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Role of Some Artificial and Natural Substances in Improving Germination and Seedlings Parameters of Sugar Beet Under Various Irrigation Water Sources

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ABSTRACT

At the Agronomy Department, Faculty of Agriculture, Mansoura University, Egypt, a laboratory experiment was carried out in March 2023 to investigate the impact of some artificial and natural substances to improve germination and seedling parameters of sugar beet Heba cultivar under various irrigation water sources. The investigation was carried out using factorial complete randomized design (CRD). The first factor included three different irrigation water sources (irrigation water, usual agricultural wastewater and industrial wastewater). The second factor comprised eight different methods of soaking seeds: without soaking "control", soaking in distilled water, boron (B), humic acid (HA), yeast extract (YE), silicon (Si), potassium (K), and macro and micro elements and amino acids (Macro + Micro + AA). Irrigation water was the control treatment that produced the greatest results in terms of germination and seedling characteristics. Usual agricultural wastewater came in second. Sugar beet seeds soaked in YE at a rate of 150 ml per liter produced the highest germination percentage, speed germination index, germination index, mean germination time, energy of germination, lengths of the plumel, radical, and seedlings, as well as the highest values of total chlorophyll, radical dry weight, and plumel dry weight and lowest values of abnormal and hard seed percentages. It may be advised to soak seeds for 18 hours in YE at a rate of 150 ml/L and irrigation by usual agricultural wastewater to improve sugar beet Heba cultivar germination and seedlings parameters.

Keywords: Sugar beet, irrigation water sources, artificial substances, natural substances, germination and seedlings parameters.

INTRODUCTION

One of the two principal sugar crops in the world is sugar beet (*Beta vulgaris*, var. *altissima* Doll). In comparison to sugar cane, sugar beet recently outperformed it in terms of total production of sugar and took the lead as Egypt's primary source of sugar production (Abu-Ellail and El-Mansoub, 2020). Sugar beet is a significant crop for sugar production alongside sugar cane in Egypt. Consequently, the total area under cultivation for the 2022 season was roughly 604104 feddan, and the average amount of roots produced per feddan was 22.441 tons, exceeding 13.557 million tons in total (FAO, 2024).

Water is a major factor in determining how seeds germinate and thrive. The quantity of dissolved salts in the water regulates the pace of imbibition, whereas the water potential controls the amount of water accessible for metabolic processes. There isn't enough freshwater available to sustain irrigation. The amount of salts present in the irrigation water will therefore have an impact on the water's quality and, in turn, the seed's metabolic processes. Wastewater is a valuable resource for irrigation, and it can occasionally even aid the agricultural industry. In this concern, Sharma *et al.* (2002) examined the effects of toxicity from distillery effluent on the germination and growth of sugar beet seedlings. Although higher effluent volumes have been found to be detrimental, they can still be used for irrigation if diluted properly. Kalaiselvi *et al.* (2009) demonstrated that finger and pearl millet seed germination and seedling growth were negatively impacted by soap factory effluent. However, the aforementioned properties improved when the effluent was diluted to a concentration of 2.5 to 5 percent. Marthandan *et al.* (2018) showed that wastewater and industrial effluents may be utilized for irrigation without harming seeds if diluted to the proper concentrations. The salts in the effluents improved the germination and vigorous growth of the seedlings when diluted appropriately.

Applying natural substances, sometimes called biostimulants, to plants and seeds can promote plant development even if they are not classified as fertilizers, pesticides, or soil amendments. Frequently used biostimulants include microbial inoculants, plant extracts, biopolymers, helpful bacteria and fungi and compounds containing nitrogen. Recently, research into and application of biostimulants have increased in an effort to reduce reliance on conventional pesticides and fertilizers, which are sometimes overused and less sustainable in agricultural cropping systems. Seed treatments increase plant development and germination when applied to untreated seed; because the treated surface area is less, they also require even less active ingredien (Rouphael and Colla, 2018). Jafarzadeh and Aliasgharzad (2007) showed that treating with distilled water produced about 30 % germination, supporting the idea that the inherent traits and responsiveness of the seed is what essentially controls germination in beets. Moursy (2018) declared that after

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soaking sugar beet seeds in water for 72 hours, the maximum value of germination ratio was 94.35 %, while the lowest value was 93.53 % under the control condition (without soaking).

For cell division, elongation, translocation and cell wall formation, boron is essential (Iqbal *et al*., 2012). Shorrocks *et al*. (1997) demonstrated that the effect on sugar beet germination was both enhanced and diminished by different B doses ranging from 2 to 20 mM.

According to the current study, biostimulants like humic acid may have positive effects on germination because of their effects on hormonal balance changes that promote the production of auxins and cytokinins, which in turn allows for the continuous production of antioxidants during stressful situations (Schmidt, 2005). Abbas *et al.* (2014) indicated that there were positive effects of soaked seeds with humic acid on chlorophyll content (Chl) of fodder beet compared with the unsoaked seeds. Rassam *et al.* (2015) found that applying humic acid as a pre-treatment to sugar beet seed led to a significant increase in the plant's growth and shoot dry mass.

The positive effects of yeast extract may be attributed to its cytokinin concentration, which stimulates cell growth and division, the synthesis of proteins and carbohydrates and increases the production of chlorophyll (Wanas, 2002). Nemeat Alla *et al.* (2015) indicated that yeast extract's beneficial effects are mostly due to its ability to make nutrients available to plants. Its combination of macro and micronutrients, growth regulators, and vitamins also encourages the development of dry matter in plants. Arafat (2023) revealed that immersing sugar beet seeds in 200 milliliters of YE came the second of soaking seed treatments in some natural substances in terms of germination and seedling parameters.

Silicon is a useful element that strengthens cell walls when it deposits as opal phytoliths and amorphous silica (Haghighi *et al*., 2012). Shawki *et al*. (2020) revealed that soaking sugar beet seedlings in potassium silicate for eight to twelve hours before to sowing greatly raised the amount of total chlorophyll in comparison to the untreated control.

Plants use potassium for a variety of purposes. It maintains the ionic balance and ionically binds to pyruvate kinase, an enzyme essential to respiration and glucose metabolism (Aisha *et al*., 2007). Kaya and Kulan (2020) concluded that hydrating for 8-16 hours with 1 % KNO_3 enhanced sugar beet emergence and seedling growth. Shawki *et al.* (2020) revealed that soaking sugar beet seedlings in potassium silicate for eight to twelve hours before to sowing greatly raised the amount of total chlorophyll in comparison to the untreated control.

Micronutrient seed priming, particularly with zinc, promotes better germination and strong seedling establishment. Improved plant population, robust seedlings resistant to harsh field conditions like weeds and hard soil crust, etc., could all contribute to a good yield (Munawar *et al*., 2013). Gharib and El-Henawy *et al.* (2011) claimed that when seeds were soaked in a solution containing micronutrients, their emergence was much increased as opposed to when they were left untreated (dry). Abou-Salem *et al.* (2022) showed that sugar beet seeds soaked in CuO at 150 µg/mL concentration for two hours significantly increased the vegetative development.

Due to shortage of irrigation water, farmers used recyclling agricultural and industrial wastewater for sugar beet irrigation therefore using some artificial and natural substances may affect seed germination and concequently decrease optimum population density, root and sugar yield.

MATERIALS AND METHODS

In March 2023, An experiment was carried out in a lab in the Agronomy Department Laboratory of Seed Testing, Faculty of Agriculture, Mansoura University, Egypt. This experiment's goal was to investigate how various artificial and natural materials might enhance sugar beet Heba cultivar seedling parameters when grown with varying irrigation water sources.

This experiment carried out in a factorial complete randomize design (CRD). Three distinct sources of irrigation water (irrigation water, usual agricultural wastewater, and industrial wastewater) were included in the first factor.

The irrigation water (control treatment) obtained from the irrigation canal of the Experimental Station Farm, Faculty of Agriculture, Mansoura University, Dakahlia Governorate, Egypt. The usual agricultural wastewater comes from the drainage canal of Qalabsho and Zayan Farm, Faculty of Agriculture, Mansoura University, Dakahlia Governorate, Egypt and the industrial wastewater comes from the drainage canal of the Misr Oils and Soap Company in Sindoub, Dakahlia Governorate, Egypt. water samples were collected to test the chemical parameters of the water as indicated in Table 1.

Table 1. Chemical properties of irrigation water sources* used in this experiment.

Water chemical properties		Irrigation water	Usual agricultural wastewater	Industrial wastewater
E.C. ds./M		0.54	0.95	1.26
pH		7.68	7.72	7.89
Cations (meq./ liter)	Ca^{++}	1.67	2.28	3.27
	Mg^{++}	1.18	2.47	3.02
	Na^{+}	2.05	3.23	4.41
	K^{+}	0.50	1.57	1.90
Anions)meq. /liter(	CO_3^{-}	-	-	-
	HCO_3^{-}	0.59	1.14	1.51
	Cl^{-}	1.40	2.94	3.90
	SO_4^{-}	3.40	5.42	7.19
Na %		41.35	62.56	64.80

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The second factor included eight soaking seed treatments in various artificial and natural materials at different levels for 18 hours *i.e.* without soaking (untreated "control treatment"), soaking seeds in; distilled water, B at the level of 5 milliliters for every liter water, HA at the level of 2.5 g/liter water, YE at the level of 150 milliliters for every liter water, Si at the level of 10 milliliters for every liter water, K at the level of 1 millilites for every liter water and Macro + Micro + AA at the level of 3.2 milliliters for every liter water. Boron, silicon, potassium as well as macro and micro elements and amino acids as artificial substances and humic acid as well as YE as natural substances.

New-actipor as a source of B contains of 15 % B. Silica-top as a source of Si contains of 22.5 % silicon oxide, 12 % potassium oxide and 25 % citric acid. Cigo-K xpress liq as a source of K contains of 50 % K and 4.6 % N. Amino-mineral (fertilizer preparation manufactured using nanotechnology) as a source of Macro + Micro + AA contains of 8 % N, 5 % P, 3 % K, 11 % micro elements, 5 % amino acids and 5 % algae extract. Raw-humimax contains of 90 % humic acid, 5 % K and 5 % marine algae. YE was produced as a natural biostimulant by using a technique that allowed yeast cells (pure dry yeast) to grow and replicate efficiently under ideal aerobic and nutritional conditions. As a result, the process made it possible to create novel, advantageous bioconstituents (such as proteins, sugars, carbohydrates, fatty acids, amino acids, and hormones) that could easily exit yeast cells. After dissolving active dry yeast in water at a rate of 20 g per liter and adding sugar in a 1:1 ratio, the mixture was left overnight to allow for yeast activation and reproduction. After that, two cycles of freezing and thawing were carried out in order to disturb the yeast cells and cause their contents to leak out. This technique for making yeast was altered by Spencer *et al.* (1983).

According to rules of International Seed Testing Association (ISTA, 1996), a random sample of 288 seeds per treatment were sown between tissue paper in sterilized Star-cups (12 seed beds). Each Star-cup contains 12 seeds, and six Star-cups kept close together were assessed as though they were one 72-seeds replication under the environmental conditions of the Laboratory for Seed Testing in the Agronomy Department, Faculty of Agriculture, Mansoura University, Egypt during the second week of March, 2023.

A. Germination parameters:

1. Germination percentage (%). After 14 days of seeding, the normal seedlings in each replicate were counted to determine the final germination % using the equation given by ISTA (1996):

$$\text{Germination percentage (\%)} = \frac{\text{Number of normal seedlings}}{\text{Number of total seeds}} \times 100$$

2. Speed germination index (SGI). The formula used to calculate it was as follows (ISTA, 1996):

$$SGI = \frac{\text{No. of germinated grains}}{\text{Days to first count}} + \frac{\dots\dots}{\dots\dots} + \frac{\text{No. of germinated grains}}{\text{Days to final count}}$$

3. Germination index (GI). The following formula was used to calculate it (Karim *et al.* 1992):

$$GI = \frac{\text{Germination percentage in each treatment}}{\text{Germination percentage in control treatment}}$$

4. Co-efficient of germination (CG). It was computed using the subsequent formula in accordance with Copeland (1976):

$$CG = \frac{100\,(A_1 + A_2 + \dots\dots + A_n)}{A_1\,T_1 + A_2\,T_2 + \dots\dots\ A_n\,T_n}$$

Where;

A = Number of seeds that sprouted.
T = The time (days) that correspond to A.
n = Days remaining till the final tally.

5. Mean germination time (MGT). It was computed using the subsequent equation of Ellis and Roberts (1981):

$$MGT = \frac{\sum Dn}{\sum n}$$

Where

D is the number of days measured from the start of germination and (n) is the number of seeds that germinated on that day.

6. Energy of germination (EG). The proportion of seeds that germinated at the first count (4 days after sowing) in relation to the total number of seeds tested was used to calculate it (Ruan *et al.*, 2002).
7. Abnormal seedlings percentage (%). A percentage of aberrant seedlings was counted and expressed after 14 days, as per ISTA (1996).
8. Hard seeds percentage (%). According to ISTA (1996), it was tallied and expressed as a percentage of hard seeds after 14 days.

B. Seedling parameters:

9. Radical length (cm). After the standard germination test, the average root length of five seedlings, selected at random for each treatment, was measured from the seed to the tip of the root and recorded. The root length was then expressed in centimeters (cm).
10. Plumel length (cm). The five seedlings that were randomly selected for each treatment had their average shoot length measured from the seed to the tip of the leaf blade. This measurement was recorded and converted to centimeters at the conclusion of the standard germination test.
11. Seedling length (cm). At the conclusion of the normal germination test, the average length of the five seedlings, selected at random for each treatment, was measured and stated in centimeters.
12. Seedling vigor index (SVI). It was computed using the formula recommended by AbdulBaki and Anderson (1973):

$$SVI = \frac{(\text{radical} + \text{plumel length}) \times \text{Germination percentage}}{100}$$

13. Radical dry weight (mg). Five seedling roots were weighed at random per treatment and then dried in an oven at 70 º C until their weight remained constant (Agrawal, 1986).
14. Plumel dry weight (mg). After drying in an oven at 70 º C until their weight remained consistent, the weight of five plumel seedlings was recorded at random for each treatment (Agrawal, 1986).
15. Total chlorophyll (SPAD). With the use of SPAD-502 (Minolta Co. Ltd., Osaka, Japan), the total chlorophyll content in a wide leaf of plumel was measured.

All data were statistically evaluated using the Statistix-9 computer software program in accordance with the factorial totally randomized design (Gomez and Gomez, 1984). Duncan's multiple range tests, as reported by Duncan (1955), were used to compare the means of the treatments at the 5% level of probability.

RESULTS AND DISCUSSION

1. Effect of various irrigation water sources:

From obtained results of this study it was evident that significant differences were detected in germination parameters *i.e.* germination percentage (%), SGI, GI, MGT, abnormal and hard seeds % as well as seedling parameters *i.e.* SVI, radical and seedling lengths (cm) as well as total chlorophyll (SPAD) among studied different irrigation water sources (irrigation water, usual agricultural wastewater and industrial wastewater). While, different irrigation water sources insignificantly affected CG, EG, radical and plumel dry weights (mg) as well as plumel length (cm) as shown from results in Tables 2 and 3.

The highest values of germination %, SGI, GI, MGT, radical length (cm), seedling length (cm), SVI and total chlorophyll (SPAD) and lowest values of abnormal and hard seeds percentages (%) of sugar beet were acquired from the control treatment (irrigation water), and then usual agricultural wastewater. While, the lowest values of germination %, SGI, GI, MGT, radical length (cm), seedling length (cm), SVI and total chlorophyll (SPAD) and maximum percentages (%) of hard and abnormal seeds of sugar beet were produced from industrial wastewater. The majority of industrial effluents contain heavy metals, which are potential contaminants (Marthandan *et al.*, 2018). Higher concentrations of metals and other contaminants interfere with the biochemical, physiological, and genetic components of plants, making it difficult for crops to germinate, grow, and develop (Wang *et al.*, 2003). These results align with those of Sharma *et al.* (2002) and Kalaiselvi *et al.* (2009).

Table 2. Means of germination percentage (%), speed germination index, germination index (GI), co-efficient of germination (CG), mean germination time (MGT), energy of germination (EG) and abnormal seedlings percentage (%) of sugar beet as affected by various irrigation water sources and soaking seed treatments in some artificial and natural substances as well as their interaction during March month, 2023.

Characters / Treatments	Germination percentage (%)	Speed germination index (SGI)	Germination index (GI)	Co-efficient of germination (CG)	Mean germination time (MGT)	Energy of germination (EG)	Abnormal seedlings percentage (%)
A. Irrigation water sources:							
Irrigation water (control)	84.26 a	1.85 a	1.413 a	16.17 a	10.28 a	43.49 a	1.93 b
Usual agricultural wastewater	76.69 b	1.82 ab	1.310 a	15.98 a	9.68 a	40.88 a	4.81 a
Industrial wastewater	68.51 c	1.69 b	1.176 b	15.13 a	8.87 b	39.84 a	6.73 a
F. test	*	*	*	N.S	*	NS	*
B. Soaking seeds:							
Without (control)	56.89 g	1.36 c	0.967 e	14.26 a	7.75 f	31.25 c	11.16 a
Distilled water	65.20 f	1.54 bc	1.111 de	14.87 a	8.66 ef	31.25 c	6.99 b
B	70.07 ef	1.57 bc	1.194 cd	15.41 a	9.00 de	36.80 c	5.61 bc
HA	87.47 ab	2.09 a	1.489 ab	16.54 a	10.66 ab	50.00 ab	1.41 d
YE	92.56 a	2.18 a	1.573 a	16.71 a	11.16 a	60.41 a	1.17 d
Si	79.37 cd	1.94 a	1.344 bc	16.21 a	9.91 bcd	40.27 bc	3.27 cd
K	75.66 de	1.65 b	1.281 bcd	15.79 a	9.41 cde	37.50 bc	3.51 bcd
(Macro + Micro + AA)	84.69 bc	1.96 a	1.437 ab	16.31 a	10.33 abc	43.74 bc	2.80 cd
F. test	*	*	*	N.S	*	*	*
C. Interaction (F. test):							
A × B	*	*	*	*	*	*	*

Table 3. Means of hard seeds percentage (%), radical and plumel lengths (cm), seedling length (cm), seedling vigor index (SVI), radical and plumel dry weights (mg) as well as total chlorophyll (SPAD) of sugar beet as affected by various irrigation water sources and soaking seed treatments in some artificial and natural substances as well as their interaction during March month, 2023.

Characters / Treatments	Hard seeds percentage (%)	Radical length (cm)	Plumel length (cm)	Seedling length (cm)	Seedling vigor index (SVI)	Radical dry weight (mg)	Plumel dry weight (mg)	Total chlorophyll (SPAD)
A. Irrigation water sources:								
Irrigation water (control)	13.80 b	6.93 a	6.24 a	13.18 a	11.25 a	0.0161 a	0.0128 a	1.46 a
Usual agricultural wastewater	18.49 b	6.75 a	6.24 a	12.99 a	10.17 b	0.0146 a	0.0117 a	1.45 a
Industrial wastewater	24.74 a	6.12 b	6.15 a	12.28 b	8.65 c	0.0141 a	0.0116 a	1.40 b
F. test	*	*	NS	*	*	NS	NS	*
B. Soaking seeds:								
Without (control)	31.94 a	4.54 g	5.23 f	9.78 g	5.59 g	0.0028 f	0.0020 e	1.20 f
Distilled water	27.77 ab	5.50 f	5.64 e	11.15 f	7.29 f	0.0045 f	0.0032 de	1.27 f
B	24.30 abc	6.07 e	6.02 d	12.09 e	8.47 e	0.0096 e	0.0057 de	1.34 e
HA	11.11 de	7.71 b	6.78 ab	14.49 b	12.71 b	0.0258 b	0.0219 b	1.58 b
YE	6.24 e	8.43 a	7.07 a	15.51 a	14.40 a	0.0328 a	0.0275 a	1.73 a
Si	17.36 cd	6.91 cd	6.26 cd	13.17 d	10.46 d	0.0142 cd	0.0110 c	1.45 cd
K	20.83 bc	6.46 de	6.14 d	12.60 e	9.56 d	0.0116 de	0.0073 cd	1.40 de
(Macro + Micro + AA)	12.50 de	7.20 bc	6.56 bc	13.76 c	11.68 c	0.0185 c	0.0176 b	1.51 c
F. test	*	*	*	*	*	*	*	*
C. Interaction (F. test):								
A × B	*	*	*	*	*	*	*	*

2. Effect of soaking seed treatments in some artificial and natural substances:

The averages of the following germination parameters: germination %, SGI, GI, MGT, EG, percentages of abnormal and hard seeds % and total chlorophyll (SPAD) of sugar beet significantly affected by soaking seed treatments in various artificial and natural substances for 18 hours, *i.e.* without soaking (untreated "control treatment"), soaking in distilled water, boron at a rate of 5 ml per liter, humic acid at a rate of 2.5 g/liter, yeast extract at a rate of 150 ml per liter, silicon at a rate of 10 ml per liter, potassium at a rate of 1 ml per liter and Macro + Micro + AA at a rate of 3.2 ml per liter. While, soaking seed treatments in various artificial and natural substances insignificantly affected co-efficient of germination (CG) as shown from results in Tables 2 and 3.

The results clearly showed that in terms of germination and seedling characteristics, soaking sugar beet seeds in YE at a rate of 150 milliliters per liter outperformed the other examined soaking seed treatments in various artificial and natural substances and produced the maximum numbers of germination %, SGI, GI, MGT, EG, radical, plumel and seedling lengths (cm), SVI, radical and plumel dry weights (mg) as well as total chlorophyll (SPAD) and lowest percentages of irregular and hard seeds of sugar beet. It was followed by soaking sugar beet seeds in HA at a rate of 2.5 g/liter. The arrangement of other studied soaking seed treatments in some artificial and natural substances was as follows; Macro + Micro + AA at a rate of 3.2 milliliters for every liter, Si at a rate of 10 milliliters for every liter, K at a rate of 1 milliliter for every liter, boron at a rate of 5 milliliters for every liter and distilled water. Whereas, the lowest values of germination %, SGI, GI, MGT, EG, radical, plumel and seedling lengths (cm), SVI, radical and plumel dry weights (mg) as well as total chlorophyll (SPAD) and maximum values of abnormal and hard seeds percentages of sugar beet were produced from without soaking (untreated "control treatment"). By soaking seeds in a solution of micronutrients, inhibitory compounds from the fruits may have leached into the seed, enhancing plant vigor, growth traits, and crop emergence (Gharib and El-Henawy et *al*., 2011). These outcomes partially agree with those noted by Shorrocks *et al*. (1997), Jafarzadeh and Aliasgharzad (2007), Moursy (2018), Kaya and Kulan (2020) and Arafat (2023).

3. Effect of interaction:

The findings demonstrated that all germination parameters as well as seedling parameters, as displayed in Tables 2 and 3, were significantly impacted by the interaction between the two investigated factors (various irrigation water sources and soaking seed treatments in various artificial and natural substances). We present only the significant interaction between the two studied factors on germination percentage (%), radical and plumel dry weights (mg) as well as SVI.

The maximum numbers of germination % (as visually demonstrated in Fig. 1), seedling vigor index (as visually demonstrated in Fig. 2), radical dry weight (as graphically illustrated in Fig. 3) and plumel dry weight (as visually demonstrated in Fig. 4) of sugar beet were recorded when soaking sugar beet seeds in YE at a rate of milliliters for every liter under irrigation water (control treatment). However, the lowest values of germination percentage (%), radical and plumel dry weights (mg) as well as SVI of sugar beet were resulted from without soaking sugar beet seeds in any artificial and natural substances under industrial wastewater.

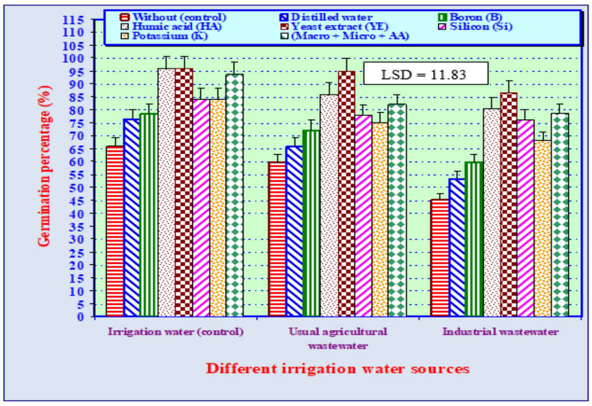

Fig. 1. Means of germination percentage (%) of sugar beet as affected by various irrigation water sources and soaking seed treatments in some artificial and natural substances as well as their interaction during March, 2023.

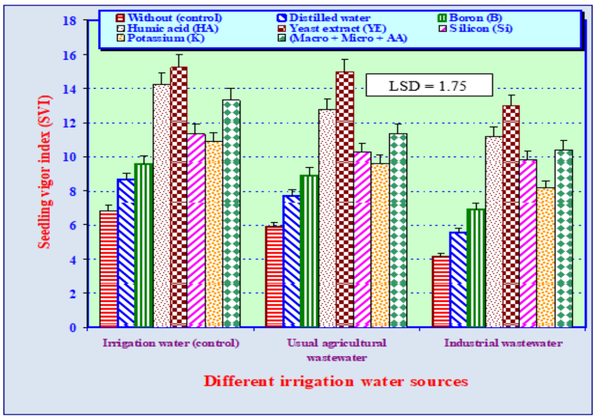

Fig. 2. Means of seedling vigor index (SVI) of sugar beet as affected by various irrigation water sources and soaking seed treatments in some artificial and natural substances as well as their interaction during March, 2023.

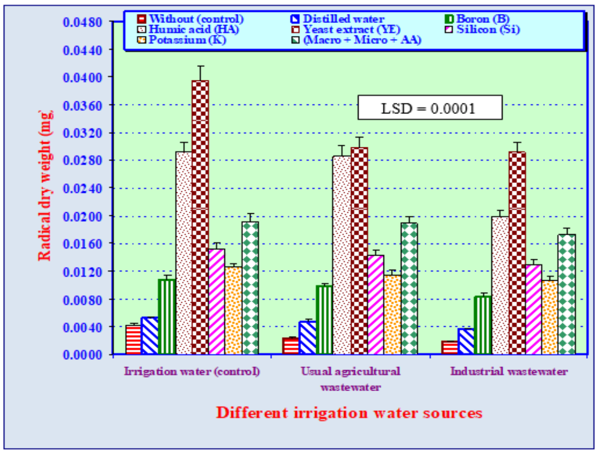

Fig. 3. Means of radical dry weight (mg) of sugar beet as affected by various irrigation water sources and soaking seed treatments in some artificial and natural substances as well as their interaction during March, 2023.

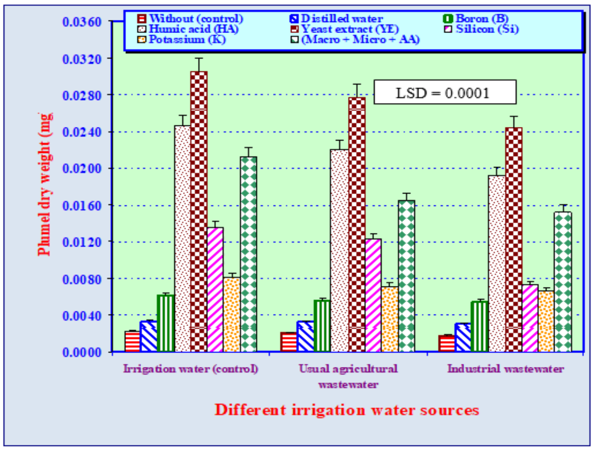

Fig. 4. Means of plumel dry weight (mg) of sugar beet as affected by various irrigation water sources and soaking seed treatments in some artificial and natural substances as well as their interaction during March, 2023.

CONCLUSION

Soaking seeds for 18 hours in YE at a rate of 150 ml per liter and irrigation by usual agricultural wastewater improve sugar beet Heba cultivar germination and seedlings parameters.

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دور بعض المواد الصناعية والطبيعية فى تحسين إنبات وصفات بادرات بنجر السكر تحت مصادر مياه الرى المختلفة

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الملخص

أجريت تجربة معملية بقسم المحاصيل، كلية الزراعة، جامعة المنصورة، مصر، خلال شهر مارس 2023 م، وذلك لدراسة تأثير بعض المواد الصناعية والطبيعية (بدون نقع، النقع فى؛ الماء المقطر، البورون بمعدل 5 مل/لتر ماء، حمض الهيوميك بمعدل 2.5 جم/لتر ماء، مستخلص الخميرة بمعدل 150 مل/لتر ماء، السيليكون بمعدل 10 مل/لتر ماء، البوتاسيوم بمعدل 1 مل/لتر ماء والعناصر الكبرى والصغرى والأحماض الأمينية بمعدل 3.2 مل/لتر ماء) لتحسين صفات إنبات وبادرات بنجر السكر تحت مصادر مياه الرى المختلفة (مياه الرى، مياه الصرف الزراعى ومياه الصرف الصناعى) في الظروف المعملية. تم إجراء التجربة المعملية في تجربة عاملية في تصميم تام العشوائية (CRD). نتجت أعلى القيم من صفات النسبة المئوية للإنبات، معدل سرعة الإنبات، معدل الإنبات، متوسط زمن الإنبات، طول الجذير، طول البادرة، معدل قوة البادرة ومحتوى الكلوروفيل الكلى وأقل القيم من صفات النسبة المئوية للبادرات الغير طبيعية والبذور الصلبة من بنجر السكر من معاملة المقارنة (مياه الرى)، يليها مياه الصرف الزراعى. أدى نقع بذور بنجر السكر في بنجر السكر في مستخلص الخميرة بمعدل 150 مل/لتر للحصول على أعلى القيم من صفات النسبة المئوية للإنبات، معدل سرعة الإنبات، معدل الإنبات، متوسط زمن الإنبات، طاقة الإنبات، طول الجذير، طول الريشة، طول البادرة، معدل قوة البادرة، وزن الجذير، وزن الريشة ومحتوى الكلوروفيل الكلى وأقل القيم من صفات النسبة المئوية للبادرات الغير طبيعية والبذور الصلبة من بنجر السكر. تبع ذلك نقع بذور بنجر السكر في حمض الهيوميك بمعدل 5.2 جم/لتر. يمكن التوصية بنقع البذور لمدة 18 ساعة في مستخلص الخميرة بمعدل 150 مل/لتر في حالة الرى بمياه الصرف الزراعى لتحسين إنبات وصفات بادرات بنجر السكر صنف هبة.