Role of Foliar Spraying with Biostimulants Substances in Decreasing Mineral Nitrogen Fertilizer of Sugar Beet
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ABSTRACT

In order to study the role of foliar spraying with biostimulants substances and fertilizing with nitrogen mineral fertilizer on productivity and quality of sugar beet, a field experiment was performed during 2015/2016 and 2016/2017 winter seasons at Tag Al-Ezz, Agricultural Research Station Farm, Dakahlia Governorate, Egypt. Strip-plot designs with four replications were used. Spraying plants with 150 ml yeast extract/liter plus 1.5 ml humic acid/liter as mixture recorded the highest means of all studied characters. However, spraying with 150 ml yeast extract/liter came in the second rank, followed by spraying with 1.5 ml humic acid/liter, then spraying with water and lastly without (control treatment) in the two seasons. Decreasing mineral nitrogen fertilization from 100 to 85, 70 and 55% from the recommended dose (90 kg N/fed) caused gradual reduction in all studied characters, with exception sucrose and apparent purity in both seasons. Highest values of root, top and sugar yields per fed were recorded with adding 100 or 85 % from the recommended dose without significant differences between them during growing seasons. For maximizing sugar beet productivity and quality and decreasing environmental pollution and cost could be succeeded with spraying plants twice with the mixture of 150 ml yeast extract/liter plus 1.5 ml humic acid/liter and fertilizing with 76.5 kg N per fed as soil application under environmental conditions of Dakahlia Governorate, Egypt.

Keywords: Sugar beet, biostimulants, yeast extract, humic acid, nitrogen fertilizer levels, growth, yields, quality.

INTRODUCTION

Sugar beet (Beta vulgaris L.) is considering one of the main sources of sugar beside sugar cane in the world and Egypt. Increasing production of sugar as of unit area is attractive one of the essential domestic targets to reduce the gap between sugar consumption and production. So, farmers require using additional nutrient inputs, especially mineral nitrogen fertilizers to improve growth characters and root yield per unit area. Increasing mineral nitrogen fertilizer caused many problems like higher emission of N₂O to the atmosphere (Bronson et al., 1997) and NO₂ pollution of groundwater and soil acidification (Shrestha and Ladha, 1998). For these problems, a great effort has been concentrated for using other fertilizers, including organic sources and non-polluting sources like biostimulants i.e. humic acid substances.

Natural and non-harmful substances like yeast extract can use as foliar application due to it plays a vital role as induction gibberellic acid (GA), indole acetic acid (IAA) and phytohormones (cytokinins) as endogenous hormones, rich sources of enzymes, vitamins, essential minerals and amino acids (Natio et al., 1981 and Mok and Mok, 2001). In addition, Castelfranco and Beale (1983) found that development and division of cells, synthesis of nucleic acid and protein and the formation of chlorophyll significantly affected by using yeast extract. Essam et al. (2012) and Aly et al. (2014) indicated that using yeast extract at the rate of 5 g/liter as a soil application and a foliar spraying on sugar beet plants increased root yield components and root and gross sugar yields/fed in both seasons. Awad and Mostafa (2014) found that spraying sugar beet plants with yeast significantly increased percentage of root juice purity and sugar yield/fed. Abdou (2015) showed that spraying sugar beet plants with yeast resulted in significant increases in the averages of all studied characters, except root diameter and root juice apparent purity percentage as compared with the control treatment.

The compounds of humic acid have multifarious roles which can significantly effects on the structure of soil characters, aggregation, aeration, permeability, water-holding capacity and activity of soil microbial populations, permeability and absorbency of plant cell and the uptake of nutrients (Akinremi et al., 2000, Nardi et al., 2002 and Tan, 2003). Moreover, humic acid play an important role and effect on the process of the functions of cell membrane by stimulating nutrients uptake, respiration, chlorophyll content, photosynthesis, biosynthesis of DNA, absorption of ions and intensify of system of enzyme as well as control the activity of H⁺ and ATP in plasmalema and tonoplast (Yang et al., 2004 ; Fathy et al., 2009 ; Khaled and Fawy, 2011 ; Seydabadi and Armin, 2014 and Abd El-Hai and El-Saidy, 2016). Rassam et al. (2015) and El-Hassanin et al. (2016) revealed that foliar application with humic acid significantly enhanced growth, root yield/fed, sucrose content, purity percentage of sugar yield. El-Gamal et al. (2016) showed that foliar spraying with 25 g/litter of humic acid produced the maximum values of leaves area, relative growth rate, crop growth rate and sugar and top yields/fed.

Sugar beet, need big amounts of nitrogen due to nitrogen is one of the most important yield carrier, and element that improve growth characters, yield, its attributes and root quality. So, nitrogen has a marked effect on plant growth characters. In addition, application mineral nitrogen fertilizer increase the formed of protoplasm and chlorophyll, protein content, building up metabolites and activation of enzymes that associate with carbohydrate accumulation, to increasing division and elongation of cells, accordingly increasing growth and yield of plants. In this connection, El-Sarag (2009), Ferweez et al. (2011) and Shaban et al. (2014) concluded that root length, root diameter and root, top as well as sugar yield per fed were increased with increasing the levels of nitrogen fertilizer to 100 or 110 kg N per fed. Moreover, Abdelaal and Tawfik (2016) and El-Hassanin et al. (2016) confirmed that increasing nitrogen fertilizer levels caused increase in chlorophyll content, foliage length, area of leaves, fresh weights of foliage and root, root length, diameter of roots and top, root as well as sugar yield per fed. In contrast, Monreala et al. (2007), El-Geddawy et al. (2008) and Abdelaal and Tawfik (2016) reported that sucrose and purity percentages were a decrease due to increasing the levels of nitrogen fertilizer, this might be as a result of the increases of amino compounds caused by the extreme of nitrogen uptake.
Therefore, this study aimed to enhance growth, yield and its attributes as well as quality of sugar beet plants by foliar spraying with some biostimulants substances and reducing mineral nitrogen fertilization and environmental pollution under the conditions environments of the Governorate of Dakahlia, Egypt.

**MATERIALS AND METHODS**

A field experiments was conducted during 2015/2016 and 2016/2017 winter seasons at Tag Al-Elz, Agricultural Research Station Farm, Dakahlia Governorate, Agricultural Research Center, Egypt, to assess the role of foliar spraying with biostimulants substances and the levels of nitrogen mineral fertilizer on growth, productivity and quality parameters of sugar beet cv. Oskarpoly.

A strip-plot design with four replicates was used. Foliar spraying with biostimulants substances i.e. without (control treatment), water, 150 ml/Liter of yeast extract, 1.5 ml/Liter of humic acid and mixture of 150 ml/Liter of yeast extract beside 1.5 ml/Liter of humic acid were arranged in the vertical plots. Foliar solution volume was 200 Liter/fed sprayed by hand sprayer on units of experimental twice until the saturation point later than 50 & 70 days from sowing (DFS).

According to Spencer et al. (1983) 1 gram from active dry yeast were liquefied in one liter of water followed by adding sugar at the same rate then saved for activation, multiplied efficiently and reproduction of yeast during beneficial aerobic. Sugars, carbohydrates, amino acids, proteins, hormones and fatty acids were produced, then yeast cells components could be release out easily by two freezing rotation and defrosting for causing disruption in yeast cells and producing their content.

Uni-humic, which contains 18.5 % high purity humic acid in liquid form, 1.5% folic acid, 0.5 % K_2O and 0.5-1.0 % micronutrients (Fe, Zn and Mn) as a source of humic acid, it was manufactured by United for Agricultural Development.

Nitrogen fertilizer levels (100, 85, 70 and 55% from the recommended dose "90 kg N/fed") i.e. 90, 76.5, 63.0 and 49.5 kg N/fed were distributed in the horizontal plots. The nitrogen in the form of urea (46.0 % N) were added in similar two portions, the first one was added after the thinning (35 DFS) and prior to the 2nd irrigation, and the other dose was added after (50 DFS) and before the 3rd irrigation.

According to the soil properties of the experimental site, the soil texture was clay loam, pH (7.65), electrical conductivity (2.25 dSm⁻¹), organic matter (1.49 %), available nitrogen (34.35 ppm), available phosphorous (7.7 ppm) and exchangeable potassium (221 ppm), all these data were estimated as an averages over both growing seasons of 2015/2016 and 2016/2017.

The unit basic area of each experimental was 10.5 m² (1/400 fed) included five ridges, each (60 cm width) apart and 3.5 m long. Rice was the preceding summer crop during two growing seasons.

The experimental field was well prepared, then divided to experimental units. During soil preparation, 150 kg calcium superphosphate "15.5 % P_2O_5" per feddan was applied. Hand dry sowing method of sugar beet used, which 3-5 balls per hill were sown in hills 20 cm apart on one side of the ridge, the date of sowing was 15th of October in both seasons. After sowing all plots directly were irrigated and plants were thinned after full germinated after 35 DFS to produce one plant/hill, plant population (35000 plants/fed). The recommendations for growing sugar beet of the Ministry of Agriculture were applied, excluding the factors under study.

**Data recorded:**

**Growth characters:**

At 120 DFS, five guarded plants were collected randomly from the two outer ridges of each plot to estimate the following traits:

1. Total chlorophyll (SPAD): by using SPAD-502 (Minolta Co. Ltd., Osaka, Japan) total chlorophyll content was estimated.
2. Leaves area/plant (cm²): It was estimated by applying the dry-weight method as confirmed by Roads and Bloodworth (1964).
3. Foliage length (cm).

After 120 and also 150 days DFS, samples of five plants were collected randomly from the two outer ridges of each plot to estimate the dry weight of chosen plants, where the portions of all plant were air-dried, then at 70°C it was oven dried till constant weight, to calculate the following traits:

4. Crop growth rate (CGR) in g/week was calculated by using equation as confirmed by Radford (1967):

\[
CGR = \frac{W_2 - W_1}{T_2 - T_1}
\]

Where: \(W_1\) and \(W_2\) refers to plant dry weight at sampling recorded at time \(T_1\) and time \(T_2\) after 120 and 150 DFS, respectively.

5. Relative growth rate (RGR) in g/g/week as described by Radford (1967) was estimated by using the following equation:

\[
RGR = \frac{\log W_2 - \log W_1}{T_2 - T_1}
\]

Where: \(\log\) refers to the natural log and \(W_1\) and \(W_2\) refers to plant dry weight at sampling recorded at time \(T_1\) and time \(T_2\) after 120 and 150 DFS, respectively.

**Yield and its components and quality characters:**

After 210 DFS, randomly five guarded plants were collected from the external ridges of each plot to measure the following characters:

1- Fresh weight of roots (g/plant).
2- Fresh weight of foliage (g/plant).
3- Length of roots (cm). 4- Diameter of roots (cm).
5- Total soluble solids (TSS %) was estimated in juice of fresh roots by using Hand Refractometer.
6- Sucrose (%) was determined Polarimetrically according the method confirmed by Carruthers and Oldfield (1960).

7- Apparent purity (%) was calculated as following equation (Carruthers and Oldfield, 1960).

\[
\text{Apparent purity} (%) = \left( \frac{\text{Sucrose content}}{\text{TSS content}} \right) \times 100
\]

All Plants in the three inner ridges of each plot were harvested, cleaned and root and foliage were separated and weighted to calculate the following characters:

1- Root yield (t/fed). 2- Top yield (t/fed).
3- Sugar yield (t/fed): it was calculated by multiplying sucrose % by root yield/fed.
The collected data were subjected to the proper analysis of variance (ANOVA) for the strip-plot design as described by Gomez and Gomez (1984). Least significant differences (LSD) technique was applied to compare the differences among treatments means at the probability level of (0.05) as confirmed by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

A- Impact of foliar spraying with biostimulants substances:
Foliar spraying with biostimulants substances i.e. without (control treatment), foliar spraying twice with water, 150 ml/Liter of yeast extract, 1.5 ml/Liter of humic acid and mixture of 150 ml/Liter of yeast extract beside 1.5 ml/Liter of humic acid markedly affected growth traits i.e. total chlorophyll, leaves area/plant, foliage length, crop growth rate (CGR) and relative growth rate (RGR) "Table 1", yield attributes i.e. root fresh weight, root length and root diameter, root juice quality i.e. TSS, sucrose, apparent purity percentages "Table 2" and yields i.e. root yield, top yield and sugar yields/fed in both seasons “Table 3”. The results indicated that all studied characters were increased due to foliar spraying twice after 50 and 70 DFS with biostimulants substances as compared with control treatment during growing seasons.

Results revealed that maximum values of studied characters were recorded from foliar spraying with mixture of yeast extract plus humic acid during growing seasons. While, using yeast extract came in the second rank, followed by humic acid, then water and lastly the control treatment in both seasons.

In general, using mixture of 150 ml/Liter of yeast extract plus 1.5 ml/Liter of humic acid significantly increased total chlorophyll by (10.10%), leaves area/plant by (9.20%), foliage length by (13.91%), CGR by (19.70%), RGR by (11.26%), root fresh weight by (19.98%), root length by (19.15%), root diameter by (27.00%), TSS by (7.03%), sucrose % by (12.88%), apparent purity by (5.44%), root yield/fed by (8.19%), top yield/fed/fed by (26.79%) and sugar yield/fed by (22.81%), respectively as an average over two growing seasons as compared with without foliar spraying (control treatment).

Table 1. Total chlorophyll, leaves area/plant, foliage length at 120 DFS, crop growth rate (CGR) and relative growth rate (RGR) as affected by foliar spraying with biostimulants substances and nitrogen fertilizer levels as well as their interaction during 2015/2016 and 2016/2017 seasons.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Total chlorophyll (SPAD)</th>
<th>Leaves area/plant (cm²)</th>
<th>Foliage Length (cm)</th>
<th>CGR (g/week)</th>
<th>RGR (g/week)</th>
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<tr>
<td>Seasons</td>
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<tr>
<td>A- Foliar spraying with biostimulants substances:</td>
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<td>Without</td>
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<td>Water</td>
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<td>Yeast extract</td>
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<td>Humic acid</td>
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<td>Yeast extract + humic acid</td>
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<td>LSD at 5%</td>
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<tr>
<td>100% (90 kg N/fed)</td>
<td>49.43</td>
<td>50.58</td>
<td>3374.43</td>
<td>3485.76</td>
<td>49.39</td>
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<tr>
<td>85% (76.5 kg N/fed)</td>
<td>49.15</td>
<td>50.14</td>
<td>3371.18</td>
<td>3482.65</td>
<td>49.01</td>
</tr>
<tr>
<td>70% (63.0 kg N/fed)</td>
<td>47.00</td>
<td>48.92</td>
<td>3328.66</td>
<td>3406.96</td>
<td>45.36</td>
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<tr>
<td>55% (49.5 kg N/fed)</td>
<td>42.10</td>
<td>45.84</td>
<td>3291.02</td>
<td>3376.70</td>
<td>42.37</td>
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<tr>
<td>B- Nitrogen fertilizer levels from the recommended dose:</td>
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<tr>
<td>LSD at 5%</td>
<td>1.43</td>
<td>0.96</td>
<td>14.56</td>
<td>20.89</td>
<td>1.49</td>
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<td>C- Interaction (F. test):</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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Table 2. Root fresh weight, root length, root diameter, total soluble solids (TSS), sucrose and apparent purity percentages as affected by foliar spraying with biostimulants substances and nitrogen fertilizer levels as well as their interaction during 2015/2016 and 2016/2017 seasons.

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</thead>
<tbody>
<tr>
<td>A- Foliar spraying with biostimulants substances:</td>
<td>Root fresh weight (g)</td>
<td>636.60</td>
<td>647.03</td>
<td>22.21</td>
<td>23.60</td>
<td>8.73</td>
<td>9.67</td>
<td>22.15</td>
<td>22.53</td>
<td>18.64</td>
<td>19.03</td>
</tr>
<tr>
<td>Without</td>
<td>Root length (cm)</td>
<td>652.32</td>
<td>658.00</td>
<td>23.41</td>
<td>25.98</td>
<td>9.68</td>
<td>10.84</td>
<td>22.38</td>
<td>22.87</td>
<td>19.88</td>
<td>20.37</td>
</tr>
<tr>
<td>Water</td>
<td>Root diameter (cm)</td>
<td>711.98</td>
<td>702.67</td>
<td>26.05</td>
<td>28.05</td>
<td>11.69</td>
<td>12.41</td>
<td>23.95</td>
<td>23.98</td>
<td>20.95</td>
<td>20.98</td>
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<tr>
<td>Yeast extract</td>
<td>TSS (%)</td>
<td>667.80</td>
<td>676.40</td>
<td>25.05</td>
<td>27.06</td>
<td>10.50</td>
<td>12.09</td>
<td>23.40</td>
<td>23.69</td>
<td>21.50</td>
<td>21.79</td>
</tr>
<tr>
<td>Humic acid</td>
<td>Apparent purity (%)</td>
<td>776.69</td>
<td>795.57</td>
<td>28.80</td>
<td>29.95</td>
<td>12.81</td>
<td>13.19</td>
<td>24.18</td>
<td>24.25</td>
<td>22.68</td>
<td>22.75</td>
</tr>
<tr>
<td>Yeast extract + humic acid</td>
<td>LSD at 5%</td>
<td>5.39</td>
<td>4.81</td>
<td>0.96</td>
<td>0.79</td>
<td>0.40</td>
<td>0.16</td>
<td>0.35</td>
<td>0.40</td>
<td>0.35</td>
<td>0.40</td>
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<tr>
<td>B- Nitrogen fertilizer levels from the recommended dose:</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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Table 1373
The considerable effect of foliar spraying of sugar beet plants twice with yeast extract plus humic acid on the growth traits, yields and its attributes and quality may be ascribed to the mixture in the desired impact of them. Meanwhile, yeast extract (YE) plays a vital role as inductor of endogenous hormones, rich sources of vitamins, cytokinins, enzymes, vital minerals and amino acids (Natio et al., 1981 and Mok and Mok, 2001). Also YE had beneficial effects on the processes of cell division, the synthesis of protein and DNA and the formation of chlorophyll (Castelfranco and Beale, 1983). However, humic acid (HA) have multifarious roles, which can significantly increase mechanisms involved in plant growth stimulation, the uptake of nutrients and the permeability of cell (Akinremi et al., 2000 ; Nardi et al., 2002 and Tan, 2003). Also, HA play an important role and effect on the process of cell membrane functions by stimulating nutrients uptake, respiration, chlorophyll content, photosynthesis, ion absorption, nucleic acid biosynthesis, intensify enzyme system and controls the activity of H+ and ATP in plasmalemma and tonoplast (Yang et al., 2004 ; Fathy et al., 2009 ; Khaled and Fawy 2011 and Seydabadi and Armin, 2014). These findings are in a good line with thus confirmed by Rassam et al. (2015), El-Gamal et al. (2016) and El-Hassanin et al. (2016).

**B- Effect of mineral nitrogen fertilizer levels:**

**A- Foliar spraying with biostimulants substances:**

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</thead>
<tbody>
<tr>
<td>Yeast extract</td>
<td>25.017</td>
<td>25.517</td>
<td>12.517</td>
<td>13.208</td>
<td>5.231</td>
<td>5.338</td>
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<tr>
<td>Humic acid</td>
<td>23.658</td>
<td>24.825</td>
<td>11.492</td>
<td>12.308</td>
<td>5.084</td>
<td>5.402</td>
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<tr>
<td>Yeast extract + humic acid</td>
<td>25.700</td>
<td>25.992</td>
<td>13.750</td>
<td>14.208</td>
<td>5.815</td>
<td>5.900</td>
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<tr>
<td>LSD at 5 %</td>
<td>0.182</td>
<td>0.384</td>
<td>0.205</td>
<td>0.310</td>
<td>0.101</td>
<td>0.124</td>
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<tr>
<td>100% (90 kg N/fed)</td>
<td>25.313</td>
<td>26.660</td>
<td>13.020</td>
<td>13.440</td>
<td>5.024</td>
<td>5.352</td>
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<tr>
<td>85% (76.5 kg N/fed)</td>
<td>25.220</td>
<td>26.567</td>
<td>12.933</td>
<td>13.353</td>
<td>5.196</td>
<td>5.584</td>
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<tr>
<td>70% (63.0 kg N/fed)</td>
<td>22.780</td>
<td>23.100</td>
<td>10.967</td>
<td>11.667</td>
<td>4.845</td>
<td>4.962</td>
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<tr>
<td>55% (49.5 kg N/fed)</td>
<td>22.207</td>
<td>22.600</td>
<td>9.693</td>
<td>10.320</td>
<td>4.774</td>
<td>4.873</td>
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<tr>
<td>LSD at 5 %</td>
<td>0.227</td>
<td>0.110</td>
<td>0.280</td>
<td>0.479</td>
<td>0.221</td>
<td>0.293</td>
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<tr>
<td>C- Interaction (F. test):</td>
<td>* *</td>
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weight as well as diameter, water content of tissue and increasing the amount of non-sucrose substances i.e. alpha amino acid and proteins therefore, minimizing sucrose and apparent purity percentages in the roots of sugar beet. Authorizing these findings, Monreala et al. (2007), El-Geddawy et al. (2008) and Abdelaal and Tawfik (2016) they reported that the decrease in both of sucrose % and purity % may be due to the increase in amino compounds caused by the extreme of nitrogen uptake.

C- Effect of the interaction:

Concerning to the relation between studied characters (biostimulants substances and mineral nitrogen fertilizer levels) there were a significant effects on Total chlorophyll (in the second season only), leaves area/plant, foliage length, CGR, root fresh weight, root length, root diameter, root yield, foliage yield as well as sugar yield in two growing seasons as presented in Tables 1, 2 and 3. The recommended treatment that produced the highest values of leaves area/plant "Fig 1", foliage length "Fig 2", CGR "Fig 3", root fresh weight "Fig 4", root length "Fig 5", root diameter "Fig 6", root yield "Fig 7", top yield "Fig 8" and sugar yield "Fig 9" were resulted from foliar spraying with the mixture of yeast extract at the rate of 150 ml/Liter plus humic acid at the rate of 1.5 ml/Liter beside fertilization with soil mineral nitrogen fertilizer at the 100% from the recommended dose (90 kg N/fed). This treatment was followed by foliar spraying with the same biostimulants substances beside applying 85% from the recommended dose of nitrogen (76.5 kg N/fed) without significant differences between them in both seasons. Therefore, this treatment considered the favorable treatments due to its importance in saving about 15 kg N/fed and the reduction in root yield and top yield of sugar plant not exceeded (0.35 and 0.65%) as an average of both seasons, respectively. Vice versa, the minimum values of above mentioned characters were obtained from control treatment (without foliar spraying) beside mineral nitrogen fertilizer (55% from the recommended dose) in both growing seasons.

![Fig 1. Leaves area/plant (cm²) of sugar beet as affected by the interaction between foliar spraying with biostimulants substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.](image1)

![Fig 2. Foliage length (cm) of sugar beet as affected by the interaction between foliar spraying with biostimulants substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.](image2)
Abido, W. A. E. and M. E. M. Ibrahim

Fig. 3. Crop growth rate (g/week) of sugar beet as affected by the interaction between foliar spraying with biostimulants substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.

Fig. 4. Root fresh weight (g) of sugar beet as affected by the interaction between foliar spraying with biostimulants substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.

Fig. 5. Root length (cm) of sugar beet as affected by the interaction between foliar spraying with biostimulants substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.
Fig. 6. Root diameter (cm) of sugar beet as affected by the interaction between foliar spraying with biostimulant substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.

Fig. 7. Root yield (t/fed) of sugar beet as affected by the interaction between foliar spraying with biostimulant substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.

Fig. 8. Top yield (t/fed) of sugar beet as affected by the interaction between foliar spraying with biostimulant substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.
**Fig. 9.** Sugar yield (t/fed) of sugar beet as affected by the interaction between foliar spraying with biostimulants substances and nitrogen fertilizer levels during 2015/2016 and 2016/2017 seasons.

**CONCLUSION**

In conclusion, it could be recommended that foliar spraying twice with the mixture of 150 ml/Liter of yeast extract plus 1.5 ml/Liter of humic acid beside nitrogen fertilizing with 76.5 kg N/fed as soil application led to maximize growth traits, yields and its components quality of sugar beet in addition and saving 15 kg N/fed and reducing the environmental pollution under the environmental conditions of this study.

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