beet production under Nubaria region conditions.

MATERIALS AND METHODS:

Two field experiments were carried out at Nubaria region, Egypt during 2017/2018 and 2018/2019 seasons, to study the effect of mineral and biofertilizer besides growth regulators on sugar beet (*Beta vulgaris* L. var Kowemira) under Nubaria region.

The preceding summer crop was maize (*Zea mays* L.) in both seasons. Before planting, soil samples were randomly taken from the experimental site at a depth of 0 to 30 cm from soil surface and prepared for chemical analysis according to method described by Chapman and Pratt (1978) as shown in Table (1).

Table 1. Some physical and chemical properties of the experimental soil sites.

Soil properties	Season 2017/2018	Season 2018/2019
A- Mechanical		
Clay %	19.0	18.0
Silts %	24.5	24.2
Sands	56.5	57.8
Texture soil	**Sandy loam**	
B- Chemical analysis clay loam soil		
pH	8.1	8.3
Ec (ds/m)	2.9	1.8
Anions (meq/l)		
HCo_3^-	1.8	2.2
Cl^-	24.6	25.0
So_4^{--}	1.7	2.0
Cations (meq/l)		
Cu^{++} (meg/l)	5.0	4.9
Mg^{++} (meg/l)	6.2	5.9
Na^{++} (meg/l)	13.6	12.4
K^+ (meg/l)	1.5	1.6
Available nitrogen (ppm)	70.0	68.5
K (ppm)	5.50	5.8
Organic matter (%)	0.45	0.27

The soil of field experiments was prepared through two ploughing and leveling. Weeds were three times manually controlled by hand hoeing at three times. Common agricultural practices for growing sugar beet plant according to the recommendations of Ministry of Agriculture and land Reclamaintion were followed, except the factors under study.

Seeds of sugar beet variety Kowemira were obtained from Sugar Crop Research Institute, Agricultural Research Center, Giza. Seeds were hand sown as the usual dry sowing on one side of the ridge in hills 25 cm apart at the rate of 4-5 seed balls per hill on 9^{th} and 12^{th} October in the two successive seasons and harvested after 6 months.

The experimental design was split plot design in three replications, experimental unit was 10.5 m^2, included 5 ridges, 60 cm apart and 3.5 m long, (1/400 fed, fed= 4200 m^2). The main plots were occupied by growth regulators [water, Gibberellin (GA_3), Kainten (K), Indole acetic acid (IAA)] at the rate of 300 mg/l, while the sub plots were occupied by mineral and biofertilizer i.e. (100% mineral-N, 75% mineral- N + Cerealine, 75% mineral N + Nitrobine, 50% mineral N + Cerealine + Nitrobine).

The treatments of N were 100%, 75% and 50% of the recommended dose of N, where 100% N (150 kg urea), 75% N (112.5 kg urea) and 50% N (75 kg urea) as urea (46.5 % N), the amount of urea for each treatment was divided into two equal doses, the first application was done after thinning and the second one was carried out after 30 days from the first one.

Cerealine and Nitrobine as commercial products were obtained from Bio-fertilizer Unit, Agricultural Research Center (ARC), Giza, Egypt. Cerealine and Nitrobine is a free-living nitrogen-fixing bacterium, represents the best characterized genus of plant growth-promoting rhizobacteria. Sugar beet seeds inoculated with Cerealine and Nitrobine at rates of 400 g/fed for each. Before the inoculation, Arabic gum was used as an adhesive agent of bio-fertilizers to sugar beet seeds and then directly sown.

Mono calcium superphosphate (15.5 % P_2O_5) at the rate of 100 kg and potassium sulphate (48 % K_2O) at the rate of 50 kg K_2O/fed. The whole amount of calcium superphosphate was added before sowing during soil preparation, while potassium sulphate was added with the first dose of urea.

Plant fresh weight (g), root weight (g), root length (g), root diameter (cm), biological yield (t/fed), root yield (t/fed), top yield (t/fed), sugar yield (t/fed), TSS (%) as well as sucrose (%) were studied. Where, TSS and sucrose percentage estimated in fresh samples of sugar beet root by using Saccharometer according to the method described by A.O.A.C. (1995).

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split plot design as published by Gomez and Gomez (1984). Least Significant Difference (LSD) method was used to test the differences between treatment means at 5% level of probability. Correlations of the traits obtained from the experiment were computed using Costat program. All the statistical analyses were performed using CoStat V 6.4 (2005) for Windows.

RESULTS AND DISCUSSIONS

Results in Table (2) showed the effect of growth regulators, N- mineral- biofertilizer and their interaction on plant fresh weight (g), root weight (g)/plant, root length (cm), root diameter and biological yield (t/fed) during 2017/2018 and 2018/2019 seasons.

In regarding to effect of the growth regulators, the results in the same Table revealed that foliar application of indole acetic acid (IAA) recorded the highest mean values of plant weight (g), root weight (g)/plant, root length (cm), root diameter and biological yield (t/fed) followed by foliar application of Kainten then gibberellin as compared with control (water) which recorded the lowest ones in both seasons. This increase in these traits may be due to the vital role of IAA or Kainten in growth and yield of plant. These results are in the same line with those recorded by Ashraf (2009), Egamberdieva (2009), Guru Devi *et al*. (2012) and Tognetti *et al*. (2012).

Results in the same Table, also showed the significant effect of mineral- biofertilizer (N) where the highest mean values of plant weight (g), root weight (g), root length (cm), root diameter and biological yield (t/fed) with fertilizing sugar beet plants by 50% mineral N fertilizer + biofertilizer (Cerealine + Nitrobine) in both seasons. Meanwhile, 100% mineral fertilizer N or 75% mineral N + Cerealine gave the lowest ones in both seasons. Meanwhile, the highest mean value of plant weight obtained under the application of T2 and T4 treatments where the mean values of plant weight under those treatments were not great enough to reach the 5 % of significant as shown in Table (2). The increases of these traits could be due to role of combination of mineral and biofertilizer for crops and soil. These findings are in harmony with those obtained by Agamy *et al*. (2013), Amin *et al*. (2013), Abdelaal (2015), Abdelaal and Tawfik (2015). Biofertilizer use have emphasized that dual or combined inoculation showed higher productivity than single inoculation (Rajendran and Devaraj, 2004 and Shah *et al*., 2006).

Results in the that Table, again cleared that the interaction between growth regulators and combined of mineral fertilizer with biofertilizer (N) resulted a significant effect on plant weight (g), root weight (g)/plant, root length (cm), root diameter and biological yield (t/fed) in the first and the second seasons. This showed that growth regulators and combined of mineral fertilizer with biofertilizer (N) act dependently on the previous mentioned characters.

With regard the interaction effect, the results in Table (2) showed that the interaction between growth regulators and combined of mineral fertilizer with biofertilizer (N) resulted a significant effect on plant attributes of sugar yield in the first and second seasons.

Table 2. Plant attributes of sugar beet as affected by growth regulators and mineral N, biofertilizer and their interaction in both seasons.

Treatments		Plant fresh weight (g)		Root weight (g)		Root length (cm)		Root diameter (cm)		Biological yield (t/fed)	
		Season									
		2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019
A) Growth regulator											
Water		822.3	856.3	682.7	779.2	22.3	23.2	12.3	12.1	21.8	22.3
Gibberellin (GA_3)		1145.4	1197.5	819.8	853.8	26.5	26.5	12.3	12.6	24.8	24.3
Kainten (K)		1195.6	1250.0	894.2	880.3	22.3	25.4	12.4	12.3	25.9	25.7
IAA		1279.9	1322.9	897.2	926.3	30.0	29.4	14.4	14.0	27.3	27.2
LSD at 0.05		39.9	40.0	72.3	33.7	2.3	1.9	1.1	1.1	1.1	1.5
B) Mineral- biofertilizer (N)											
T1		1032.8	1077.8	802.8	855.3	24.4	24.6	11.6	11.7	22.9	23.4
T2		1166.3	1211.2	727.2	797.3	25.2	25.2	12.0	12.1	24.0	23.3
T3		1070.6	1112.9	852.7	882.1	26.5	26.4	13.3	13.0	25.9	25.8
T4		1173.6	1224.8	911.2	904.8	27.9	28.3	14.4	14.2	26.7	26.8
LSD at 0.05		67.1	58.7	67.2	47.4	2.0	1.6	1.4	0.9	1.2	1.2
Interaction											
A x B		*	*	*	*	*	*	*	*	*	*
Water (control)	T1	667.8	712.8	716.7	800.0	21.3	21.3	11.0	11.3	19.6	20.5
	T2	753.7	798.3	483.3	683.3	23.3	24.0	12.0	12.0	21.7	22.9
	T3	883.0	928.0	947.3	883.3	22.3	23.3	13.0	12.0	23.6	23.0
	T4	984.7	986.0	586.6	750.0	22.0	24.0	13.0	13.0	22.1	22.9
Gibberellin (GA)	T1	1188.7	1233.7	800.0	843.3	25.0	24.7	11.3	12.0	22.3	22.8
	T2	1323.3	1368.3	738.3	783.3	29.7	28.7	10.3	10.7	24.8	21.9
	T3	1138.8	1183.8	722.0	871.7	25.7	26.7	13.0	12.7	25.0	25.8
	T4	1468.8	1505.8	1018.7	916.7	25.7	26.0	14.3	15.0	26.8	26.4
Kainten (K)	T1	1326.8	1371.8	816.7	870.0	23.7	25.0	10.3	10.4	24.2	24.4
	T2	1566.7	1611.7	964.3	907.3	22.3	21.7	12.0	12.0	25.1	24.0
	T3	988.3	1026.0	876.3	865.0	28.7	28.4	13.9	13.8	26.0	26.6
	T4	900.7	990.3	931.3	878.7	26.3	26.5	13.5	13.1	28.3	27.8
IAA	T1	948.0	993.0	877.7	908.0	26.7	25.4	13.8	13.1	25.9	26.0
	T2	1021.3	1066.3	722.7	815.0	25.2	26.4	13.8	13.7	24.5	24.5
	T3	1272.2	1313.7	865.0	908.3	30.5	29.3	13.2	13.1	28.8	27.8
	T4	1340.2	1417.0	1111.3	1073.7	37.5	36.7	16.7	16.0	29.6	30.1
LSD at 0.05		134.3	117.4	134.4	94.8	4.0	3.2	2.9	1.9	2.4	2.3

T1 100% mineral N (150 kg Urea=70 kg N).
T2 75% mineral N + Cerealine.
T3 75% mineral N + Nitrobine.
T4 50 % mineral N + Cerealine + Nitrobine.

- * : significant at 0.05 level of probability.

Where, foliar application of IAA or Kainten (K) with application of combined 50% mineral fertilizer (N) and inoculation seed by T4 (Cerealine and Nitrobine) achieved the highest value of these traits except plant weight with T2 which gave the highest ones in both seasons of this our study.

The obtained results in Table (3) showed the effect of foliar application of growth regulators, N- mineral + biofertilizer and their interaction on root yield (t/fed), top yield (t/fed), sugar yield (t/fed), total soluble solid (TSS%) and sucrose (%) during 2017/2018 and 2018/2019 seasons.

Table 3. Plant attributes of sugar beet as affected by growth regulators and mineral N, biofertilizer and their interaction in both seasons.

Treatments		Root yield (t/fed)		Top yield (t/fed)		Sugar yield (t/fed)		TSS (%)		Sucrose (%)	
		Season									
		2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019
A) Growth regulator											
Water		17.5	18.1	4.3	4.2	3.1	3.2	20.3	19.3	17.6	17.5
Gibberellin (GA_3)		20.0	19.7	4.8	4.6	3.6	3.5	23.1	22.3	17.7	18.0
Kainten (K)		20.4	20.7	5.5	5.0	3.7	3.8	22.4	22.0	17.5	18.3
IAA		21.5	21.6	5.8	5.6	3.9	4.0	22.6	21.9	18.6	18.7
LSD at 0.05		0.8	1.7	0.8	0.3	0.3	0.4	1.6	1.0	0.7	0.5
B) Mineral- biofertilizer (N)											
T1		18.1	18.7	4.8	4.7	3.2	3.2	20.6	19.9	16.9	17.1
T2		18.8	18.5	5.2	4.8	3.4	3.4	22.3	21.7	18.0	18.5
T3		20.7	20.8	5.2	5.0	3.7	3.8	21.7	20.7	17.7	18.5
T4		21.7	21.9	5.0	4.9	4.1	4.0	23.8	23.1	19.0	18.4
LSD at 0.05		1.1	1.1	0.5	0.4	0.3	0.3	1.4	1.3	0.7	0.6
Interaction											
A x B		*	*	*	*	*	*	*	*	*	*
Water (control)	T1	16.4	17.0	3.2	3.5	2.7	2.6	18.3	18.3	16.2	15.7
	T2	17.4	18.7	4.3	4.2	3.1	3.4	20.0	19.3	17.5	18.0
	T3	18.7	18.3	4.9	4.7	3.3	3.3	19.7	17.7	17..9	18.3
	T4	17.5	18.4	4.6	4.5	3.3	3.3	23.0	21.7	19.0	17.8
Gibberellin (GA)	T1	17.5	18.0	4.8	4.8	3.1	3.1	22.0	21.3	16.7	17.4
	T2	19.9	17.5	4.9	4.4	3.4	4.0	22.7	22.3	16.8	17.8
	T3	20.3	21.0	4.7	4.8	3.7	3.9	22.7	22.0	18.0	19.2
	T4	22.2	22.2	4.6	4.2	4.3	3.9	25.0	23.3	19.3	17.3
Kainten (K)	T1	18.5	19.2	5.7	5.2	3.4	3.2	22.0	21.7	16.3	16.8
	T2	19.0	18.7	6.1	5.3	3.4	3.6	23.3	22.7	18.0	19.0
	T3	20.3	21.7	5.7	4.9	3.5	4.0	22.0	21.3	17.2	18.2
	T4	23.7	23.0	4.6	4.8	4.4	4.4	22.2	22.2	18.7	19.2
IAA	T1	20.2	20.6	5.7	5.4	3.8	3.8	20.0	18.3	18.5	18.3
	T2	18.9	19.0	5.6	5.5	3.7	3.6	23.1	22.3	19.5	19.0
	T3	23.3	22.3	5.5	5.5	4.2	4.1	22.3	21.9	17.8	18.2
	T4	23.3	24.0	6.3	6.1	4.2	4.4	25.0	25.0	18.7	19.2
LSD at 0.05		2.2	2.1	0.9	1.0	0.6	0.5	2.7	2.6	1.5	1.1

T1 100% mineral N (150 kg Urea=70 kg N).
T2 75% mineral N + Cerealine.
T3 75% mineral N + Nitrobine.
T4 50 % mineral N + Cerealine + Nitrobine.

- * : significant at 0.05 level of probability.

In respect to foliar application of growth regulators effect, the results revealed that foliar application of indole acetic acid (IAA) achieved the highest mean values of root yield (21.5 and 21.6 t/fed), top yield (5.8 and 5.6 t/fed), sugar yield (3.9 and 4.0 t/fed), total soluble solid (TSS%) (22.6 and 21.9 %) and sucrose (18.6 and 18.7 %) followed by foliar application of Kainten then gibberellin as compared with control (water) which gave the lowest ones in both seasons. This increase in these traits may be due to the vital role of IAA or Kainten or gibberellin for crop yield. These results are in the same line with those results were recorded by Ashraf (2009), Egamberdieva (2009), Guru Devi *et al*. (2012) and Tognetti *et al*. (2012).

The results in the same Table cleared the significant effect of combination of mineral N fertilizer and biofertilizer (N), where fertilizing sugar beet plants by 50% mineral N fertilizer + biofertilizer (Cerealine + Nitrobine) recorded the highest mean values of root yield (21.7 and 21.9 t/fed), top yield (5.0 and 4.9 t/fed), sugar yield (4.1 and 4.0 t/fed), total soluble solid (TSS) (23.8 and 23.1 %) and sucrose (19.0 and 18.4 %) followed by application of combination of 75% mineral fertilizer with Nitrobine in both seasons. Meanwhile, 100% mineral fertilizer N recorded the lowest ones in both seasons. The increases of these traits could be due to the role of combination of mineral and biofertilizer for crops and soil. These findings are in harmony with those obtained by Agamy *et al*. (2013), Amin *et al*. (2013), Abdelaal (2015), Abdelaal and Tawfik (2015). However, Cakmakci *et al*. (2001) confirmed that Cerealine caused an increase in TSS%, sucrose% and sugar yield/fed. Biofertilizer use have emphasized that dual or combined inoculation showed higher productivity than single inoculation (Rajendran and Devaraj, 2004 and Shah *et al*., 2006).

Cerealine and Nitrobine are bio-fertilizers which contain one or more of the previous N- fixing bacteria. They are known for fixing atmospheric nitrogen and benefit host plants by supplying growth hormones and vitamins. Biofertilizers play a crucial role in the reduction of in organic fertilizers and its utilization. There has been considerable progress during the recent past in the development of biofertilizers production technology and has been established to some extent as an efficient tool for increasing the trees and plants yield. (Jamaluddin, 2002).

With regard the interaction effect, the results in Table (3) showed that the interaction between growth regulators and combined of mineral fertilizer with biofertilizer (N) resulted a significant effect on yield and its component of sugar yield in the first and second seasons. Where, foliar application of IAA or Kainten (K) with application of combined 50% mineral fertilizer (N) and inoculation seed by biofertilizer (Cerealine and Nitrobine) achieved the highest value of root yield (t/fed), top yield (t/fed), sugar yield (t/fed), total soluble solid (TSS%) and sucrose (%) in both seasons of this our study.

CONCLUSION

The results of this investigation revealed that the foliar application of growth regulators (IAA or Kainten) with combination between 50% mineral fertilizer and biofertilizers (Cerealine and Nitrobine) or 75% mineral fertilizer with biofertilizer (Nitrobine) to achieve the highest yield, yield components and quality of sugar beet crop variety Komera at Nubaria region.

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الملخص العربي

إنتاجية وجودة بنجر السكر تأثراً بمنظمات النمو والتسميد الكيماوي والحيوي في منطقة النوبارية

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أجريت هذه الدراسة بطريق مصر – الأسكندرية الصحراوي الكليو ٧١ – النوبارية. لدراسة تأثير منظمات النمو والتسميد الكيماوي الحيوي النتروجيني على صفات المحصول والجودة لصنف بنجر السكر (كواميرا) خلال موسمى الزراعة ٢٠١٧/٢٠١٨ و ٢٠١٨/٢٠١٩.

تم تنفيذ التجارب في التصميم التجريبي القطع المنشقة مرة واحدة ووزعت المعاملات كالتالي:

١- منظمات النمو (ماء وحمض الجبرلين والكاينتين وأندول حمض الخليك) وتم توزيعها عشوائيا في القطع الرئيسية بمعدل ٣٠٠ مللجم/لتر.

٢- التسميد المعدني والحيوي: (١٠٠ معدني و٧٥% معدني + سريالين و٧٥% معدني + نيتروبين، ٥٠% معدني + سريالين + نيتروبين) وتم توزيعها عشوائيا في القطع الفرعية.

وكان ميعاد الزراعة في ٩، ١٢ اكتوبر خلال موسمي الدراسة على التوالي، وزرعت النباتات على مسافة ٢٥ سم والمسافة بين الخطوط ٦٠ سم، اجريت العمليات الزراعية الأخري على حسب توصيات وزارة الزراعة للمنطقة.

وسجلت الصفات التالية (وزن النبات الغض و وزن الجذر طول الجذر وقطر الجذر والمحصول البيولوجي ومحصول الجذور ومحصول العرش ومحصول السكر والمواد الصلبة الذائبة الكلية ونسبة السكروز.

أشارت النتائج المتحصل عليها الي وجود اختلافات معنوية بين معاملات الرش الورقي بمنظمات النمو في كل صفات المحصول ومكوناته وصفات الجودة. حيث أن الرش الورقي أندول حمض الخليك او الكاينتينات حقق أعلى متوسطات قيم للصفات مقارنة بالرش بالجبرلين ومعاملة المقارنة (الرش بالماء) خلال موسمى الدراسة.

كما وجد هناك تأثيراً معنوياً لمعاملات التسميد الكيماوي والحيوي غلى صفات المحصول وجودته لبنجر السكر خلال موسمى الزراعة ماعدا محصول العرش فقط في الموسم الثاني حيث أن معاملة التسميد ٥٠% من الجرعة الموصى بها من السماد المعدني النتروجيني مع تلقيح البذور بالسريالين والنتروبين أعطت أعلى صفات للمحصول ومكوناته خلال موسمى الدراسة تليها معاملة التسميد ٧٥ % من الجرعة الموصى بها من سماد النتروجيني المعدني مع التلقيح البكتيري بالسماد الحيوي النتروبين خلال موسمي الدراسة.

أوضحت النتائج أن هناك تأثيراً معنوياً بالتداخل بين عاملى الدراسة حيث أن زراعة بنجر السكر مع الرش الورقي بأندول حامض الخليك او الكايتتين بمعدل ٣٠٠ ملجم/لتر والأضافة الأرضية لـ ٥٠% من الجرعة الموصى بها من السماد المعدني النتروجيني وتلقيح البذور بالأسمدة الحيوية السريالين والنتروبين بمعدل ٤٠٠ جم/تقاوي فدان حققت أعلى قيم لصفات المحصول والجودة تحت ظروف منطقة النوبارية خلال موسمي الدراسة.

وتوصي هذه الدراسة بزراعة بنجر السكر مع استخدام الرش الورقي بمنظمات النمو مثل الكايتين واندول حامض الخليك والتسميد النتروجيني بمعدل ٥٠% من الجرعة الموصى بها مع التسميد الحيوي بالسريالين والنتروبين لتحقيق أعلى زيادة في المحصول وجودته تحت ظروف منطقة النوبارية.