H

EGYPTIAN ACADEMIC JOURNAL OF BIOLOGICAL SCIENCES BOTANY

ISSN 2090-3812

www.eajbs.com

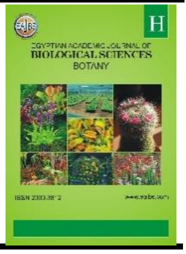
Vol. 13 No.2 (2022)

Citation: Egypt. *Acad. J. Biolog. Sci.* (H. Botany) *Vol.13(2) pp195-206(2022)*

DOI: 10.21608/EAJBSH.2022.279081

Egypt. Acad. Journal Biology. Sci., 13(2):195-206(2022)

Egyptian Academic Journal of Biological Sciences
H. Botany
ISSN 2090-3812
www.eajbsh.journals.ekb.eg.



Sugar Beet Productivity and Quality as Affected by Some Nanoparticles and Gibberellic Acid Under Soil as Affected by Salinity

Mahmoud A. Gomaa[1]; Bahaa A. EL-Gendy[2]; Saeed A. Fawaz[2] and Essam E. Kandil[1]
1-Plant Production Department, Faculty of Agriculture, Saba Basha, Alexandria University, Alexandria, Egypt.
2-Nile Sugar Company, Alexandria, Egypt.
***E-mail: srashwan@nile-sugar.com**

ARTICLE INFO
Article History
Received:12/10/2022
Accepted:9/12/2022
Available:15/12/2022

***Keywords*:**
Sugar beet;
titanium dioxide;
gibberellic acid;
Nanosilver;
yield; quality.

ABSTRACT

Two field experiments were executed to study the seed priming, foliar spray of some Nanoparticles, gibberellic acid, and their interactions in the productivity of sugar beet cv BTS 105 under the conditions of the salt-affected soil. Each field experiment was including three factors in split-split plot design with three replications. The main plots were assigned to the methods, the rates of nanodomains were arranged randomly on the sub-plots and the concentrations were distributed in sub-sub-plots. Each sub-plot included six ridges 0.5 meters apart and 3.50 meters in length, The findings indicated that plants that received the combined application method (foliar spray + seed priming) were the most effective followed by foliar spray application alone the seed priming addition method alone, where the best performance with all studied characters, where plants were treated with TiO_2NPs at a rate of 100ppm priming+200ppm spray and $AgNO_3$NPs at a rate of 30 ppm priming +75ppm spray increased significantly white sugar yield, total soluble solids content (T.S.S.), sugar content (SC), white sugar yield (WSY), Extraction coefficient of sugar (ECS) and white sugar content (WSC) as compared with control treatments. In the contrast decreased significantly potassium, α- amino nitrogen, and sodium in sugar beet root.

INTRODUCTION

Sugar beet (Beta vulgaris var. L.) is one of the world's two traditional sugar crops. Sugar beet production began in Egypt in 1982 and is expected to reach 682771 feddan by 2021. Additionally, by examining the statistics that have been published by (Sugar Crops Council 2021).

Egyptian agriculture depends on the winter crop sugar beet (Beta vulgaris L.). Recently, the Egyptian government pushed sugar beet producers to increase planted acreage in order to close the gap between sugar production and demand. (Mehanna *et al*., 2017). The quality and productivity of sugar beets are important determinants of Egyptian farmers'

DOI: 10.21608/EAJBSH.2022.279081

income. Maximizing the production of sugar is the main objective of sugar beet plant cultivation. One important factor affecting sugar yield is the sugar beets' sucrose concentration. Furthermore, sugar beet byproducts like top yield are thought to make good animal feed. (Wang *et al.,* 2012) livestock Sugar beet is a crop that tolerates salt, making it a good model for research on how plants become acclimated to salt (Lvx *et al*., 2019).

Stress still significantly slows down development. Salinity has an impact on pasture, tree, and agricultural growth by slowing growth, restricting plant reproduction, and interfering with nitrogen uptake. When the concentration of particular ions increases, especially chloride, the plant gets poisoned and dies.(Parihar *et al*., 2015 and Abo El-Ezz *et al*., 2020). The main challenge for researchers is to reduce the number of chemical nitrogen fertilizers added causing symptoms of nitrogen deficiency because continued use of nitrogen fertilizers poses environmental risks like surface and groundwater pollution from nitrate leaching, which exacerbates salinity conditions. Egyptian soils don't contain enough N in a usable form, hence plants grown there need nitrogen fertilizers. (Faiyad *et al.,* 2020).

Seed priming is the process of gently soaking seeds to promote pre-germinative metabolic activity. Seed priming improves establishment, increases uniformity, increases resistance to environmental stress, and aids in breaking dormancy. It also increases yield under a variety of conditions. The main biochemical and physiological changes that occur during seed priming include oxidative stress management, reserve mobilisation, cell cycle regulation, seed ultrastructure modification, and seed water content. To ensure their widespread acceptance and adaptability (Raj and Raj 2019)

Silver nanoparticles increase plant competitiveness and the potential for higher plant exploitation of water and light availability from the environment for photosynthesis in situations of salt. Generally speaking, the application of silver nanoparticles to S. hortensis increases the yield of seed germination and growth of this plant in greenhouse environments, making it simpler to create conditions for survival(Nejatzadeh 2021).

Titanium dioxide makes up about 0.25% by mole and 0.57% by weight of the crust. Titanium dioxide is thought to be a good substance for plants since it can promote growth and development. Numerous studies have established Its role in nitrogen-fixing. (Haghighi *et al.,* 2012 and Moll *et al.,* 2016). It was determined that applying titanium dioxide to tomato plants as a non-biological nitrogen fixation method had a positive impact on atmospheric nitrogen-fixing. Furthermore (El-Ghamry *et al.,* 2018) discovered that an increase in titanium element, due to its ability to fix nitrogen, increased the quantity of nitrogen in the soil after harvesting lettuce plants. According to other writers, plants treated with titanium dioxide showed higher levels of chlorophyll and more active photosynthesis. Additionally, it affects enzymatic activity and nutrition absorption (Malinowska *et al.,* 2012 and Kleiber *et al.,* 2013). It was determined that applying TiO2NPs at sugar beet can fix atmospheric nitrogen whether its application method for agricultural purposes is foliar or soil addition, but the combination of both methods is the most effective compared to each method alone due to raising TiO2NPs ability to non-biological nitrogen fixation under the combined application method. (GHAZI, *et al.,* 2021).

Different methods of applying fertilizer can feed plants more or less efficiently; foliar spray is more efficient than soil treatment since it results in fewer losses. Using a foliar spray, the interval between treatment and plant absorption can also be decreased (wang *et al.,*2012)

In conclusion, the goal of this study is to ascertain the impact of various concentrations of gibberellic acid (GA3), silver nanoparticles (AgNO3NPs), and TiO2NPs (as a non-traditional nutrient element) on the physiological behavior and production of sugar beet under the circumstances of the salt-affected soil Alexandria Government, Egypt.

MATERIALS AND METHODS

Two field experiments were carried out at the Faculty of Agriculture's Saba Basha Research Farm in Alexandria, Egypt, throughout the course of two subsequent seasons, 2020/ 2021 and 2021/ 2022, to examine the effects of seed priming and foliar spraying with some nanoparticles and gibberellic acid on the growth and productivity of sugar beet in soil that has been affected by salinity. Beta vulgaris L., cv. sugar beet (B T S 105).

Some physical and chemical characteristics of soil in accordance with Piper (1950), soil samples were collected at a depth of 0: 30 cm from various experimental sites. The results are displayed in Table. (1)

Each field experiment had a split-split plot design, three components, and three replications. The main plots were seed priming, foliar spraying and (foliar spraying + seed priming) (A). the subplots are Nanocomposites (B), and sub-sub-plot Concentrations (C).

priming the Seeds:

- priming the seeds for 12 hours before planting.
- titanium dioxide (TiO_2NPs) :(0 -50 -100 ppm). silver nanoparticles ($AgNO_3NPs$):0 -15 -30ppm). gibberellic acid (GA_3): (0-100 -200ppm).

Second, Spraying Plants: Spraying Plants at The Age of 50 Days:

- titanium dioxide (TiO_2NPs) (0 - 50 -100 ppm).
- silver nanoparticles ($AgNO_3NPs$) (0 -15 -30ppm). gibberellic acid (GA_3) (0 -100 -200ppm).

Third, Seed Priming and Foliar Spraying Coefficients Seed Priming and Foliar Spraying Coefficients At 50 Days:

- titanium dioxide (TiO_2NPs) (0 -50 priming +200 spray-100 priming +300 spray). Silver nanoparticles ($AgNO_3NPs$) (0 -15 priming +50 spray-30 priming +75 spray)
- gibberellic acid (GA_3) (0 -100 priming +200 spray-200 priming +300 spray).

Each sub-subplot consisted of six ridges that were 3.50 meters long and 0.5 meters apart. The plot, therefore, had a 10.50 m^2 (1/400 fed.) surface area. The experimental field was ready to be ploughed. After performing the laser levelling, compression, ridging, and division into the experimental units. 200 Kg/fed of calcium super phosphate (15.5% P_2O_5) was added to the soil as part of soil preparation. Using the dry sowing method, sugar beet balls were manually planted on the 14th of September during seasons 2020–2021 and the 24th of September during seasons 2022–2022 in hills spaced 0.20 m apart. After seeding, the plots were immediately irrigated. At the age of four-leaf stages, plants were thinned to produce one plant per hill. The nitrogen fertilizers, in the form of ammonium nitrate (33.5% N), and potassium sulphate (48.5% K_2O), were applied as a side-dress in two equal dosages. After thinning, the first was administered, and the second was applied four weeks later.

The other agricultural practices were done according to recommendations of the Ministry of Agriculture and Land Reclamation for growing sugar beet in this region.

The titanium dioxide (TiO_2 NPs), silver nanoparticles ($AgNO_3NPs$), and gibberellic acid (GA_3) were obtained from El-Gamhoria Company in Egypt. After thinning, treatments were immediately started at varying speeds.

Table 1. Soil Physical and chemical properties of experimental sites in both seasons.

Soil properties	**Seasons**	
	2019/2020	**202/2021**
A- Mechanical analysis		
Sand	14.50	14.70
Silt	42.10	42.10
Clay	43.40	43.20
Soil texture	Clay loam	Clay loam
B- Chemical properties		
pH (1:1)	8.20	8.30
EC (1:1) dS/m	4.10	4.15
1- Soluble cations (1:2)		
K^+	1.40	1.45
Ca^{++}	9.00	10.00
Mg^{++}	11.30	11.50
Na^+	13.60	13.80
2- Soluble anions (1:2)		
$CO^-_3 + HCO^-_3$	2.80	2.90
CL^-	19.70	19.80
SO^-_4	12.80	13.50
Calcium carbonate (%)	6.70	6.90
Total nitrogen (%)	1.10	1.20
Available P (mg/kg)	3.70	3.60
Organic matter (%)	1.50	1.60

Data Recorded:

Yield characters:

1- Roots yield (tons/ fed).
2- Top yield (tons/ fed).
3- Biological yield (tons/ fed) = Roots yield/ fed + Top yield/ fed.
4- Gross sugar yield (tons/ fed) = Roots yield/ fed × Gross sugar%.
5- Harvest index (HI) was calculated by using the following equation:

$$HI = \frac{\text{Root yield (ton/ fed}}{\text{Top yield (ton/fed)} + \text{Root yield (ton/fed)}}$$

Quality characters:

1- Total soluble solids content (T.S.S %). It was measured in the juice of fresh roots by using Hand Refractometer according to Me Ginnis, (1982).
2- Soluble non-sugar content (impurities parameters, sodium, potassium and α-amino-N in meq/ 100 g beetroots).
3- Purity percentage (QZ%). **QZ = (ZB × 100)/ (Pol)**

ZB = Pol – {0.345 (K + Na) + 0.094 α- amino- N + 0.29}

4 - Sugar content (SC).
5 - Molasses sugar (MS) **MS = {0.343 (K + Na) + 0.094 (α- amino- N) – 0.31}**

Statistical Analysis:

The differences between treatment means were tested using the least significant difference (LSD) method at 5% rates of probability after all data were statistically evaluated using "COSTAT" computer software using CoStat V 6.4 (2005) program. Steel and Torrie (1981).

RESULTS AND DISCUSSION

The results in Tables (2) indicated that the effect of titanium dioxide, silver nanoparticles and gibberellic acid interaction on root yield (tons/fed), top yield (tons/fed), biological yield (tons/fed) and gross sugar yield (tons/fed) during two seasons.

The findings indicated that plants that received the combined application method (foliar spray + seed priming) were the most effective followed by foliar spray application method alone and then the seed priming addition method alone, across all attributes examined over the course of two seasons. on root yield, top yield, biological yield, and gross sugar yield output were all considerably impacted by the addition methods. (Table 2).

Titanium dioxide fertilization resulted from significant differences in all traits studied. value was gradually increased with increasing titanium dioxide rate. In general, the highest values of Root yield were (31.69 and 33.72 tons/fed) and top yield was (17.56 and17.69ton / fed) and gross sugar yield was (6.34and 6.75ton / fed) with the application of titanium dioxide, respectively during the two seasons, followed by silver nanoparticles While the lowest values achieved with gibberellic acid. on Root yield were (27.71 and 29.70 ton/fed) and of top yield were (14.43 and 14.44 ton/fed) and gross sugar yield was (5.09 and 5.47 ton/fed) respectively during the two seasons. This rise in weight could be the result of faster plant development This was brought about by improved nitrogen metabolism, which boosted nitrogen uptake and sped up the transformation of inorganic nitrogen into organic nitrogen. These results are consistent with Servin *et al*. (2012). He stated that nitrogen buildup and subsequent protein creation are stimulated by titanium dioxide (TiO2NPs), which in turn enhances plant root growth Mingyu *et al*. (2008) reported that titanium dioxide nano-particles (TiO_2NPs) more rapidly assimilate translocation by improving the structure of chlorophyll. (Teama *et al.,* 2019) In order to produce the highest quality and the largest sugar yield/fed, it is advised to apply 300 or 200 ppm TiO2NP. (Ghazi *et al.,* 2021) The chlorophyll value rose as plants were exposed to titanium dioxide at a rate of 5 mg L-1 by foliar application, soil addition, and combined treatment techniques (reading SPAD). The current results agree with those obtained by previous researchers El-Kady and Helmy (2020), gibberellic acid at 300 ppm was more effective at improving sugar beet crop yields and growth characteristics when sprayed on plants.

When apply titanium dioxide concentrating, silver nanoparticle concentrating, and gibberellic acid concentrating during the two seasons of growth, root yield, top yield, biological yield, and gross sugar output is considerably impacted. And the third concentration in a row had the best concentration the highest values on Root yield were (34.30 and 37.28 tons/fed) and top yield was (18.85 and 18.98 tons/fed) and gross sugar yield was (6.89 and 7.48 tons/fed) respectively during the two seasons. followed by the second concentration in all attributes examined under the control treatment, the lowest mean values were found (water only) on root yield were (22.40 and 22.28 ton/fed) and of top yield were (11.02 and 11.04 ton/fed) and of gross sugar, the yield was (3.87 and 3.79 ton/fed), respectively during the two seasons.

Although top yield was not significantly impacted during the two seasons and biological yield during the first season also showed significant changes in biological yield during the second season, the interaction between addition methods and composites was significant in root yield and gross sugar. The highest mean values of root yield (35.93 and 38.16 ton/fed) and expected sugar yield (7.43 and 7.80 ton/fed) respectively. were obtained by the addition of the application method (foliar spray + seed priming) and titanium dioxide of production during the two seasons (Table 3).

Table 2. Effect of seed priming and foliar spray of some Nanoparticles and gibberellic acid on Roots yield (tons/ fed), Top yield (tons/ fed), Biological yield (tons/ fed) and Gross sugar yield (tons/ fed) in both seasons.

Treatments	Roots yield		Top yield		Biological yield		Gross sugar yield	
	Seasons							
	2020/021	021/022	2020/021	021/022	2020/021	021/022	2020/021	021/022
A) Methods								
Priming	27.66	29.79	15.41	15.42	43.06	45.21	5.16	5.58
Spray	28.39	30.25	15.34	15.34	43.73	45.60	5.42	5.80
Priming + Spray	33.44	35.38	16.95	17.18	50.39	52.56	6.67	7.05
LSD at 0.05	0.54	0.61	0.67	0.63	0.42	0.91	0.17	0.15
B) Materials								
GA3	27.71	29.70	14.43	14.44	42.14	44.14	5.09	5.47
Ag NPs	30.08	32.00	15.72	15.82	45.80	47.82	5.81	6.21
TiO_2NPs	31.69	33.72	17.56	17.69	49.25	51.41	6.34	6.75
LSD at 0.05	0.47	0.64	0.50	0.48	0.73	0.87	0.11	0.13
C) Concentrations								
C 1	22.40	22.28	11.02	11.04	33.42	33.32	3.87	3.79
C 2	32.79	35.87	17.84	17.92	50.62	53.79	6.49	7.15
C3	34.30	37.28	18.85	18.98	53.14	56.26	6.89	7.48
LSD at 0.05	0.37	0.48	0.35	0.36	0.53	0.63	0.92	0.09
Interactions								
A x B	*	*	NS	NS	NS	*	*	*
A x C	*	*	*	*	*	*	*	*
B x C	*	*	*	*	*	*	*	*
A x B x C	*	*	*	*	*	*	*	*
N.S: Not significant.								

The interaction between addition methods and concentration was significant in all traits studied. The highest mean values of root yield (39.88 and 42.86 ton/fed), top yield (20.58 and 20.98 ton/fed), and expected sugar yield (8.31 and 8.82 ton/fed) respectively. were obtained by the addition of the application method (foliar spray + seed priming) and a concentration of a third of output during the two seasons (Table 3).

The interaction between concentrates and composites was significant and affected during the two seasons. The highest mean values of root yield (37.15 and 40.33 ton/fed), top yield (21.84 and 22.14 ton/fed), and expected sugar yield (7.75 and 8.31 ton/fed) respectively. were obtained by the addition titanium dioxide concentration of 100 ppm. The traits of root yield, top yield, biological yield, and gross sugar production were all significantly impacted by the other interactions among the factors examined (the interactions between adding methods, nanocomposites, and concentrating).

Table 3. Interaction effect between A x B, A x C and B x C on Root yield, Top yield and Gross sugar yield tons/ fed in both seasons.

A) Methods	B) Materials	Root yield		Top yield		Gross sugar yield	
		2020/021	021/022	2020/021	021/022	2020/021	021/022
Priming	GA3	26.30	28.29	13.91	13.93	4.68	5.03
	Ag NPs	27.74	29.89	15.24	15.27	5.20	5.62
	TiO_2 NPs	28.93	31.20	17.06	17.06	5.61	6.08
Spray	GA3	26.24	28.47	14.04	14.04	4.75	5.17
	Ag NPs	28.70	30.48	15.04	15.04	5.52	5.88
	TiO_2 NPs	30.22	31.81	16.96	16.96	5.99	6.35
Priming + Spray	GA3	30.58	32.35	15.34	15.34	5.85	6.21
	Ag NPs	33.80	35.63	16.88	17.14	6.73	7.14
	TiO_2 NPs	35.93	38.16	18.64	19.05	7.43	7.80
LSD at 0.05		0.79	1.10	NS	NS	0.19	0.23
A) Methods	C) Concentrations						
Priming	C1	22.40	22.28	10.92	10.97	3.87	3.79
	C2	29.85	33.15	17.17	17.17	5.66	6.31
	C3	30.72	33.94	18.12	18.12	5.96	6.62
Spray	C1	22.40	22.28	11.22	11.22	3.87	3.79
	C2	30.48	33.45	16.97	16.97	5.98	6.61
	C3	32.28	35.03	17.84	17.84	6.41	6.99
Priming + Spray	C1	22.40	22.28	10.92	10.92	3.87	3.79
	C2	38.03	41.00	19.36	19.62	7.83	8.54
	C3	39.88	42.86	20.58	20.98	8.31	8.82
LSD at 0.05		0.65	0.83	0.62	0.62	0.16	0.16
B) Materials	C) Concentrations						
GA3	Control	22.40	22.28	10.92	10.95	3.87	3.79
	100 ppm	29.60	32.73	16.07	16.07	5.54	6.15
	200 ppm	31.13	34.09	16.29	16.29	5.88	6.46
Ag NPs	Control	22.40	22.28	11.22	11.25	3.87	3.79
	15 ppm	33.23	36.32	17.53	17.68	6.52	7.18
	30 ppm	34.61	37.40	18.41	18.52	7.05	7.66
TiO2 NPs	Control	22.40	22.28	10.92	10.92	3.87	3.79
	50 ppm	35.53	38.56	19.91	20.01	7.41	8.13
	100 ppm	37.15	40.33	21.84	22.14	7.75	8.31
LSD at 0.05		0.65	0.83	0.62	0.62	0.16	0.16
N.S: Not significant.							

The data in Table (4) indicated that the effect of titanium dioxide, silver nanoparticles and gibberellic acid interaction on total soluble solids content (T.S.S.%), sugar content (SC %), purity percentage (QZ%) and harvest index (HI%).

The addition methods significantly affected total soluble solids content, sugar content, purity percentage, and harvest index. In all traits studied over the two seasons, soaking with spraying yielded the highest value. followed by the foliar spray application method alone and then the seed priming addition method alone, across all attributes examined over the two seasons. In general, the highest values of (T.S.S.%) were (24.30 and 23.82) and of (SC %) were (19.53 and 19.45) and of (QZ%) were (80.24 and 81.49) and of (HI%) were (66.51 and 67.33) with the application of soaking with spraying, respectively during the two seasons. (Table 4).

The studied characters i.e., (T.S.S.%), (SC %), (QZ%), and (HI%) were significantly affected in all traits studied. when adding titanium dioxide, silver nanoparticles and gibberellic acid during the two seasons. value was gradually increased with increasing titanium dioxide rate, in general, the highest values of (T.S.S.%) were (24.34 and 23.90) and of (SC %) were (19.61 and 19.55) and of (QZ%) were (80.45 and 81.64) with the application of titanium dioxide, respectively during the two seasons. followed by, the silver nanoparticles. The lowest mean values were in all traits studied under gibberellic acid. Except for the Harvest index, the best composite was gibberellic acid, which was the highest value of (HI%) were (65.85 and 67.24). These results exhibit the same trend as the results obtained by previous researchers (El-Kady and Helmy 2020). Gibberellic acid at 300 ppm was more effective at improving sugar beet crop yields and growth characteristics when sprayed on plants.

These results are in line with Servin *et al*. (2012), who summarized that titanium dioxide (TiO2NPs) promotes plant root growth by stimulating nitrogen accumulation and thus protein formation. Mingyu *et al*. (2008) reported that titanium dioxide nano-particles (TiO2NPs) heightened assimilate translocation by improving the structure of chlorophyll. (Teama *et al.*, 2019). It is recommended to apply 300 or 200 ppm TiO2NP to produce the best quality as well as the highest sugar yield/fed. These results exhibit the same trend as the results obtained by previous researchers. The efficiency of sugar processing, which is significantly influenced by the quality of the roots, is measured by sugar recovery, an approximate indicator that describes the recovery of crystalline sugar. The ability to recover sugar might be viewed as a sign of the roots' chemical makeup Oltmann et al. (1984).

Total soluble solids content, sugar content, purity percentage, and harvest index are significantly affected when using titanium dioxide concentrating, silver nanoparticles concentrating, and gibberellic acid concentrating during the growth period during the two seasons. And the best concentration was the third of the highest values on (T.S.S.%) were (24.61 and 24.25) and of (SC %) were (19.79 and 19.79) respectively during the two seasons. The lowest mean values were in traits studied under the control treatment (water only). (T.S.S.%) were (22.41 and 21.76) and (SC %) were (17.27 and 17.03) respectively during the two seasons. But the best concentration was the third of the highest values of (QZ%) were (81.34 and 82.54) respectively during the two seasons.

The interaction between addition methods and nanocomposites was significant in purity percentage during the two seasons, but sugar content and harvest index were not significantly affected during the two seasons. and also showed significant changes in total soluble solid content during the first season. (Table 4). The interaction between addition methods and concentration was significant in all traits studied during the two seasons. The interaction between composites and concentrating was significant and affected during the two seasons.

All of the other interactions between the factors studied (the interaction between addition methods, nanocomposites, and concentrating) had no significant effect on the trait of total soluble solids content and sugar content, and this was true in both growing seasons. Except for sugar content, there was a significant difference in the second season. The purity percentage and harvest index were significantly impacted by all of the other interactions between the parameters examined (the interactions between adding techniques, nanocomposites, and concentrating). (A× B×C) the highest values of (QZ. %) were (84.32 and 85.59) respectively during the two seasons.

Table 4. Effect of seed priming and foliar spray of some Nanoparticles and gibberellic acid on Total soluble solids content (T.S.S %), sugar content (SC %), Purity percentage (QZ%) and Harvest index (HI) in both seasons.

Treatments	T.S.S %		SC %		QZ%		HI	
	Seasons							
	2020/021	021/022	2020/021	021/022	2020/021	021/022	2020/021	021/022
A) Methods								
Priming	23.20	22.85	18.50	18.49	79.69	80.86	64.60	66.08
Spray	23.67	23.34	18.87	18.88	79.63	80.80	65.12	66.41
Priming + Spray	24.30	23.82	19.53	19.45	80.24	81.49	66.51	67.33
LSD at 0.05	0.29	0.27	0.27	0.19	0.26	0.39	1.12	0.77
B) Materials								
GA3	23.08	22.70	18.23	18.21	78.98	80.18	65.85	67.24
Ag NPs	23.74	23.41	19.05	19.06	80.13	81.33	65.72	66.83
Tio2Nps	24.34	23.90	19.61	19.55	80.45	81.64	64.67	65.76
LSD at 0.05	0.19	0.22	0.20	0.21	0.31	0.31	0.62	0.63
C) Concentrations								
C 1	22.41	21.76	17.27	17.03	77.08	78.28	67.02	66.87
C 2	24.15	23.99	19.66	19.81	81.34	82.54	64.69	66.66
C3	24.61	24.25	19.97	19.97	81.15	82.34	64.52	66.30
LSD at 0.05	0.28	0.21	0.18	0.14	0.31	0.32	0.49	NS
Interactions								
A x B	*	NS	NS	NS	*	*	NS	NS
A x C	*	*	*	*	*	*	*	*
B x C	*	*	*	*	*	*	*	*
A x B x C	NS	NS	NS	*	*	*	*	*

N.S: Not significant

The data in Tables (5) indicated the effect of titanium dioxide, silver nanoparticles and gibberellic acid interaction on molasses sugar (MS) and impurities parameters (sodium, potassium, and α -amino-N in meq/100 g beetroots).

During the first season, the additional methods had a significant effect on sodium, α -amino-N. and potassium, while the addition methods did not significantly affect the second season. but the addition methods did not significantly affect molasses sugar during the two seasons. seed priming yielded the lowest value of α -amino-N (1.99) during the first season. with no significant difference between seed priming and foliar spray (Table 5).

The data in Tables (5) indicated that Molasses sugar (MS), sodium, potassium, and α -amino-N were significantly affected in all traits studied. when adding titanium dioxide, silver nanoparticles and gibberellic acid during the two seasons. titanium dioxide and silver nanoparticles addition resulted from significant differences in (MS), sodium, potassium, and α -amino-N content. value was gradually reduced with increasing titanium dioxide and silver nanoparticles rate respectively. The lowest values of (MS) content were (4.49 and 4.46) and sodium content was (2.9 and1.93) and potassium content was (6.64 and 6.43) and α -amino-N content (1.92 and 1.95) with the application of titanium dioxide, respectively during the two seasons as compared with control treatment. as shown in Table And the highest composite was gibberellic acid (GA3) was the highest value during two seasons, (Table 5). This may be due to enhanced nitrogen metabolism that promoted the absorption of nitrogen and accelerated the conversion of inorganic nitrogen into organic nitrogen, resulting in an which led to a reduction in molasses sugar (MS), sodium, potassium, and α -amino-N. These results are in line with Servin *et al*. (2012), who summarized that titanium dioxide (TiO_2NPs) promotes plant root growth by stimulating nitrogen accumulation and thus protein formation. Mingyu *et al*. (2008) reported that titanium dioxide nano-particles (TiO2NPs) heightened assimilate translocation by improving the structure of chlorophyll. (Teama *et al.*, 2019). It is recommended to apply 300 or 200 ppm TiO2NP to produce the best quality as well as the highest sugar yield/fed. The current results agree with those obtained by previous researchers (GHAZI, *et al.*, 2021) It was clear that the values of purity and quality index (%) increased as the rate of adding titanium dioxide rose. These results showed that titanium dioxide plays an important role in N-fixation and enhances purity. In a study by El-Kady and Helmy (2020), spraying plants with 300 ppm of gibberellic acid was more efficient on growth traits and yields of sugar beet crops.

The results in Tables (5) indicated that Molasses sugar (MS), sodium, potassium, and α-amino-N are significantly affected when applying titanium dioxide concentrating, silver nanoparticles concentrating, and gibberellic acid concentrating, during the growth period during the two seasons. And the highest concentration was under the control treatment (water only) in two seasons. The lowest mean values were in all traits studied for the second concentration during the two seasons. (MS) content was (4.27 and 4.30) and sodium content was (2.06 and1.87) and α -amino-N content (1.72 and 1.76) but the lowest mean values were in the third concentration in potassium content during the two seasons was (6.33 and 6.30)

The interaction between addition methods and nanocomposites was significant in molasses sugar, sodium, potassium, and α -amino-N during the two seasons, but sodium was not significantly affected during the first season. The interaction between addition methods and concentration was not significant in sodium or potassium during the two seasons. and also showed significant changes in molasses sugar (MS)and α -amino-N during the two seasons. The interaction between composites and concentrates was significant and had significant effects during the two seasons and also, showed significant changes in sodium during the second season. (Table 5).

All of the other interactions between the factors studied (the interaction between addition methods, nanocomposites, and concentrating) had a significant effect on the trait of molasses sugar (MS), sodium, potassium, and α-amino-N, and this was true in both growing seasons. Except for potassium, there was nothing significant during the first season.

Table 5. Effect of seed priming and foliar spray of some Nanoparticles and gibberellic acid on Molasses sugar (MS ton/fed) and (impurities parameters, sodium, potassium and α-amino-N in meq/ 100 g beet roots) in both seasons.

Treatments	MS		sodium		potassium		α-amino-N	
	Seasons		Seasons		Seasons		Seasons	
	2020/021	021/022	2020/021	021/022	2020/021	021/022	2020/021	021/022
A) Methods								
Priming	4.74	4.66	2.14	1.94	7.12	6.86	1.99	2.01
Spray	4.94	4.86	2.14	1.96	7.11	6.83	2.20	2.22
Priming + Spray	4.74	4.69	2.18	2.00	6.97	6.73	2.04	2.07
LSD at 0.05	NS	NS	0.01	NS	0.33	NS	0.16	NS
B) Materials								
GA3	5.14	5.07	2.25	2.04	7.51	7.22	2.24	2.27
Ag NPs	4.79	4.69	2.11	1.92	7.05	6.77	2.08	2.08
Tio2Nps	4.49	4.46	2.09	1.93	6.64	6.43	1.92	1.95
LSD at 0.05	0.13	0.10	0.04	0.04	0.21	0.20	0.09	0.06
C) Concentrations								
C 1	5.82	5.56	2.32	2.13	8.28	7.58	2.66	2.63
C 2	4.27	4.30	2.06	1.87	6.59	6.54	1.72	1.76
C3	4.32	4.36	2.07	1.91	6.33	6.30	1.86	1.90
LSD at 0.05	0.09	0.11	0.06	0.08	0.22	0.23	0.14	0.13
Interactions								
A x B	*	*	*	*	NS	*	*	*
A x C	*	*	NS	NS	NS	NS	*	*
B x C	*	*	*	NS	*	*	*	*
A x B x C	*	*	*	*	NS	*	*	*

N.S: Not significant

Conclusion :

It is recommended from this experiment to use the method of seed priming with foliar spray at the age of 50 ppm from planting with titanium Nano dioxide compound at a concentration of 100 ppm priming + 300 ppm foliar spray and using silver Nano nitrate at a concentration of 30 ppm seed priming + 75 ppm foliar spray to obtain the root yield and the highest top yield ton /fed and also obtaining the highest percentage of sugar (SC%) and (T.S.S) and sugar yield (SY) ton /fed and reduce the percentage of impurities in the juice and and the high percentage of extraction under the conditions of this experiment in the Abees area in Alexandria for the sugar beet cv BTS 105 under the conditions of the salt-affected soil.

REFERENCES

A.O.A.C.'(1995) Association of official analytical chemists. Official methods of analysis, 16th Ed., AOAC International, Washington, D.C., USA.

Abo El-Ezz, S. F., El-Hadidi, E. M., El-Sherpiny, M. A., and Mahmoud, S. E. (2020). Land Reclamation Using Compost, Agricultural Gypsum and Sugar Beet Mud. *Journal of Soil Sciences and Agricultural Engineering*, *11*(9), 503-511.

El-Ghamry, A., Ghazi, D., and Mousa, Z. (2018). Effect of titanium dioxide on lettuce plants grown on sandy soil. *Journal of Soil Sciences and Agricultural Engineering*, *9*(10), 461-466.

El-Kady, M. S., and Helmy, S. A. (2020). Effect of Fish Farm Waste Water Irrigation and Growth Regulators on Growth, Yield and Quality of Sugar Beet Crop. *Egyptian Journal of Agricultural Sciences*, 71(2), 73-84.

Faiyad, R. M., and Hozayn, M. (2020). Effect of magnetic water and urea fertilizer on sugar beet yield and quality. *Plant Archives*, *2*(20), 8622-8634.

Ghazi, D. A., El-Ghamry, A. M., El-Sherpiny, M. A., and ALLA, A. N. (2021). Response of sugar beet plants to nitrogen and titanium under salinity conditions. *Plant Cell Biotechnology and Molecular Biology*, 82-94.

Haghighi, M., Heidarian, S., and Teixeira da Silva, J. A. (2012). The effect of titanium amendment in N-withholding nutrient solution on physiological and photosynthesis attributes and micronutrient uptake of tomato. *Biological Trace Element Research*, 150(1), 381-390.

Kleiber, T., and Markiewicz, B. (2013). Application of “Tytanit” in greenhouse tomato growing. *Acta Scientiarum Polonorum, Hortorum Cultus*, 12(3), 117-126.

Lv, X., Chen, S., and Wang, Y. (2019). Advances in understanding the physiological and molecular responses of sugar beet to salt stress. *Frontiers in Plant Science*, *10*, 1431.

Malinowska, E., and Kalembasa, S. (2012). The yield and content of Ti, Fe, Mn, Cu in celery leaves (*Apium graveolens* L. var. dulce Mill. Pers.) as a result of Tytanit application. *Acta Scientiarum Polonorum-Hortorum Cultus*, *11*(1), 69-80.

Me Ginnis, R. A. (1982). Beet sugar technology. 3rd ed. Sugar beet development foundation. Fort Collins, 855 pp.

Mehanna, H. M., Safi-naz, S. Z., and Hussien, M. M. (2017). Influences of irrigation and fertilizer on growth and yield of two sugar beet varieties in Egypt. *Middle East Journal of Agriculture Researches*, *6*(4), 1295-1300.

Mingyu, S., Chao, L., Chunxiang, Q., Lei, Z., Liang, C., Hao, H., ... and Fashui, H. (2008). Nano-anatase relieves the inhibition of electron transport caused by linolenic acid in chloroplasts of spinach. *Biological Trace Element Research*, *122*(1), 73-81.

Moll, J., Okupnik, A., Gogos, A., Knauer, K., Bucheli, T. D., Van Der Heijden, M. G., and Widmer, F. (2016). Effects of titanium dioxide nanoparticles on red clover and its rhizobial symbiont. *PloS one,* 11(5).

Nejatzadeh, F. (2021). “Effect of Silver Nanoparticles on Salt Tolerance of Satureja Hortensis l. during in Vitro and in Vivo Germination Tests.” Heliyon 7(2): e05981. https://doi.org/10.1016/j.heliyon.2021.e05981

Oltmann, W.; M. Burba; and G. Bolz (1984). The quality of the sugar beet: importance, evaluation criteria and measures to improve it. *Advance Plant Breeding*, 12. Berlin: Verlag Paul Parey.

Parihar, P., Singh, S., Singh, R., Singh, V. P., and Prasad, S. M. (2015). Effect of salinity stress on plants and its tolerance strategies: a review. *Environmental Science and Pollution Research,* 22(6), 4056-4075.

Piper, C. S. (1950), Soil and plant analysis. The Univ. of Adelaide, Australia.

Raj, A. B., and Raj, S. K. (2019). Seed priming: An approach towards agricultural sustainability. *Journal of Applied and Natural science*, *11*(1), 227-234.

Reinefeld, E.; Emmerich A.; Baumgarten G.; Winner C., and Beiss C., (1974). Zur Voraussage des Melassezuckers aus Riibenanalysen. *Zucker,* 27, 2-15

Servin, A. D., Castillo-Michel, H., Hernandez-Viezcas, J. A., Diaz, B. C., Peralta-Videa, J. R., and Gardea-Torresdey, J. L. (2012). Synchrotron micro-XRF and micro-XANES confirmation of the uptake and translocation of TiO2 nanoparticles in cucumber (*Cucumis sativus*) plants. *Environmental Science and Technology*, *46*(14), 7637-7643.

Steel, R. G. D., and Torrie, J. H. (1981). Principles and procedures of statistics: a biometrical approach., 2nd edn.(McGraw-Hill International Book Company: Sydney).

Sugar Crops Council (2021). Annual report "Sugar crops and sugar production in Egypt in 2019/2021 growing and Juice 2021 season".177 pp.

Teama, E. A., Dawood, R. A., Osman, A. A., Ahmed, A. Z., and ssef, A. M. M. (2019). Yield and Quality of Three Sugar Beet Varieties as Affected by Titanium Dioxide Nanoparticles Foliar Application and Nitrogen Fertilization. *Egyptian Sugar Journal*, 13(0), 1-27.

Wang, J., Mao, H., Zhao, H., Huang, D., and Wang, Z. (2012). Different increases in maize and wheat grain zinc concentrations caused by soil and foliar applications of zinc in Loess Plateau, China. *Field crops research*, *135*, 89-96.