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PRODUCTIVITY AND QUALITY OF SUGAR BEET AS AFFECTED BY PLANT DISTRIBUTION PATTERN AND NITROGEN FERTILIZER LEVEL

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ABSTRACT

Two field trials were conducted during 2012/2013 and 2013/2014 seasons at El-Manyal Village, Talkha District, Dakahlia Governorate, to study the effect of plant distribution sowing patterns and nitrogen fertilizer levels on yield and quality of sugar beet, "cv. Kawemira". The obtained results indicate that:

1- Sowing distribution patterns had significant effects on all studied characters over the two seasons, except for root diameter in the second season The studied sowing patterns(28, 24 and 20 or 35, 30 and 25 cm between hills in the two sides of terrace (mastaba) led to significant differences on the most of the studied characteristics in both seasons. Sowing beet seeds in both sides of terrace 80 cm width at 25 cm distance between hills led to significant increase in yields of roots, gross sugar and white sugar (t/fad) as well as the percentage of the extractable white sugar.
2- Increasing nitrogen fertilizer levels from 80 to 100 and 120 kg N/fad, significantly increased root fresh weight (g), root diameter, sugar loss percentage, the yields of root, gross sugar, white sugar and lost sugar/fad in both seasons besides root length (cm) in the second season. On the other side, it significantly decreased root gross sugar and extractable white sugar percentages in both seasons.

Generally, it could be concluded that sowing sugar beet seeds at 25 cm apart between hills on the two sides of terrace (mastaba) 80 cm width and adding 120 kg N/fad is recommended to maximize its productivity and quality under the environmental conditions of Dakahlia Governorate.

Keywords: Sugar beet, *Beta vulgaris L*, plant distribution patterns, sowing distance, hill space, nitrogen levels, yield, quality.

INTRODUCTION

Several investigations were conducted to investigate the roles of plant populations and nitrogen fertilizer levels for giving the highest yields of roots and sugar (t/fad) besides the highest quality of sugar beet juice, but there is no enough investigative work around plant distribution that help in having more of yield and quality.

Plant distributions are considered one of the important tools to maximize root yield and quality. In this regard, El-Khattib (1991) stated that plant distribution had significant effects on root fresh weight, root diameter (cm), root sugar percentage as well as root and sugar yields/fad in both seasons. El-Bakary (2006) studied the effect of ridge width and distance between hills on sugar beet plants harvested at 210 days after sowing. He found that row width and hill spacing significantly effected on root fresh weight (g), root length and diameter, TSS %, sucrose %, root and sugar yields/fad in the two seasons.

Concerning nitrogen fertilizer effects, no doubt that nitrogen is the most important fertilizer element for sugar beet. Optimum level of nitrogen varies according to time of planting, soil conditions (fertility, type, texture – etc.) and preceding crop. So, there are wide variations among the results of these studies conducted in that field. There for, it is difficult to have a fixed management to be conducted for some years or in some regions. The following are some review conducted on the effect of nitrogen levels on sugar beet yield and quality. Seadh (2008) found that application of the highest level of nitrogen fertilizer (150 kg N/fad) produced the highest values of root and top yields and its components in both seasons. While, fertilizing beet plants with 125 kg N/fad, came in the second rank with respect to these characters and resulted in the highest values of sugar yield in both seasons. Optimum means of sucrose and purity percentages were obtained with using 75 kg N/fad in both seasons. Abdel-Motagally and Attia (2009) studied the effects of different nitrogen levels (143, 214 and 285 kg/ha) on yield, quality and nutrient contents of sugar beet grown on sandy calcareous soil. They observed that increasing nitrogen levels significantly increased root and foliage fresh and dry weights and sugar yield (t/ha) of sugar beet. Increasing nitrogen level up to 285 kg/ha significantly increased impurities (Na, K & alpha -amino-N) and sugar loss percentage. El-Hosary *et al.* (2010) and Sarhan *et al.* (2012) found that increasing nitrogen fertilizer levels caused significant differences in yield, yield components and quality of sugar beet. Gobarah *et al.* (2010) reported that increasing N levels from 60 to 150 kg/fad were associated with significant increases in root yield, yield components, Na, K and alpha-amino nitrogen contents. Khalil (2010) found that increasing nitrogen levels from 80 to 100 and 120 kg/fad significantly increased root length, root diameter, root fresh weight/plant, root yield and the percentages of Na, K and alpha-amino nitrogen and sugar loss to molasses. Abo-Shady *et al.* (2011) found that increasing nitrogen fertilizer levels from 75 to 90 and 105 kg N/fad caused significant increase in root, sugar and top yields as well as Na, K and alpha-amino nitrogen in root contents and sugar loss in molasses in both seasons. On the contrary, they added that sucrose, purity, extractable sugar percentages and alkaline coefficient recorded low averages in both seasons. Osman (2011) indicated that increasing N levels up to 120 kg/fad gave high averages of root length, root diameter, root fresh weight/plant and root and sugar yields/fad While, gradual reduction in sucrose and purity percentages had been detected with increasing nitrogen level over 80 kg/fad. Seadh (2012) stated that growth characters, yields and its components significantly increased as nitrogen fertilizer level increased from 50 to 75 and 100 % of the recommended rate (80 kg N/fad). Abdou (2013) studied the effect of nitrogen fertilizer levels under the newly reclaimed sandy soil conditions. He found that increasing nitrogen levels from 100 to 120 and 140 kg/fad significantly increased root fresh weight, root length and diameter as well as root and sugar yields/fad, in both seasons. On the other hand, it significantly decreased TSS, sucrose and purity percentages in both seasons. El-Sarag and Moselhy (2013) found that increasing N levels from 105 to 210 kg/ha, caused significant increase in root, top and sugar yields/ha. Omar and Mohamed (2013) found that nitrogen fertilizer levels had significant effects on all traits in the two seasons and their combined analysis. Increasing nitrogen fertilizer levels from 50 up to 125 kg N/fad caused significant increases in root dimensions (length and diameter), top fresh weight/plant, root fresh weight/plant, Na%, K%, sugar loss % in molasses (SLM %) and root yield/fad Top and recoverable sugar yields were responded only to 100 kg N/fad. The highest averages of sugar %, purity % and extractable sugar % were produced with using low nitrogen levels (either 50 or 75 kg N/fad). Abdou and Badawy, Shimaa (2014) stated that increasing nitrogen fertilizer levels from 70 to 90, 110 and 130 kg N/fad significantly increased root fresh weight, root length and diameter, TSS %, root and sugar yields/fad in both seasons. On the other side, the same treatment significantly decreased both of sucrose and purity percentages in both seasons.

So, this study was conducted to find out the relative effect of distribution sowing pattern and nitrogen fertilizer levels on root yield, its attributes and quality of sugar beet

MATERIALS AND METHODS

The present investigation was conducted at El-Manyal Village, Talkha District, Dakahlia Governorate during the two successive winter seasons of 2012/2013 and 2013/2014, to investigate the effect of six sowing distribution patterns (planting on 25, 30 and 35 cm between hills on the two sides of terrace (mastaba) 80 cm width and planting on 20, 24 and 28 cm between hills on the two sides of terrace (mastaba)100 cm width. (Each three distances between hills on the two sides of the two mastabas (80 and 100 cm width give 42000, 35000 and 30000 plant/fad, respectively) and three nitrogen fertilizer levels (80, 100 and 120 kg N/fad) on productivity and quality of sugar beet " cv. Kawemira".

Split-plots in a randomized complete block design with four replicates were used in both seasons. The main plots were occupied with six pant distribution patterns. While, the sub-plots were devoted to the three nitrogen fertilizer levels (80, 100 and 120 kg N/fad) N- fertilizer was applied in the form of urea (46.5 % N), which was added in two equal doses, the 1^{st} one was after thinning and the 2^{nd} dose was at 20- days later.

Plot area was 20 m^2, which included 5- terraces 80 cm width and 5 m long or 4- terrace 100 cm width and 5 m. long The preceding crop was maize in both seasons. Soil samples were taken at random from the experimental sites at a depth of 0.0-30 cm from soil surface. Mechanical (physical) and chemical properties of the experimental soil are presented in Table 1.

Both of calcium superphosphate (15.5 % P_2O_5) at the rate of 31 kg P_2O_5/fad and potassium sulphate (48.0 % K_2O) at the rate of 24 kg K_2O/fad were added before the last ploughing

Sowing of dry sugar beet balls took place in the dry soil during the first week of September in both seasons. The experimental field area was immediately irrigated after sowing Plants were thinned to one plant/hill at the age of 30 days. Plants were kept free from weeds by hand hoeing for three times. All normal agricultural practices were done according to the recommendations of Sugar Crops Research Institute (SCRI).

Table 1: Mechanical and chemical soil properties of the experimental site during the two growing seasons of 2012/2013 (I) and 2013/2014 (II).

Soil analysis	I	II
A: Mechanical properties:		
Fine sand (%)	9.60	10.20
Coarse sand (%)	5.30	4.90
Silt (%)	32.10	30.80
Clay (%)	52.90	54.00
Texture	Clayey	Clayey
B: Chemical analysis		
Soil reaction pH	7.60	7.70
Available N (ppm)	48.40	49.30
Available P (ppm)	11.50	12.00
Exchangeable K (ppm)	140.00	130.00

STUDIED CHARACTERS*:*

A- Root yield attributes:

At harvest time (210 days after sowing), ten plants were randomly chosen from each plot to determine the studied characteristics as follows:

1. Root fresh weight (g/plant).
2. Root length (cm).
3. Root diameter (cm).

B- Root yield (t/fad):

At harvest, all plants of the four inner rows of each plot were harvested. Roots were carefully topped, cleaned and weighed to estimate root yield (t./fad).

C- Quality parameters and sugar yield:

All percentages as gross sugar, potassium (K), sodium (Na) and α-amino nitrogen were determined in Dakahlia Sugar Company Laboratories at Bilkas District, Dakahlia Governorate. All studied quality parameters were calculated as follows:

1. Extractable white sugar %. Correct sugar content (white sugar) of beet roots was calculated by linking the beet non-sugar, K, Na and α-amino nitrogen (expressed as a milliequvalent/100 g of beet) according to Harvey and Dutton (1993) using the following equation:

$$ZB = Pol - [0.343\,(K + Na) + 0.094\ Am\ N + 0.29]$$

Where:

ZB = corrected sugar content (% per beet) or extractable white sugar.

Pol = Gross sugar %.

2. White sugar yield = Root yield (t/fad) × white sugar %.
3. Loss sugar percentage. It was determined as follows;

Sugar loss % = gross sugar % - white sugar %.

4. Lost sugar yield. It was determined as follows;

Lost sugar yield (t/fad) = root yield (t/fad) × sugar loss %.

5. Gross sugar yield (t/fad). It was calculated by multiplying root yield (t/fad) × gross sugar %.

Statistical analysis:

Data obtained were statistically analyzed according to the procedures outlined by Gomez and Gomez (1984) using means of "MSTAT-C" computer software package. Least Significant Difference (LSD) method was used to compare the differences between treatment means at 5% level of probability as mentioned by Waller and Duncan (1969).

RESULTS AND DISCUSSION

1-Root freshweight and dimensions:

Results presented in Table 2 show the influence of plant distribution patterns and nitrogen fertilizer levels on sugar beet root characteristics in terms of root dimensions and root fresh weight.

Concerning the influence of plant distribution patterns on root dimensions and root fresh weight, results in Table 2 clear that plant distributions significantly effected on sugar beet root fresh weight and root length in both seasons and root diameter in the first season. Planting on the two sides of terrace (mastaba) 80 cm width surpassed planting on the two sides of terrace (mastaba) 100 cm width in the most of characteristic values in both seasons, where planting beet plants at 35 cm distance between hills in the two sides of terrace (mastaba) 80 cm width recorded the highest values of these characteristics, except root length in the second season These obtained results may be due to the facts that hill dimensions; A) Allow to high amounts of light to pass to individual plants which reflect on photosynthesis process consequently root fresh weight and - B) It increase the soil volume which plants feed (It decrease the competitions among beet roots). Similar results were stated by El-Khattib (1991) and El-Bakary (2006).

Results given in Table 2 show that the above mentioned characteristics significantly responded to the increase in the applied dose of nitrogen fertilizer. This increase was gradually in both growing seasons. It is obviously show that the increase in root fresh weight/plant was accompanied with the increase in root dimensions *i.e.*, (length and diameter). These findings may be indicate to the fruitful effect of nitrogen element on growth of sugar beet root as a result to its effective role on cell division and elongation which consequently reflected on root fresh weight. Also , it could be noted that the difference between 80 and 100 or 100 and 120 kg N/fad was insignificant in its effect on root traits, however the significant difference was between 80 and 120 kg N/fad. This may be indicate to the higher requirement of the experimental soil to high application of nitrogen , this observation could explained through the available data in soil analysis (Table 1) where the available nitrogen in such soil was at the low margin of fertility These results are in agreement with those stated by Seadh (2008), Sarhan *et al.* (2012), Seadh (2012), Abdou (2013) and Abdou and Badawy, Shimaa (2014).

Regarding the interaction between sowing distribution patterns and nitrogen fertilizer levels, obtained results clear that, the above mentioned root criteria insignificantly affected by the various interactions of the studied factors in both seasons.

Table 2: Sugar beet root characteristics as affected by plant distribution pattern and nitrogen fertilizer level as well as their interaction during 2012/2013 (I) and 2013/2014 (II) seasons.

Characters / Treatments	Root fresh weight (g)		Root length (cm)		Root diameter (cm)	
	I	**II**	**I**	**II**	**I**	**II**
A- Plant distribution pattern:						
25 × 40 cm	961.6	946.6	31.46	31.51	10.53	10.46
30 × 40 cm	996.6	1026.6	30.76	30.33	11.16	10.90
35 × 40 cm	1095.0	1126.6	28.96	28.90	11.43	11.60
20 × 50 cm	951.6	940.0	31.36	31.08	10.40	10.41
24 × 50 cm	1000.0	1010.0	30.96	30.20	10.93	11.00
28 × 50 cm	1088.3	1096.6	27.58	29.63	11.16	11.36
F. test	*	*	*	*	*	NS
LSD at 5 %	32.5	21.1	2.50	4.36	0.68	-
B-Nitrogen fertilizer level:						
80 kg N/fad	949.1	961.6	29.33	27.34	10.31	10.10
100 kg N/fad	1020.0	1026.6	30.43	29.82	11.05	11.18
120 kg N/fad	1077.5	1085.0	30.79	31.66	11.45	11.59
F. test	*	*	NS	*	*	*
LSD at 5 %	29.8	30.5	-	1.91	0.55	0.67
C- Interaction (A× B):	NS	NS	NS	NS	NS	NS

2- Gross sugar percentage and root and gross sugar yields:

Results given in Table 3 clear the influence of plant distribution patterns and nitrogen fertilizer levels on gross sugar percentage and root and gross sugar yields (t/fad). As for the effect of Sowing distribution patterns on the studied criteria, the illustrated results in Table (3) clear that both of root yield / fad, gross sugar percentage and gross sugar yield/fad, were significantly affected by the different sowing distribution patterns. Whereas, changing of plant distributions from 28, 24 and 20 cm distance between hills on the two sides of mastaba 100 cm width to be 35, 30 and 25 cm between hills on the two sides of mastaba 80 cm width increased (improved) all previous mentioned characters in both seasons, except for root yield (t/fad) in the first season, whereas planting sugar beet on 24 cm distance between hills on the two sides of mastaba 100 cm width surpassed planting on 30 cm as a distance between hills on the two sides of mastaba 80 cm width. The increase (improvement) that obtained with changing plant distributions from planting sugar beet plants on 28, 24 and 20 cm distance between hills on the two sides of mastaba 100 cm width to be 35, 30 and 25 cm distance between hills on the two sides of mastaba 80 cm width may be due to; A) Increasing the amounts of light coming to individual plants and- B) It increased the soil volume in which plants feed (It decreased the competitions among beet roots). Similar results were stated by El-Khattib (1991) and El-Bakary (2006).

The available results reveal that the three criteria appeared were statistically affected by the examined factors, however, this effect was positively with respect to yield of roots/fad and its gross sugar yield/fad, meanwhile gross sugar percentage responded negatively to the increase in the applied dose of nitrogen The positive effect of nitrogen fertilizer levels on both yields *i.e.* (root and sugar mainly) due to the benefit influence on plant growth which reflected on root fresh weight/plant and its dimensions (Table 2) in turn reflected on root yield consequently gross sugar yield t/fad (Table 3 and Figs. 1 and 2).

Despite of the effective role of nitrogen fertilizer with the highest level of nitrogen, it could be noted that the lowest value of gross sugar percentage was recorded with that level of nitrogen. So, it is clearly shown that the relative increase in gross sugar yield/fad, mainly due to the influence of the high level of nitrogen on yield of sugar beet roots/fad The effective role of nitrogen fertilizer levels on root and sugar yield was reported by Osman (2011), Sarhan *et al.* (2012), Seadh (2012), Abdou (2013) and Abdou and Badawy (2014).

Regarding the interaction between sowing distribution patterns and nitrogen fertilizer levels, obtained results clear that root yield, gross sugar (%) and gross sugar yield/fad insignificantly affected by the various interactions of the studied factors in both seasons.

Table 3: Root yield, gross sugar (%) and gross sugar yield as affected by plant distribution pattern and nitrogen fertilizer level as well as their interaction during 2012/2013 (I) and 2013/2014 (II) seasons.

Characters / Treatments	Root yield (t/fad)		Gross sugar (%)		Gross sugar yield (t/fad)	
	I	**II**	**I**	**II**	**I**	**II**
A- Plant distribution pattern:						
25 × 40 cm	40.390	39.760	17.33	17.26	6.995	6.853
30 × 40 cm	34.717	35.933	18.76	18.56	6.509	6.664
35 × 40 cm	32.683	33.800	19.73	19.53	6.443	6.592
20 × 50 cm	39.970	39.480	16.84	17.00	6.725	6.704
24 × 50 cm	35.000	35.350	18.53	18.36	6.485	6.485
28 × 50 cm	32.650	32.900	19.10	19.03	6.230	6.256
F. test	*	*	*	*	*	*
LSD at 5 %	1.126	0.825	0.52	0.825	0.308	0.186
B-Nitrogen fertilizer level:						
80 kg N/fad	33.584	33.938	18.86	18.75	6.309	6.343
100 kg N/fad	36.055	36.288	18.35	18.28	6.585	6.609
120 kg N/fad	38.066	38.385	17.93	17.85	6.800	6.824
F. test	*	*	*	*	*	*
LSD at 5 %	1.034	1.074	0.32	0.34	0.243	0.203
C- Interaction (A× B)	NS	NS	NS	NS	NS	NS

3-Extractable sugar percentage and white sugar yield (t/fad):

Results given in Table 4 show that plant distribution patterns and nitrogen fertilizer levels had significant effects on extractable white sugar percentage and white sugar yield/fad in both seasons.

With regarding to the effect of plant distribution patterns on the values of the extractable sugar percentage and white sugar yield, obtained results in Table 4 show that increasing hill spaces from 20 up to 28 cm on the two sides of terrace (mastaba) 100 cm width or increasing hill spaces from 25 up to 35 cm on the two sides of terrace (mastaba) 80 cm width led to increase in extractable sugar percentage and white sugar yield/fad in both seasons. This findings were completely true under the two terraces width .This result may be due to the wide spaces among hills which allow more light trapping and low competition between plants and soil available nutrients which reflected on better assimilation and in turn reflected on photosynthesis products in terms of extractable sugar percentage. On the other side, the values of white sugar yield negatively responded to the increase in the hill spaces under the two terraces. This results due to the reduction in root yield by increasing hill spaces which finally effect on root yield which considered the direct factor effect on sugar yield. Moreover, the most important point in this subject, that changing of plant distribution from 28, 24 and 20 cm distance between hills on the two sides of terrace (mastaba) 100 cm width to be 35, 30 and 25 cm distance between hills on the two sides of terrace (mastaba) 80 cm width increased both extractable white sugar % and white sugar yield/fad in both seasons. These results may be due to the fact that the last plant distribution saves the suitable distances among beet plants that allow to high amounts of solar radiation to pass to individual plants which cause more photosynthesis that increase sucrose content without increase in alpha-amino nitrogen, K and Na that prevent crystallization of some sucrose that go out with the molasses. Similar results were stated by El-Khattib (1991) and El-Bakary (2006).

Detailed view in Table 4 show that there were inverse relationships between nitrogen levels and the values of the extractable sugar percentage, as the applied dose of nitrogen increase, the values of the extractable white sugar percentage decreased. On the contrary, each increase in the applied rate of nitrogen was accompanied with an increment in the values of white sugar yield (Figs. 1 and 2). This effect was due to the pronounced effect of nitrogen fertilizer levels on root yield (Table 3). These results are in line with those reported by Abo-Shady *et al.* (2011), Osman (2011), Sarhan *et al.* (2012), Seadh (2012), Abdou (2013) and Abdou and Badawy (2014).

Regarding the interaction between sowing distribution patterns and nitrogen fertilizer levels, obtained results clear that the extractable white sugar (%) and white sugar yield(t/fad) insignificantly affected by the various interactions of the studied factors in both seasons.

4- Sugar loss % and loss sugar yield (t/fad)

Results in Table 5 reveal the values of sugar loss (%) and loss sugar yield as affected by plant distribution patterns and nitrogen fertilizer levels as well as their interaction during 2012/2013 and 2013/2014 seasons.

Results in Table 5 obviously show that hill spaces led to increase in the values of sugar loss %. These results can be explained as changing the distances among hills as plant distributions were conducted included wide spaces between hills that increase photosynthetic process and led to more total soluble solids as a result to nutritents absorption and more impurities. However, the increase of wider hill space also increased the extractable sugar % and compensate the increase in sugar loss (%) .

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Table 4: Extractable sugar % and white sugar yield as affected by plant distribution pattern and nitrogen fertilizer level as well as their interaction during 2012/2013 (I) and 2013/2014 (II) seasons.

Characters / Treatments	Extractable white sugar (%)		White sugar yield (t/fad)	
	I	II	I	II
A- Plant distribution pattern*:*				
25 × 40 cm	14.00	13.98	5.646	5.546
30 × 40 cm	15.29	15.04	5.301	5.397
35 × 40 cm	15.71	15.50	5.128	5.227
20 × 50 cm	13.57	13.74	5.418	5.416
24 × 50 cm	15.10	14.88	5.283	5.253
28 × 50 cm	15.13	15.02	4.933	4.936
F. test	*	*	*	*
LSD at 5 %	0.52	0.45	0.278	0.184
B-Nitrogen fertilizer level*:*				
80 kg N/fad	15.43	15.31	5.162	5.181
100 kg N/fad	14.76	14.69	5.302	5.314
120 kg N/fad	14.21	14.09	5.391	5.390
F. test	*	*	*	*
LSD at 5 %	0.32	0.36	0.180	0.148
C- Interaction (Ax B):	NS	NS	NS	NS

Table 5: Sugar loss (%) and loss sugar yield as affected by plant distribution pattern and nitrogen fertilizer level as well as their interaction during 2012/2013 (I) and 2013/2014 (II) seasons.

Characters / Treatments	Sugar loss (%)		Loss sugar yield (t/fad)	
	I	II	I	II
A- Plant *distribution pattern:*				
25 × 40 cm	3.33	3.27	1.349	1.307
30 × 40 cm	3.47	3.51	1.208	1.266
35 × 40 cm	4.01	4.03	1.315	1.364
20 × 50 cm	3.26	3.25	1.307	1.288
24 × 50 cm	3.43	3.47	1.202	1.232
28 × 50 cm	3.96	4.00	1.297	1.320
F. test	*	*	*	*
LSD at 5 %	0.11	0.09	0.054	0.038
B-Nitrogen fertilizer level:				
80 kg N/fad	3.43	3.43	1.147	1.160
100 kg N/fad	3.58	3.59	1.283	1.295
120 kg N/fad	3.72	3.75	1.409	1.434
F. test	*	*	*	*
LSD at 5 %	0.07	0.07	0.046	0.047
C- Interaction (A x B):	NS	NS	NS	NS

Results obtained in Table 5 appear significant increases in the values of sugar loss (%) and loss sugar yield in the two growing seasons accompanied with the increase in the applied nitrogen levels from 80 up to 120 kg N/fad These results may be due to the increase in the impurities in terms of alpha- amino nitrogen which decrease juice extraction consequently increase sugar loss (%) in turn reduction in loss sugar yield.

Concerning the interaction between the studied factors, available results show that sugar loss (%) and loss sugar yield insignificantly affected by the various combination between sowing distribution patterns and nitrogen fertilizer levels during the two seasons.

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إنتاجية وجودة بنجر السكر وتأثرها بتوزيع النباتات ومستويات السماد النيتروجينى

محمد على الدسوقى عبده ، داليا إبراهيم حنفى الجداوى وعلى محمد علوان
معهد بحوث المحاصيل السكرية- مركز البحوث الزراعية - الجيزة - مصر.

أقيمت تجربتان حقليتان بقرية المنيل – مركز طلخا – محافظة الدقهلية خلال موسمى الزراعة ٢٠١٣/٢٠١٢ و ٢٠١٤/٢٠١٣ م – بغرض دراسة تأثير ست توزيعات نباتية من خلال الزراعة على مسافات ٢٥ ، ٣٠ و ٣٥ سم بين الجور على جانبى مصطبة عرض ٨٠ سم - والزراعة على مسافات ٢٠ ، ٢٤ و ٢٨ سم بين الجور على جانبى مصطبة عرض ١٠٠ سم. وثلاث مستويات من السماد النيتروجينى (٨٠ ، ١٠٠ و ١٢٠ كجم نيتروجين/فدان) - على إنتاجية وجودة بنجر السكر "صنف كواميرا" - نفذت التجارب بنظام القطع المنشقة مرة واحدة فى أربع مكررات، حيث وزعت نظم مسافات الزراعة على القطع الرئيسية بينما وزعت مستويات السماد النيتروجينى عشوائياً على القطع الشقية. ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:

١-كان لتغير نظام توزيع زراعة نباتات بنجر السكر(٢٨ ، ٢٤ و٢٠ سم بين الجور على جانبى المصطبة عرض ١٠٠ سم للزراعة على مسافات ٣٥ ، ٣٠ ، ٢٥ سم بين الجور على جانبى المصطبة عرض ٨٠ سم) تأثيراً معنوياً على جميع الصفات المدروسة خلال الموسمين فيما عدا صفة قطر الجذر فى الموسم الثانى. وقد أدت معاملات تغيير توزيع النباتات عند الزراعة إلى إختلافات معنوية فى جميع الصفات موضوع الدراسة خلال الموسمين – فيما عدا صفات وزن الجذر الغض للنبات ، طول الجذر ومحصول الجذور/فدان خلال الموسم الأول فقط .وقد أدت زراعة بذور بنجر السكر على جانبى المصطبة(عرض ٨٠ سم) فى جور على مسافة ٢٥ سم إلى زيادة معنوية فى محصول الجذور والسكر الكلى ونسبة السكر الأبيض المستخلص.

٢-كان لزيادة مستويات السماد النيتروجينى من ٨٠ ، ١٠٠ إلى ١٢٠ كجم نيتروجين/فدان تأثيرات معنوية على جميع الصفات المدروسة خلال الموسمين فيما عدا طول الجذر فى الموسم الأول – فإن التأثير لم يكن معنوياً - حيث أدت زيادة مستويات السماد النيتروجينى من ٨٠ ، ١٠٠ إلى ١٢٠ كجم نيتروجين/فدان إلى زيادات تدريجية فى صفات الوزن الغض للجذر ، طول وقطر الجذر وكل من محصول الجذور والسكر والسكر الأبيض المستخلص/فدان وكذلك السكر المفقود أثناء الاستخلاص/فدان خلال الموسمين. وعلى النقيض من ذلك فقد أدت زيادة السماد الأزوتى إلى نقص تدريجى فى النسبة المئوية لكل من السكر والسكر الأبيض المستخلص خلال الموسمين.

توصى هذه الدراسة بالزراعة على مسافة ٢٥ سم بين الجور على جانبى المصطبة عرض ٨٠ سم والتسميد بمعدل ١٢٠ كجم نيتروجين/فدان للحصول على أعلى إنتاجية وجودة لمحصول بنجر السكر تحت ظروف محافظة الدقهلية.