J. Plant Production, Mansoura Univ., Vol. 9 (4): 333 - 338, 2018

Effect of Potassium Humate and Nitrogen Fertilization on Yield and Quality of Sugar Beet in Sandy Soil

Nemeata Alla, H. E. A.[1]; A. H. Sasy[2] and Samar A. M. Helmy[2]
[1]Agron., Res., Dept.
[2]Sugar Technol., Res. Dept., Sugar Crops Res. Inst., Agric. Res. Center, Giza, Egypt.

ABSTRACT

Two field experiments were conducted at Wadi El-Natrun, El-Bahira Governorate, (latitude of 30.48^0 N and longitude of 30.50^0 E) in 2015/2016 and 2016/2017 seasons to study the effect of potassium humate and nitrogen fertilization and its impact on yield and quality of sugar beet sown in a sandy soil. The present work included twelve treatments, which were the combination of four potassium humate levels as soil additives (without, 4, 8 and 12 liter /fed) and three nitrogen rates (80, 100 and 120 kg N/fed). the treatments were arranged In strip plot design with four replicates. Potassium humate levels were occupied the vertical plots, while nitrogen rates were represented in horizontal plots. Results show that soil application of 8 and/or 12 l potassium humate/fed significantly exhibited higher values of leaf area index (LAI), root diameter, root and foliage fresh weight/plant, sucrose%, and quality index as well as extractable sugar%, root and sugar yields/fed in both seasons. Moreover, root potassium, sodium, α-amino N contents, alkalinity coefficient and sugar lost to molasses% were insignificantly affected by the studied potassium humate levels.Increasing nitrogen fertilizer from 80 up to 120 kg/fed positively enhanced LAI, root diameter, root and foliage fresh weights/plant in both seasons. Whilst, the highest sucrose, extractable sugar percentages, sugar and root yields/fed, quality index and alkalinity coefficient were obtained by the application of 100 kg N/fed. On the other hand, higher values of sugar lost to molasses% and non-sucrose components (K, Na and α-amino -N) were detected in beets fertilized with 120 kg N/fed. Based, under conditions of the present work, application of 8 1/fed potassium humate and fertilized with 100 kg N/fed could recommend obtaining the highest root and sugar yields/fed.

Keywords: Humate potassium, Nitrogen, Sandy soil, Sugar beet.

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is one of the main sugar crops in the world in the world. It has a wide adaptability to grow in saline, alkaline and calcareous soils. Thus, it can be economically grown in the newly reclaimed soils of Egypt. Humic acid deem a head component of humic substances, which represent the major organic components of soil (humus). It is produced by biodegradation of organic matter. It is a complex mixture of different acids containing carboxyl and phenolate groups. Humic acids are characterized by lower molecular weight and higher oxygen content. In this context, Hartwigsen and Evans (2000) reported that humic acid has enhanced the nutrient uptake of the plants, improved the soil water capacity which could ultimately improve, the germination under water deficit condition . Mollasadeghi (2010) and Mauromicale *et al*. (2011) found that humic compound helps in nitrate uptake from the soil and facilitate water use efficiency. It increases overall production of the plant i.e. yield and invigorates the stem. Shaban *et al*. (2014) studied that addition 10 kg potassium humate/fed as a soil application significantly increased sucrose%, root yield and sugar yield amounted to (2.39, 12.86 and 7.60%) and (3.68,7.60 and 11.75%) in 1^{st} season and 2^{nd} one respectively compared to the check treatment. Enan *et al*. (2016) illustrated that fertilizing beet plants with 15 l humic acid as a soiI drench increased root and foliage fresh weight/plant. In addition to the highest values of root, top and sugar yields/fed were recorded in both seasons. Whilst sugar% and corrected sugar% traits achieved the higher value in second season only.

Nitrogen is an essential element of various plant constitute organ. Such as chlorophyll, nucleotides, proteins, alkaloids, enzymes, hormones and vitamins. The role of nitrogen fertilization reflected obviously on the growth, physiological and chemical characteristics of the most crops Marinkovic *et al.* (2010). El-Geddawy and Makhlouf (2015) El-Geddawy and Makhlouf (2015) concluded that increasing nitrogen level from 80 to 120 kg N/fed significantly increased root dimension, foliage fresh weight, K and Na contents in roots as well as root, top and sugar yields/fed. The highest sucrose was obtained at the rate of 100 Kg N/fed in both seasons. Sharaf (2012) and Masri *et al*. (2015) revealed that nitrogen level at rate 120 Kg N/fed significantly increased LAI, root weight/plant and K, Na and α-amino N percentages as well as root and sugar yields/fed. They also reported that supplying 120 Kg N/fed attained lower content of sucrose, purity and extractable sugar percentages in the both seasons. Badr (2016) found that applied sugar beet with 70 kg N/fed attained the highest values of sucrose %, extractable white sugar % and purity %. main time fertilizing sugar beet up with 90 Kg N/fed increased sugar yield/fed in both seasons. He also added that 110 kg N/fed produced heaviest root/plant and higher values of top yields/fed in 1^{st} season ans 2^{nd} one. Makhlouf and Abd El-All (2017) noticed that root diameter, Na, K and α-amino N contents, root and sugar yields/fed were significantly increased by increasing N level from 80 to 120 kg N/fed, whereas adding 100 kg N/fed gave the highest significant values of sucrose% and extractable sugar%.

The main object of this study was to find out the appropriate potassium humate nitrogen fertilization level to obtain the good growth, quality characteristics and yields of root and sugar/fed grown under sandy soil conditions.

MATERIALS AND METHODS

field experiments were conducted to study the effect of potassium humate and nitrogen fertilization treatments on yield and quality of sugar beet sown in a sandy soil, at Wadi El-Natrun, El-Bahira Governorate (latitude of 30.48^0 N and longitude of 30.50^0 E) in seasons of 2015/2016 and 2016/2017. The present work included twelve treatments, which were the combinations of four potassium humate levels as a soil application (without, 4, 8 and 12 liter /fed) and three rates of nitrogen (80, 100 and 120 kg N/fed) as ammonium nitrate (33.5% N). "Potassium humate, 10% K_2O" produced by (Egyptian market, leonardite origin). It added twice after full emergence and 15 days later .Nitrogen fertilizer was split in 6 doses, the 1st dose was applied after of 25 days from sowing, while the other doses were added at 15-day intervals after the 1st one. the treatments were arranged In strip plot design with four replicates,. Potassium humate levels were occupied the vertical plots, while nitrogen rates were represented in horizontal plots. Plot area was 21 m^2 including 7 rows of 5-m in length and 60-cm width, with 20-cm hill spacing filled with one seed per hill. In the form of calcium super phosphate (15 % P_2O_5) phosphorus fertilizer was applied during seed bed preparation at the rate of 200 kg/fed. Potassium fertilizer in the form of potassium sulfate (48% K_2O) was added at a rate of 24 kg/fed in two equal doses after 25 and 60 days from sowing. The German mono-germ "Polat" cultivar was sown in 5th of September in 1st season and 8 September in 2nd season, while plants were harvested after 210 days after sowing in the two studied seasons.

Soils of the experimental sites were analyzed to assess its physical properties using the procedure described by Black *et al*. (1981). Soil chemical analysis was done according to the method of Jackson (1973). Physical and chemical analyses of the soil (the upper 30-cm) are shown in Table 1.

Table 1. Physical and chemical properties of the experimental soil in 2015/2016 and 2016/2017 seasons.

2015/2016 season										
	Particle size			Soil texture	EC		Soil pH	Organic matter %		
Sand%	Silt %	Clay %		Sandy	(dS m-1)		(1:2.5)			
82.2	13.50	4.3		loam	1.26		7.89	0.49		
Soluble Cations (mq l-L)				Soluble anions (mq l/L)				Available nutrients (mg/1kg soil)		
Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}	N	P_2O_5	K_2O
3.2	2.5	5.8	1.1	-	0.4	8.5	3.7	14.00	5.52	160.2
2016/2017 season										
	Particle size			Soil texture	EC		Soil pH	Organic matter %		
Sand%	Silt %	Clay %		Sandy	($dS\ m^{-1}$)		(1:2.5)			
84.0	10.28	5.0		loam	1.23		8.01	0.53		
Soluble Cations (mq l-L)				Soluble anions (mq l/L)				Available nutrients (mg/1kg soil)		
Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO3^{--}$	HCO_3^{-}	Cl^{-}	$SO4^{--}$	N	P_2O_5	K_2O
2.50	3.0	5.0	1.8	-	0.6	9.0	2.7	15.62	6.00	163.6

The recorded data:

1. Leaf area index (LAI) was estimated at 105 days from sowing according to the following equation:

LAI = leaf area per plant (cm^2)/plant ground area (cm^2) according to Watson (1952).

At harvest time, 10 guarded plants from the three liners were uprooted, topped and weighed to determine:

2. Root diameter (cm).
3. Root and foliage fresh weight/plant (g).

The following quality traits were determined in the Quality Control Laboratory at Alexandria Sugar Factory, Alexandria, Egypt.

4. Impurities of juice, i.e. Na and K (meq/100 g beet) were determined in the lead acetate extract of fresh macerated root tissue using "Flame photometry" method as described by Brown and Lilliand (1964), while Alpha amino-nitrogen (meq/100 g beet) was determined using "ninhydrin hydrindantin" method according to the method of Cooke and Scott (1993).
5. Sucrose % (pol%) was polarimaterically determined using the pol method described in A.O.A.C. (2005).
6. Sugars lost to molasses percentage (SLM%) was calculated according to the equation of Devillers (1988) :

$$SLM\% = 0.14\ (Na + K) + 0.25\ (\alpha\text{-amino N}) + 0.50$$

7. Extractable sugar percentage was calculated according the equation of Dexter *et al*. (1967) as follows:

$$\text{Extractable sugar \%} = \text{Sucrose\%} - \text{SLM\%} - 0.6$$

8. Quality index (QI) = (Extractable sugar% ÷ sucrose %) × 100
9. Alkalinity Coefficient (AC) was determined from the major non sugars K, Na and α-amino N as follows equation of Devillers (1988):

$$\text{Alkalinity Coefficient} = (K\% + Na\ \%) \div \alpha\text{-amino N\%}$$

10. Root yield (ton)/fed: sugar beet roots per plot were weighed in kg and converted into tons per feddan.
11. Sugar yield/fed (ton), which was calculated according to the following equation:

$$\text{Sugar yield (ton)} = \text{root yield (ton)/fed} \times \text{extractable sugar\%} \div 100$$

Statistical analysis:

Statistical analysis of data was performed using MSTAT-C computer software package following the technique of analysis of variance (ANOVA) for the strip plot design as described by Gomez and Gomez (1984). The difference between means of treatments at 5% probability level was obtained using least significant differences (LSD) method as described by Snedecor and Cochran (1980).

RESULTS AND DISCUTION

1. Leaf area index (LAI), root diameter, root and foliage fresh weight/plant:

Data in Table 2 exhibited a significant effect on leaf area index (LAI), root diameter, root and foliage fresh weight in both seasons. It can be observed that using soil application with 8 and/or 12 l/fed was more affected than other studied potassium humate rates in increasing the previously mentioned traits. This may be due to Potassium humat act (organic matter) as a storehouse of humic and potassium, which leads to improve solubilize minerals, stabilize nitrogen and improve nitrogen efficiency, as well as improve nutrient availability and have impact on chemical and biological properties soils. These results are in accordance with those reported by Mollasadeghi (2010); Mauromicale *et al.* (2011) and Enan *et al.* (2016).

Table 2. LAI, root diameter (cm), root and foliage fresh weights (g) of sugar beet as affected by potassium humate and nitrogen rates in 2015/2016 and 2016/2017 seasons.

Treatments	Leaf area index		Root diameter (cm)		Root fresh weight (g/plant)		Foliage fresh weight (g/plant)	
	2015/16	2016/17	2015/16	2016/17	2015/16	2016/17	2015/16	2016/17
Potassium humate rates (l/fed):								
Zero	2.89	2.71	8.86	9.82	449.50	511.11	326.33	285.78
4	3.25	3.07	9.64	10.36	633.42	539.44	346.67	312.78
8	3.46	3.54	11.01	11.64	667.23	626.67	370.78	332.11
12	3.51	3.68	11.72	11.89	711.89	705.11	395.78	366.78
LSD at 5%	0.29	0.55	1.60	1.22	89.0	115.0	37.23	47.9
Nitrogen fertilizer levels (kg/fed):								
80	2.87	2.98	8.43	10.01	611.58	542.58	329.42	302.50
100	3.31	3.19	10.35	10.95	636.51	599.00	394.08	325.58
120	3.65	3.59	12.02	11.83	680.95	645.17	356.17	345.00
LSD at 5%	0.28	0.33	1.65	0.77	34.0	53.0	34.60	15.2
Interaction:								
A×B	*	*	NS	*	NS	NS	NS	NS
LSD at 5%	0.50	0.44	NS	0.98	NS	NS	NS	NS

The results showed that LAI, root diameter, root fresh and foliage fresh weights were appreciably affected by nitrogen application in both seasons. Increasing nitrogen fertilizer level 20 kg N (from 80 up to 100 kg/fed) resulted in highest values of LAI, diameter, root fresh and foliage fresh weights/plant amounted to (0.44 and 0.21), (1.92 and 0.94 cm), (24.93 and 56.42 g) and (64.7 and 23.1 g) in 1st season and second one. Moreover, adding 40 kg N (from 80 to 120 kg) was associated with an increase in LAI, root diameter, root and foliage fresh weights amounted to (0.78 and 0.61), (3.59 and 1.82 cm), (69.37 and 102.59 g/plant) and (26.75 and 42.50 g/plant) in 1st and 2nd season, successively. These results are probably due to the role of nitrogen as an essential and structural element in increasing vegetative growth through enhancing leaf initiation, increment chlorophyll concentration in leaves. The previous results are in line with those found by Masri *et al.* (2015) and Badr (2016).

Interaction effect:

Data in Table 3 elucidate that LAI was significantly affected by the interaction between potassium humate and nitrogen rates in both seasons. It was found that the increase in the rates of nitrogen was accompanied by a significant increase in LAI, but with a higher value for per unit area of the leaf surface at the 12 l potassium humate/fed than at 8 l/fed level .

Table 3. Effect of the interaction between potassium humate and nitrogen rates on LAI of sugar beet in 2015/2016 and 2016/2017 seasons.

Potassium humate rates (l/fed)	Nitrogen fertilizer levels					
	2015/2017			2016/2017		
	80	100	120	80	100	120
Zero	2.00	3.14	3.52	2.63	2.29	3.21
4	3.16	3.21	3.38	2.87	3.16	3.19
8	3.08	3.50	3.80	2.96	3.75	3.89
12	3.28	3.37	3.89	3.45	3.54	4.05
LSD at 5%		0.50			0.44	

Therefore the highest value was recorded when sugar beet fertilized with 12 l potassium humate along with 120 kg N/fed in 1st season and second one. These finding may be related to increase the photosynthetic surface per unit area which consequently, promoted growth and nutrient uptake by plants through addition of humic substances (Enan *et al.* 2016).

Interaction effect:

Data in Table 4 show that the interaction between potassium humate and nitrogen levels had a significant effect on root diameter in the 2nd season only. Raising nitrogen level from 80 to 120 kg N/fed resulted in a significant increase in root diameter and produced thicker roots in case of sugar beet fertilized with both of 120 kg N/fed and 12 l potassium humate /fed, than those had fertilized with 8 l/fed.

Table 4. Effect of the interaction between potassium humate and nitrogen levels on root diameter of sugar beet in 2016/2017 season.

Potassium humate rates (l/fed)	2016/2017 season		
	Nitrogen fertilizer levels (kg/fed)		
	80	100	120
Zero	9.43	9.73	10.30
4	9.60	10.13	11.33
8	10.90	11.77	12.27
12	10.10	12.17	13.40
LSD at 5%		0.98	

2. Sucrose% and impurities (K, Na and α-amino N):

Data in Table 5 showed that sugar beet root content of sucrose% significantly affected by potassium humate level in both seasons. The high values of sucrose was detected in beets fertilized with 8 and/or 12 l/fed potassium humate without significant differences between them, but both of them surpassed on the check treatment and 4 l potassium humate/fed in both seasons. Soil application of high level of potassium humate (12 l/fed) gave an increase in sucrose% amounted to 1.92% and 1.72% over that unfertilized in both seasons, respectively. Theses findings are in agreement with that mentioned by Shaban *et al.* (2014) and Enan *et al.* (2016). On the other hand, these results reveal that contents of impurities, in terms of potassium, sodium and alpha amino-N were insignificantly influenced by potassium humate in both seasons.

Table 5. Sucrose%, impurities (potassium, sodium and alpha amino N meq/100 g beet) contents of sugar beet as affected by potassium humate and nitrogen rates in 2015/2016 and 2016/2017 seasons.

Treatments	Sucrose %		Potassium (meq/100 g beet)		Sodium (meq/100 g beet)		α-amino N (meq/100 g beet)	
	2015/16	2016/17	2015/16	2016/17	2015/16	2016/17	2015/16	2016/17
Potassium humate rates (l/fed)								
Zero	15.64	15.48	3.37	3.30	1.65	1.63	1.23	1.35
4	16.54	16.13	3.36	3.24	1.68	1.58	1.17	1.31
8	17.29	16.78	3.30	3.31	1.50	1.53	1.11	1.21
12	17.56	17.20	3.29	3.32	1.43	1.42	1.07	1.23
LSD at 5%	1.18	1.00	NS	NS	NS	NS	NS	NS
Nitrogen fertilizer levels (kg/fed)								
80	16.81	16.30	3.17	3.12	1.49	1.38	1.00	1.08
100	17.02	16.73	3.27	3.29	1.47	1.56	1.06	1.24
120	16.44	16.16	3.55	3.47	1.69	1.75	1.36	1.49
LSD at 5%	0.19	0.40	0.27	0.21	0.18	0.21	0.14	0.16
Interaction								
A×B	NS	NS	NS	NS	NS	NS	NS	NS
LSD at 5%	NS	NS	NS	NS	NS	NS	NS	NS

Data in the same Table indicated that sucrose% and impurities were noticeably influenced by the application of N-fertilizer level in both seasons. The results showed that raising N-fertilizer level from 80 to 100 kg N/fed led to an increase in sucrose %. Nevertheless, a reduction in sucrose % was noticed with the increase of nitrogen level to 120 kg N/fed. Such effect may be due to the increase in acid invertase and Glycolate oxidase activity in sugar beet leaves. This was correlated with an increase in leaf weight and decline in root sucrose content (Trzebinsk and sadoch 1988). This, the results showed that adding 100 kg N/fed was required for the construction of an optimal foliage size able to play its functional role in photosynthesis and accumulation of sugars in roots. Whereas, fertilized beets with 120 kg N/fed was enhance the increase of foliage production on sugar translocation and storage it in the roots. The favorable effect of nitrogen element on sucrose was reported by Masri *et al.* (2015) and Badr (2016). Meantime, it was found that increasing N-dose from 80 to 120 kg N/fed was associated with a gradual increase in root impurities, which may be due to that raising the amount of the applied nitrogen enhances plants to absorb more solvents from the soil solution in addition to an increase in the absorption of Na element from the soil by roots accompanied with increasing nitrogen fertilizer level, Makhlouf and Abd El-All (2017).

3. Alkalinity coefficient (AC), sugar lost to molasses and quality index:

Results in Table 6 declared that alkalinity coefficient and sugar lost to molasses% were insignificantly affected by potassium humate application in both seasons. Whilst, the quality index has been obviously affected by potassium humate in both seasons. Higher values of quality index was recorded in beets fertilized with 8 and/or 12 l/fed potassium humate in both seasons, without any significant difference between both levels. This finding may be due to the higher values of sucrose % and the lesser values of non-sucrose components most relevant for "technical quality" of sugar beet (Table 5). These results assured by Enan *et al* (2016).

Table 6. Alkalinity coefficient (AC), sugar lost to molasses and quality index of sugar beet as affected by potassium humate and nitrogen rates in 2015/2016 and 2016/2017 seasons.

Treatments	Alkalinity coefficient (AC)		Sugar lost to molasses %		Quality index	
	2015/16	2016/17	2015/16	2016/17	2015/16	2016/17
Potassium humate rates (l/fed):						
Zero	4.18	3.81	1.51	1.60	86.49	86.17
4	4.43	3.72	1.48	1.57	87.39	86.88
8	4.36	4.04	1.45	1.54	88.11	87.54
12	4.46	3.93	1.42	1.52	88.40	87.91
LSD at 5%	NS	NS	NS	NS	0.90	0.88
Nitrogen fertilizer levels (kg/fed):						
80	4.68	4.18	1.41	1.49	88.01	87.69
100	4.52	3.93	1.42	1.51	88.06	87.42
120	3.87	3.53	1.58	1.67	86.71	86.26
LSD at 5%	0.61	0.40	0.12	0.10	0.39	0.15
Interaction:						
A×B	NS	NS	NS	NS	NS	NS
LSD at 5%	NS	NS	NS	NS	NS	NS

Nitrogen fertilizer application had a appreciable effects on alkalinity coefficient, sugar lost to molasses% and quality index (Table 6). Alkalinity coefficient decreased gradually as nitrogen levels to reach its maximum corresponding to 120 kg N/fed, on the other side, sugar lost to molasses exhibited a vice versa trend as nitrogen level increased (Table 6). As for quality index data clear that the lowest quality index was recorded as nitrogen level of 120 kg N/fed such effect may be due to the observed and gradual increase in the impurities and sugar lost to molasses with the increase in nitrogen level (Masri *et al.* 2015). In this connection, Pollach (1984) stated that AC value should not fall below 1.8 to prevent corrosion at high temperature of evaporation.

4. Extractable sugar%, root and sugar yields/fed:

Data in Table 7 illustrated that soil application of 8 and/or 12 l potassium humate/fed without significant differences between both rates gave the highest extricable sugar %, root and sugar yields/fed as compared with check treatment in the two growing seasons. It was found that fertilizing sugar beet with 12 l/fed potassium humate as compared with check treatment gave an increase amounted to (14.8 and 13.7%), (9.7 and 20.8 %) and (25.8 and 37.5%) increase in extractable sugar%, root and sugar yields/fed in 1st season and second one respectively. These results may be due to the role of potassium in potassium humate on metabolic translocation process. The favorable effect of potassium humate on extractable sugar % and sugar yield/fed was reported by Enan (2011). In this respect, Mehdi *et al.* (2013) reported that root yield of sugar beet was strongly affected by potassium humate, meantime its increase root yield by 25.86% and sugar yield by 27 % compared with untreated plant.

The results showed that extractable sugar %, root and sugar yields/fed were considerably affected by the applied nitrogen level in both seasons. Raising nitrogen fertilizer level from 80 up to 100 kg N/fed led to increased in extractable sugar%, root and sugar yields/fed amounted to (0.18 and 0.34%), (0.78 and 0.98 ton/fed) and (0.15% and 0.21%), successively. Nevertheless, the trend of increase extractable sugar% and sugar yield/fed, in both seasons was not associated with the increased in the nitrogen level from 100 to 120 kg N/fed, where, a slight reduce their have been observed. On the contrary, the increases in the nitrogen level up to 120 led to a slight increase root yield/fed. These results may refer to the negative relation between juice quality (Table 6) and in turn sugar extractability and alpha amino-N (Table 5). As well as the positive role of nitrogen on the vegetative growth through enhancing leaf initiation and photosynthesis process, consequently increase in root diameter which, led to increase in root fresh weight/plant (Table 2), and directly affected those traits. Such effect was mentioned by EL-Geddawy and Makhlouf (2015) and Makhlouf and Abd El-All (2017).

Table 7. Extractable sugar %, root and sugar yields/fed of sugar beet as affected by potassium humate and nitrogen rates in 2015/2016 and 2016/2017 seasons.

Treatments	Extractable sugar %		Root yield (ton/fed)		Sugar yield (ton/fed)	
	2015/16	2016/17	2015/16	2016/17	2015/16	2016/17
Potassium humate rates (l/fed):						
Zero	13.53	13.29	21.76	20.05	2.95	2.66
4	14.46	14.02	22.73	21.28	3.28	2.98
8	15.23	14.69	23.25	23.00	3.54	3.38
12	15.53	15.12	23.87	24.24	3.71	3.67
LSD at 5%	1.10	1.00	1.0	2.0	0.38	0.43
Nitrogen fertilizer levels (kg/fed):						
80	14.81	14.30	22.32	21.30	3.31	3.05
100	14.99	14.64	23.10	22.28	3.46	3.26
120	14.26	13.90	23.30	22.85	3.32	3.18
LSD at 5%	0.18	0.36	0.47	0.70	0.12	0.07
Interaction:						
A×B	NS	NS	NS	NS	NS	NS
LSD at 5%	NS	NS	NS	NS	NS	NS

REFERENCES

A.O.A.C. (2005). Association of official analytical chemists. Official methods of analysis, 26th Ed. AOAC International, Washington, D.C; USA.

Badr, A.I. (2016). Importance of nitrogen and microelements for sugar beet production in sandy soils. J. Plant Production, Mansoura Univ., 7 (2): 283 – 288.

Black, C. A. D. D. Evans; L.E. Ensminger; G. L. White and F. E. Clark (1981). Methods of soil analysis. Part 2. Pp. 1-100. Agron. Inc. Madison. WI., USA.

Brown, I.D. and O. Lilliand (1964). Rapid determination of potassium and sodium in plant material and soil extracts by flame photometer.Proc.Amer. Soc. Hort. Sci. 48. 341-346.

Cooke, D.A. and R.K. Scott (1993). The sugar beet crop. Chapman and Hall London, Pp. 262–265.

Devillers, P. (1988). Prevision du sucre melasse sucrerie feanases 190-200. (C.F. The Sugar Beet Crop. Book).

Dexter, S.T.; M.G. Frankes and F.W. Snyder (1967). A rapid and practical method of determining extractable white sugar as may be applied to the evaluation of agronomic practices and grower deliveries in the sugar beet industry. J. Am. Soc., Sugar Beet Technol., 14:433-454.

El-Geddawy, Dalia I.H. and B.S.I. Makhlouf (2015). Effect of hill spacing and nitrogen and boron fertilization levels on yield and quality attributes in sugar beet. Minufiya J. Agric. Res. Vol. 4(1): 959–980.

Enan, S.A.A.M.; E.F.A.Aly and A. I. Badr (2016). Effect of humic acid and potassium on yield and quality of some sugar beet varieties in sandy soil. J. Plant Prod., Mansoura Univ., 7 (2):289- 297

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agriculture research. Awiley-Interscience Publication, John Wiley and Sons. Inc. New York, USA.

Hartwigsen, J.A. and M. R. Evans (2000). Humic acid seed and substrate treatments promote seedling root development. HORTSCIENCE 35(7):1231–1233.

Jackson, M. I. (1973). Soil Chemical Analysis. Prentice Hall Inc. Englewood cliffs, N. J., U.S.A.

Makhlouf, B.S.I. and A.E.A. Abd El-All. (2017). Effect of deficit irrigation, nitrogen and potassium fertilization on sugar beet productivity in sandy soils. menoufiya J. Plant Prod., 2 (6): 325 – 346.

Marinkovic, B.; J. Crnobarac; G. Jacimovic; M. Rajic; D. Latkovic; V. Acin (2010). Sugar yield and technological quality of sugar beet at different levels of nitrogen fertilization. Res. J. Agric. Sci., 42 (1):162-167.

Masri, M.I; B.S.B.Ramadan, A.M.A. El-Shafai and M.S. El-Kady (2015). Effect of water stress and fertilization on yield and quality of sugar beet under drip and sprinkler irrigation systems in sandy soil. Int. J. Agric. Sci. 5 (3): 414-225.

Mauromicale, G.; M. G. L. Angela and A. L. Monaco (2011). The effect of organic supplementation of solarized soil on the quality of tomato. Scientia Hort., 129 (2): 189-196.

Mehdi, S. S.; P. Farzad; H.D. Hossein; M. Hamid; M. Majid and R.T. Mohamad (2013). Effect of intermittent furrow irrigation, humic acid and deficit irrigation on water use efficiency of sugar beet. Annals of Biol., Res., 4 (3): - 187-193, Iran.

Mollasadeghi V. (2010). Effect of potassium humate on yield and yield components of wheat genotypes under end seasonal drought stress condition. Thesis M.Sc. of in plant breeding. Islamic Azad Univ.,

Pollach, G. (1984). Development and utilization of quality criteria for sgar beet in Austria. Paper presented to the 27th techno. Conf., British sugar Plc. 22 PP.

Shaban, KH.A. H.; Eman M. Abdel Fatah and Dalia A. Syed (2014). Impact of humic acid and mineral nitrogen fertilization on soil chemical properties and yield and quality of sugar beet under saline soil. J. Soil Sci. and Agric. Eng., Mansoura Univ., 5 (10):1317-1335.

Sharaf, E.A.A.M. (2012). Effect of some agricultural and biological treatments on sugar beet production. Ph. D. Thesis Fac. of Agric. Assiut. Univ., Egypt.

Snedecor, G.W. and W.G. Cochran (1980). Statistical Methods. 7th Ed. The Iowa State Univ. Press Amer. Iowa, USA.

Trzebinski; J. and Z. Sadoch (1988). The effect of intensive fertilizer application on sugarbeet sucrose content. Inter. Instit. For sugar beet research (IIRB) 52: 307-303.

Watson, D.J. (1952). The dependence of net assimilation rate on leaf area index. Ann. Bot. Lond. N.S., 22:37-54.

تأثُير التسميد بهيومات البوتاسيوم والنيتروجين علي حاصل وجودة بنجر السُكَّر في تربة رملية

هيثم السيدأحمد نعمت الله [1]، أنور حامد ساسي[2] و سمر عبد العاطى محمد حلمى[2]

[1] قسم بحوث المعاملات الزراعية - معهد بحوث المحاصيل السكرية - مركز البحوث الزراعية - الجيزة - مصر

[2] قسم بحوث التكنولوجي - معهد بحوث المحاصيل السكرية - مركز البحوث الزراعية - الجيزة - مصر

أقيمت تجربتان حقليتان في وادي النطرون- محافظة البحيرة (دائرة عرض 30.48 5 شمالاً و خط طول 30.50 5 شرقاً) في موسمي 2016/2015 و 2017/2016 لدراسة تأثير أربعة مستويات من هيومات البوتاسيوم (صفر ، 4، 8 و 12 لتر/ الفدان) ، وثلاثة مستويات من النيتروجين (80،100، 120 كيلوجرام نيتروجين/ فدان) على جودة وحاصل بنجر السكر.تم إستخدام تصميم الشرائح المتعامدة في اربعة مكررات ، حيث وضعت مستويات هيومات البوتاسيوم بالشرائح الرأسية بينما وزعت مستويات النيتروجين في الشرائح الأفقية.1- دلت النتائج علي أن تسميد بنجر السكر أرضياً بإضافة 8 أو 12 لتر/ فدان هيومات البوتاسيوم قد اثر معنوياً علي كلاً من صفة دليل مساحة الورقة ، قطر الجذر و وزن الجذور والأوراق الطازجة ، كذلك النسبة المئوية للسكروز و الجودة فضلاً عن نسبة السكر المستخلص وحاصلي الجذور والسكر/فدان في كلا الموسمين، في حين لم تتأثر المكونات الغير سكرية بالجذر وكذلك مؤشر الجودة ومعامل القلوية بالتسميد بهيومات البوتاسيوم.2- أدت زيادة مستوي النيتروجين المضاف من 80 إلي 120 كجم نيتروجين /فدان للحصول علي أعلي القيم في دليل مساحة الورقة ، وقطر ووزن الجذور والأوراق الطازجة للنبات. في حين سجلت أعلي القيم للنسبة المئوية للسكروز والسكر المستخلص و حاصلي الجذور والسكر/ فدان ، وكذلك دليل الجودة ومعامل القلوية عند التسميد بمعدل 100 كجم نيتروجين/ فدان في كلا الموسمين. وعلي العكس من ذلك زادت نسبة السكر المفقود في المولاس والمكونات الغير سكرية بالجذر بتسميد البنجر بمعدل 120 كجم نيتروجين/ فدان في كلا الموسمين.3- اظهر التفاعل بين مستويات هيومات البوتاسيوم والنيتروجين تأثيرا معنويا علي دليل مساحة الأوراق وكذلك قطر الجذر ، حيث أعطت التوليفة (إضافة 12 لتر هيومات بوتاسيوم/ فدان مع 120 كجم نيتروجين/ فدان اعلي القيم لدليل مساحة الاوراق في الموسمين وقطر الجذر في الموسم الثاني فقط .وتوصي الدراسة بأنه تحت ظروف الأراضي الرملية يمكن التوصية بتسميد بنجر السكر ً بإضافة 8 لتر هيومات بوتاسيوم/ فدان مع 100 كجم نيتروجين للفدان للحصول على أعلى حاصلي جذور وسكر/ فدان.