J. Plant Production, Mansoura Univ., Vol. 7 (8): 821 -828 , 2016

Yield and Quality of Sugar Beet as Affected by Rates of Nitrogen and Yeast Under the Number of Magenisem Application

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ABSTRACT

To investigate the effect of nitrogen and yeast rate, as well as number of magnesium application on sugar beet yield and quality, two field experiments were carried out at the Experimental Farm of Sakha Agric. Res. Station, KaferEL-Sheik Governorate, Egypt, during the two successive seasons of 2013/2014 and 2014/2015. Split-split plot design was used in both growing seasons. Three nitrogen rates (75, 85 and 95 kg N/fad) were arrange in main plots, two yeast rates (10, 15 g/l) were devoted in sub-plots, whereas, sub-sub plots were allocated to number of magnesium applications at rate of 6 g/l (without addition, one, two and three times). Main results could be summarized as follows: Increasing nitrogen rates from 75 to 95 kg N/fad significantly increased the most characters under study such as, root dimensions, top/ root ratio, in the second seasons sugar beet yields (top, root and sugar), impurities values as well as sugar loss in molasses and alkaline coefficient in term (AC). On the other direction, juice quality significantly decreased such as sucrose%, extractable sugar, extractability and purity percentages as nitrogen level increased. Application of yeast at the rate of 15 g/l significantly affected yield and quality and caused a significant increase in the most characters under study as compared to the rate 10 g/l which gave lowest values for all traits under studied trails. Application of study take the same trend of nitrogen fertilizer effect. Number of magnesium application as foliar spray at the rate of 6g/l significantly affected the most studied characters. Three times, significantly increased sugar beet yield and its attributes, while it significantly decreased quality values for some traits as sucrose%, extractable sugar and extractability percentages. It could be concluded that adding nitrogen fertilizer at the rate of 95 Kg N/fad and yeast at the concentration of 15g/l as well as application of magnesium three times at the rate of 6g/l is a recommended treatment for maximizing sugar beet yield and its quality under these conditions of this study.

INTRUDICTION

Now days sugar beet crop take important rank following sugar cane after increasing the area, which cultivated by sugar beet year after year until now . So we must be take in our account the factors affecting and limiting the production as nitrogen fertilizer, different nutrients and time of its applications, zalat *et al*. 2011and EL-Geddawy and Makhlouf 2015.

Nitrogen is major nutrition element to any plant due to important vital and physiological function as cell size, elongation and divisions of cells depending on nitrogen supply which in the final caused to gave maximum to and root yield by optimum addition dose. Zalat *et al*. 2011 and EL- Geddawy and Makhlouf 2015 their results agreement with this trend.

Quality characters also is very important to gain maximum income from cultivation of sugar beet which depend on optimum supply of bio fertilizer as yeast which, containing vitamins, gebberillic acid, cytokines and amino acid in addition to mineral elements as (Fe, K, Na, Ca, Mg …..etc) have direct effect on cell divisions and photosynthesis EL-Tarabily, 2004; Shalaby and EL-Nady, 2008 and Sharaf, 2012. They reported that spraying yeast on sugar beet significantly affected yield and quality of sugar beet. Investigations about effect of yeast on sugar beet production is rarely so, this study carried out to determine role and function of yeast on sugar beet yield and quality.

Magnesium element playing vital role in photosynthesis efficiency to sucrose development. Addition magnesium is very necessary to sugar beet because large quantities from this element removed in roots and shoots with harvest. Also, magnesium is needed to plant cell respiration for optimum synthesis of sugars. Yarnia *et al*. 2008 and Makhlouf *et al*. 2015.

Magnesium make balance with potassium and calcium to improve root absorption of nutrients, therefore, this research work was performed to find out the proper rate of nitrogen and yeast as well as number of magnesium application to maximize sugar beet yield and quality.

MATERIALS AND METHODS

Two field experiments were conducted on clay soil at Sakha Agricultural Research Station Far, agricultural Research Center, Egypt during 2013/2104 and 2014/2015 seasons.

Chemical analysis of soil sample taken to 30 cm depth in experimental site before soil preparation are given in Table 1.

Table 1: Chemical analysis of soil experimental site (0-30 cm in depth) of the Experimental Farm of Sakha Agric. Research Station in (2013/2014 and 2014/2015) seasons.

Season	PH 1:2.5	EC Mmhos/cm	Organic matter%	Available			Anions Meq/L.			
				N ppm	P ppm	K ppm	Hco3-	cl-	So4-	Co3-
2013/2104	8.3	3.42	1.85	16.14	6.22	288.11	6.2	5.6	0.15	0.0
2014/2015	8.5	3.38	1.78	15.76	6.31	282.25	6.5	6.2	0.19	0.0

A split- split plot design with three replication was used. The main plots included three nitrogen level, (75, 85 and 95 kg N/fad) in the form of Urea (46% N). the sup- plots were assigned to two yeast levels (10 and

15 g/l) as foliar application, while the splitting application of magnesium rate 6g/l at (60, 75 and 90 days) were assigned in the sub – sub plots (6g/l at 60 days, 3g/l at 60 and 75 days and 2g/l at 60, 75 and 90 days from sowing).

Each sub-sub plot included six ridges 60cm apart and 7m long. Sowing took place on 20cm September in 2013/2014 and 25 September in 2014/2015. Seeds of multigerm cultivate "Byramide" were sowing in hills 20cm apart at of 3-4 seeds/hill. Calcium super phosphate was added at rate of 100 kg P_2O_2 15.5% and Potassium phosphate 100kg K_2O 48% per fad were added before land preparation in both seasons. At four true leaves thinning was done to keep one plant / hill. Other cultural practices were done as recommendations of in sugar beet fields. Nitrogen rates were added at two equal doses the first after thinning and the second after one month later while, yeast was added at one dose as foliar application after 50 days from sowing. Magnesium fertilizer was added follow.

1- Spraying with distilled water.
2- Spraying at one dose at 60 days from sowing.
3- Spraying at two equal parts at 60 and 75 days from sowing.
4- Spraying at three parts at 60, 75 and 90 days from sowing.

Harvest was done after 207 days from sowing in both seasons for every plot area 25.2cm^2. Roots of middle two rids from every plot were weighted to determined top and root yield /fad and top/root ratio. Ten guarded plants were also, taken to determine the fallowing characters:

A: Yield components.

Root length and root diameter (cm) as well as top and root fresh weight.

B: Yield quality.

Ten guarded roots were taken from every plot were sent to laboratory of Delta Sugar Company to determine:

1- Sucrose% was determined by means of automatic sugar polarimetric according to Mc Ginnus (1971).
2- Losses sugar in molasses (SM) = Sugar loss to molasses (SM) = $(v_1+v_2)0.14 + (v_3)\ 0.25 + 0.5$. Devillers, (1988).
3- Extractable sugar % = v_4 – SM – 0.6 Dexter *et al.* (1967).
4- Extractability % = Extractable sugar % / sucrose %.
5- Alkaline coefficient (AC) = v_1+v_2 / v_3 Harvey and Dutton (1993).
6- Purity % was calculated according to the following formulas: Purity%= $99.36 - [14.27 (v_1 + v_2 + v_3)/v_4]$ Devillers, (1988).

Where:

V_1 = Sodium % V_2 = Potassium %

V_3 = α – amino N % V_4 = Sucrose % (Pol %)

C: Yield .

1- Top yield (t/fad).
2- Root yield (t/fad).
3- Top/root ratio.
4- Gross sugar yield (t/fad) was calculated from multiply:

(Root yield × sucrose% × purity)

The analysis of variance was carried out according to (Gomez and Gomez 1984). Treatment means were compared by Duncan's Maltiple Range Test (Duncan, 1955). All statistical analysis were using analysis of variance technique by means of "Co Hort" computer soft ware package.

RESULTS AND DISCUSSION

Root dimension (length and diameter) and top / root ratio:

Data presented in Table 2 show that there were gradual and significant increase in values of root dimensions and top/root ratio resulted from increasing nitrogen fertilizer rates from 75 to 95 kg N/fad in both seasons, except top/root ratio in the first season. With increasing nitrogen rate or yeast caused to increase growth rate of top more than root growth rate which gave the highest top/root ratio in this treatments than other which accepted low nitrogen or yeast rates. Similar observations were found by Ismail and Allam (2007), Awad *et al.* (2012) and Nemeat Alla (2016)

Yeast playing a good role for supply plants with amino acids, growth regulators and mineral elements as well as vitamins. Addition yeast to sugar beet plants at the rate of 15 g / l produced the biggest roots dimension (length and diameter) and (22.16 and 26.04 cm) and (11.96 and 14.13 cm) in both seasons, respectively and the highest top/root ratio in the second season (0.19%) as shown in Table 2. These results are in harmony with Shalaby and EL-Nady (2008), Pandya and Saraf (2010) and Sharaf (2012).

Concerning to the effect of foliar application of magnesium number root criteria (length, diameter and top / root ratio), data in Table 2 pointed out that there were significant increases in values of all mentioned traits with increasing number of application from control (without spraying) to three times, which proved that times of foliar application of magnesium is very significant effect on these traits. Top/root ratio in the first season were higher than its values in the second season because top yield increased more than root increase resulted from environmental conditions in this season. These results were also obtained by Makhlouf *et al.* (2015).

As for the interaction effect on root dimensions Data in Table 3 indicated that root length significantly affected by the interaction between nitrogen rates × yeast dose × number of magnesium application in Table 3. The largest roots were obtained in the first season only (24.6cm) resulted from addition 95kg N/ fad with foliar 15 g/l yeast and spraying magnesium 6g/l splitting at three times to plants

Root diameter recorded significant interaction effect from nitrogen levels × number of magnesium application in both seasons in Table 4. Maximum root diameters were found (13.07 and 126.25cm) resulted from addition the high N rate 95 kg N/fad with foliar application of magnesium at three times, this was true in both seasons.

Table 2: Root length (cm), root diameter (cm) and top/root ratio% as affected by nitrogen rates, concentrations of yeast and number of spraying magnesium in 2013/2014 and 2014/2105 seasons.

Characters	Root length (cm)		Root diameter (cm)		Top/root ratio%	
treatments	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
N rates kg N/fad (N):						
75	21.19c	24.09c	11.08c	12.53c	0.30	0.16c
85	21.82b	25.83b	11.77b	13.85b	0.36	0.18b
95	22.72a	27.13a	12.35a	15.03a	0.36	0.21a
F- test	**	**	**	**	NS	**
Concentrations of yeast (g /l). (Y):						
10	21.66b	25.32b	11.50b	13.47b	0.33	0.17b
15	22.16a	26.04a	11.96a	14.13a	0.35	0.19a
F- test	**	**	**	**	NS	*
No. of spraying Magnesium (S):						
0	20.68c	22.65c	10.59c	12.02c	0.30	0.14c
1	22.13b	26.43b	11.97b	14.13b	0.34	0.19b
2	22.26b	26.68ab	12.14ab	14.37b	0.35	0.19b
3	22.56a	26.95a	12.23a	14.68a	0.37	0.20a
F- test	**	**	**	**	NS	**
Interaction						
N × Y	NS	NS	NS	NS	NS	NS
N × S	NS	NS	*	**	NS	NS
Y × S	NS	NS	NS	NS	NS	NS
N × Y × S	**	NS	NS	NS	NS	NS

***,** and N.S indicated P<0.05, P< 0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Table 3: Root length (cm) as affected by the interaction among nitrogen rates, concentrations of yeast and number of spraying magnesium in 2013/2014 season.

kg N/fad	Concentrations of yeast (g/l)	No. of spraying magnesium 0	1	2	3
75		19.87m	21.40ijk	21.47ijk	21.53h-k
85	10	20.67l	21.80ghi	21.93fgh	22.13efg
95		21.20k	22.53cde	22.60cd	22.80c
75		20.00m	21.67hij	21.80ghi	21.80ghi
85	15	21.13k	22.13efg	22.33def	22.40cde
95		21.27jk	23.27b	23.40b	24.6a

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test.

Table 4: Root diameter (cm) as affected by the interaction between nitrogen rates and number of spraying magnesium in 2013/2104 and 2014/2015 seasons.

kg N/fad	No. of magnesium spraying. 2013/2104 0	1	2	3
75	10.23f	11.23d	11.37d	11.47d
85	10.67e	12.00c	12.25c	12.17c
95	10.87e	12.67b	12.80ab	13.07a
2014/2015				
75	11.10h	12.85ef	13.05e	13.10e
85	12.35g	14.10d	14.25d	14.70c
95	12.60fg	15.45b	15.80b	16.25a

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test.

Impurities values (meq/100g beet) and Alkaline coefficient (AC):

Impurities values are indicator for quality of sugar beet roots including (K, Na and α-N). Data collected in Table 5 indicated that nitrogen fertilizer is a main factor affecting sugar beet quality. Increasing nitrogen levels from 75 to 95 kg N/ fad exhibited a significant increase in all impurities content (K, Na and α-n) and Alkaline coefficient(AC) expressed as melliequivalent per 100g of sugar is indicator for optimum nitrogen level which must be added to sugar beet. If its value increases more than 1.8 this mean that nitrogen level which applied is very optimum. If its value decrease than 1.8 this mean that there is over fertilization happen in this study (Wieninger and Kubadinow, 1971; Pollach, 1984, 1989) in Table 9 all values increased more than 1.8, which indicator that all N values under study are suitable to gave good root yield and quality. These findings are harmony with these obtained by Awad *et al.* (2012) and Nemeat Alla *et al.* (2015).

Concerning foliar application of yeast on sugar beet with rates (10 and 15 g/l), data obtained in Table 5 revealed that high concentration of yeast (15 g/l) induced maximum values of impurities (K, Na and α-n). Regarding to Alkaline coefficient, which increased more than 1.8 in both two growing seasons with rate of 15 g/l yeast, this proving that all nitrogen or yeast rates were optimum and restraining production of α-amino N (impurity component). Mehdikhani *et al.* (2011) reported similar results.

Table 5: K, Na and Alfa amino nitrogen as affected by nitrogen rates, concentrations of yeast and number of spraying magnesium in 2013/2014 and 2014/2105 seasons.

Characters	K (meq/100g beet)		Na(meq/100g beet)		α- N (meq/100g beet)		Alkaline coefficient	
treatments	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
N rates kg N/fad (N):								
75	5.13c	4.83c	1.65	1.41c	1.40	3.03c	4.83	5.30c
85	5.88b	5.21b	1.83	1.78b	1.59	3.53b	4.89	5.72b
95	6.12a	5.84a	1.82	2.24a	1.85	4.09a	4.56	6.39a
F- test	*	**	NS	**	NS	**	NS	*
Concentrations of yeast (g /l) (Y):								
10	5.22b	5.14b	1.61b	1.70	1.53b	3.41	4.54	5.63b
15	6.20a	5.45a	1.99a	1.93	1.69a	3.68	4.98	5.97a
F- test	**	*	**	NS	**	NS	NS	*
No. of spraying Magnesium (S):								
0	5.34c	5.19	1.61	1.70	1.57	3.44	4.54	5.68
1	5.62c	5.24	1.71	1.80	1.59	3.52	4.66	5.76
2	5.86ab	5.31	1.91	1.86	1.60	3.58	4.90	5.83
3	6.02a	5.42	1.96	1.90	1.69	3.65	4.94	5.94
F- test	**	NS	NS	NS	NS	NS	NS	NS
Interaction								
N × Y	NS	NS	NS	NS	NS	NS	NS	NS
N × S	NS	NS	NS	NS	NS	NS	NS	NS
Y × S	NS	NS	NS	NS	NS	NS	NS	NS
N × Y × S	NS	NS	NS	NS	NS	NS	NS	NS

***,** and N.S indicated P<0.05, P< 0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Spraying magnesium had no significant effect on all impurities vales in both seasons except the content of K in the first season as shown in Table 9. Same results were found by Christian and Johnson (2004) and Makhlouf *et al.* (2015).

The first and second order of the interaction failed to excerpt any significant effect on all impurities values in both seasons of study, Table5

Sucrose, extractable sugar, extractability% and sugar losses percentages:

Mentioned characters could be considered as important factors affecting on sugar beet quality. Nitrogen and yeast levels as well as number of magnesium application play an effective role in these characters as shown in Table 6.

Nitrogen rate had a significant on these four characters (sucrose %, extractable sugar, extractability% and sugar losses percentages). Data presented in Table 6 pointed out that raising nitrogen rate up to 95 kg N/fad caused a significant and negative effect values of (sucrose %, extractable sugar and extractability %) in both seasons. On the other direction, increasing nitrogen rate up to 95 kg / N fad increased sugar losses in molasses. At any case increasing nitrogen rate up to 90 kg N/fad have bad effect in all mentioned characters. These results are accordance with those of EL-Geddawy, Dalia and Makhlouf (2105).

Regarding to concentration of yeast as foliar application on sugar beet, data presented in Table 6 showed a negative effect on values of sucrose, extractable sugar and extractability % and increased sugar losses in molasses. These results were true in both seasons Shalaby and El- Nady (2008), Mehdikhani *et al.* (2011) and Sharaf (2012) came the same result.

Table 6: sucrose%, extractable sugar, extractability% and sugar losses as affected by nitrogen rates, concentrations of yeast and number of spraying magnesium in 2013/2014 and 2014/2105 seasons.

Characters	sucrose%		extractable sugar%		extractability%		sugar losses	
treatments	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
N rates kg N/fad (N):								
75	18.10a	21.82a	16.30a	19.10a	90.04a	87.47a	1.89c	2.13c
85	17.68b	21.13b	15.70b	18.17b	88.79b	85.97b	1.97b	2.36b
95	17.23c	20.29c	15.14c	17.04c	87.63c	83.91c	2.09a	2.65a
F- test	**	**	*	**	**	**	*	**
Concentrations of yeast(g/l) (Y):								
10	17.82a	21.28a	15.98a	18.37a	89.64a	86.26a	1.84b	2.31
15	17.51b	20.89b	15.44b	17.84b	88.13b	85.31b	2.07a	2.45
F- test	**	**	**	**	**	*	**	NS
No. of spraying Magnesium (S):								
0	18.57a	22.39a	16.71a	19.46a	89.96a	86.92a	1.86c	2.33b
1	17.50b	20.79b	15.58b	17.82b	88.97b	85.68b	1.93c	2.37ab
2	17.37b	20.67b	15.38c	17.67c	88.51c	85.42bc	1.99ab	2.40a
3	17.22c	20.49c	15.18d	17.45d	88.10d	85.11c	2.04a	2.44a
F- test	**	**	**	**	**	**	**	*
Interaction								
N × Y	NS	NS	NS	NS	NS	NS	NS	NS
N × S	**	**	NS	NS	NS	NS	NS	NS
Y × S	NS	NS	NS	NS	NS	NS	NS	NS
N × Y × S	NS	NS	NS	NS	NS	NS	NS	NS

***,** and N.S indicated P<0.05, P< 0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Data in Table 6 pointed out that increasing the number of magnesium application to three times cause a significant decrease in values of sucrose%, extractable sugar and extractability%. On the other hand increasing number of magnesium application increased sugar losses in molasses. At any case increasing number of magnesium application have negative effect on these characters. Same results were found by Moustafa, Zeinab *et al.* (2006) and Makhlouf *et al.* (2015).

All the interaction effect of the three factors under study (nitrogen × yeast × number of magnesium application) had no significant effect on these four characters in the two seasons, except the interaction between nitrogen rates and number of magnesium application on sugar percentage in both seasons, Table 6. Data presented in Table 7 indicated that addition 95 kg N/fad × foliar spraying magnesium three times gave lowest sucrose % in both seasons (16.58 and 19.49%) compared to lowest nitrogen dose 75 kg N/fad which gave the highest values of sucrose %. This were true in both seasons.

Table 7: sugar percentage as affected by the interaction between nitrogen rates and spraying of magnesium in 2013/2014 and 2014/2015 seasons.

kg N/fad.	No. of spraying magnesium 2013/2014			
	0	**1**	**2**	**3**
75	18.76a	18.01c	17.90cd	17.73d
85	18.54ab	17.46e	17.36e	17.35e
95	18.43b	17.04f	16.86f	16.58g
		2014/2015		
75	22.70a	21.65c	21.55cd	21.42d
85	22.34b	20.89e	20.75ef	20.55f
95	22.13b	19.82g	19.73g	19.49h

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test

Purity%:

Purity percentage is important quality trail for sugar beet root and affected by many factors as nitrogen dose as well as yeast rates and number of magnesium applications. Data in Table 8 clearly indicated that, the purity percentage significantly affected and have negative effective with increasing nitrogen dose from 75 to 95 kg N/fad.

Concentration of yeast as foliar application from 10 to 15 g/l caused to decrease purity% in both seasons from 92.44 and 92.45 to 91.06 and 91.75%. This decrease due to decrease sucrose% from addition yeast to plants which encourage vegetative than sucrose accumulation in roots.

Increasing number of magnesium application to three times significantly decreased values of this trail in both seasons. This decreased related to effect of magnesium on increase size roots which reflected on decrease sucrose and purity percentages. Similar observations were obtained by EL- Geddawy, Dalia and makhlouf 2015.

Table 8: Purity% as affected by nitrogen rates, concentrations of yeast and number of spraying magnesium in 2013/2014 and 2014/2105 seasons.

Characters	**Purity%**	
treatments	**2013/2014**	**2014/2015**
N rates kg/fad (N):		
75	92.50a	93.29a
85	91.55b	92.25b
95	91.20b	90.77c
F-test	**	**
Concentrations of yeast (g/l) (Y):		
10	92.44a	92.45a
15	91.06b	91.75b
F- test	**	**
No. of spraying magnesium (S):		
0	92.32a	42.76a
1	91.93b	92.07b
2	91.50c	91.89c
3	91.26d	91.67d
F-test	**	**
Interaction		
N × Y	NS	NS
N × S	NS	NS
Y × S	NS	NS
N × Y × S	NS	NS

***,** and N.S indicated P<0.05, P< 0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

No significant interaction effect was found between and among the three factors under study on purity% in both seasons, Table 8.

Top, root and sugar yields (t/fad):

Effect of nitrogen rates, yeast concentrations and number of magnesium applications on top, root and sugar yields are presented in Table 9. The highest yields were obtained for the three mentioned traits in both seasons resulted from addition 95 kg N/ fad. These advantage may be due to the important role of nitrogen in increasing cell size and rate of growth in foliage and root as well as sugar yield. These finding are in harmony with those obtained by Zalat *et al.* (2011), Sharaf (2012) and EL- Sarage, Eman and Moselhy (2013).

It could be noticed that the highest yields were obtained in both seasons results from increasing rate of yeast to 15 g yeast per liter. These progressive may be due to the role of yeast and its containing from growth regulators as well as vitamins and other useful materials to sugar beet, Table 9. These results are in line with results of Shalaby and El- Nady (2008), Mok and Mok (2001), Mehdikhani *et al*. (2011) and Sharaf (2012).

Regarding the effect of number of magnesium application on sugar beet yields, data in Table 9 reveal that with raising number of magnesium application from without to three times caused to significant increase in values of top, root and sugar yields in both seasons. These advantage due to additive dose effect of magnesium amount in three times than other times. These results were obtained also by Makhlouf *et al*. (2015).

Table 9: Top yield (t/fad), root yield (t/fad) and sugar yield (t/fad) as affected by nitrogen rates, concentrations of yeast and number of spraying magnesium in 2013/2014 and 2014/2105 seasons.

Characters / treatments	Top yield (t/fad) 2013/14	Top yield (t/fad) 2014/15	Root yield (t/fad) 2013/14	Root yield (t/fad) 2014/15	Sugar yield (t/fad) 2013/14	Sugar yield (t/fad) 2014/15
N rates kg N/fad. (N):						
75	8.49c	5.70c	27.17c	30.58c	4.54c	6.10b
85	9.95b	7.44b	30.51b	32.03b	4.92b	6.21a
95	12.05a	9.23a	33.67a	33.26a	5.26a	6.23a
F- test	**	**	**	**	**	*
Concentrations of yeast (g /l). (Y):						
10	9.67b	7.01b	29.52b	31.53b	4.84b	6.17
15	10.64a	7.91a	31.38a	32.38a	4.98a	6.18
F- test	**	**	**	**	*	NS
No. of spraying Magnesium (S):						
0	7.87c	5.23c	24.29c	27.76d	4.16b	5.76b
1	10.64b	7.82b	31.87b	33.07c	5.11a	6.31a
2	10.93ab	8.20ab	32.38b	33.34b	5.13a	6.32a
3	11.22a	8.57a	33.28a	33.65a	5.21a	6.33a
F- test	**	**	**	**	**	**
Interaction						
N × Y	NS	NS	NS	NS	NS	NS
N × S	**	**	NS	NS	NS	NS
Y × S	NS	NS	NS	NS	NS	NS
N × Y × S	NS	NS	NS	**	NS	**

***,** and N.S indicated P<0.05, P< 0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Significantly interaction effect were found in both seasons between N rates × foliar spraying of magnesium three times on top yield as shown in Table 10. Maximum top yield (13.76 and 11.02 t/fad) in both seasons, respectively were resulted from addition 95 kg N/fad × spraying magnesium at rate of 6 g/l three times.

Table 10: Top yield (t/fad) as affected by the interaction between nitrogen rates and spraying of magnesium in 2013/2014 and 2014/2015 seasons.

kg N/fad	No. of spraying magnesium 2012/2013: 0	1	2	3
75	7.26g	8.86e	8.86e	8.95e
85	7.99f	10.23d	10.65cd	10.95c
95	8.35ef	12.83b	13.28ab	13.76a
2013/2014				
75	5.52f	5.95de	6.10dd	6.24d
85	5.22ef	7.87c	8.21c	8.45c
95	5.94de	9.65b	10.31ab	11.02a

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test.

As for the interaction effect among the three factors under study on root yield and sugar yield. Data presented in Table 11 and 12 show that the maximum root and sugar yields were obtained when sugar beet plants were received 95 kg N/ fad and sprayed by yeast at the rate of 15 g/l as well as by magnesium three times in the second season.

Table 11: Root yield as affected by the interaction among nitrogen rates, concentrations of yeast and spraying magnesium in 2014/2015 season.

kg N/fad	Concentrations of yeast (g/l)	No. of spraying magnesium: 0	1	2	3
75		24.58s	31.09m	31.81l	32.17k
85	10	27.70q	33.02gh	33.11gh	33.24g
95		29.12o	33.99ef	34.18de	34.41cd

75		27.16r	32.46jk	32.55ij	32.85hi
85	15	28.49p	33.33g	33.68f	33.68f
95		29.55n	34.56bc	34.73b	35.58a

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test.

Table 12: sugar yield (t/fad) as affected by the interaction among nitrogen rates, concentrations of yeast and spraying magnesium in 2014/2015 season.

kg N/fad	Concentrations of yeast (g/l)	No. of spraying magnesium 0	1	2	3
75		5.94j	6.10i	6.10i	6.17ghi
85	10	5.89j	6.31def	6.35c-f	6.28efg
95		5.29l	6.44abc	6.45adc	6.47ab
75		5.71k	6.23fgh	6.19ghi	6.13hi
85	15	5.76k	6.47ab	6.41a-d	6.36b-e
95		5.98j	6.38a-e	6.47a	6.48a

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test.

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تأثر محصول وجودة بنجر السكر بمعدلات الازوت والخميره وعدد مرات اضافة الماغنسيوم

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لدراسة تاثير معدلات الازوت والخميره وعدد مرات اضافة الماغنسيوم علي محصول وجودة بنجر السكر. أجريت تجربتان حقليتان في الموسمين الزراعيين ٢١٠٤/٢٠١٣ ، ٢٠١٥/٢٠١٤ في المزرعة البحثية لمحطة البحوث الزراعية بسخا – محافظة كفر الشيخ – جمهورية مصر العربية. وقد تم استخدام تصميم القطع منشقة مرتين في ثلاثة مكررات بكلا الموسمين، حيث وزعت معدلات التسميد النيتروجيني (٧٥ ، ٨٥ ، ٩٥ كجم ازوت / الفدان) في القطعة الرئيسية واما تركيزات الخميرة (١٠ ، ١٥ جم / لتر) فقد زورعت في القطعة الشقية الاولي ، بينما تم وضع عدد مرات رش عنصر الماغنسيوم (بدون اضافة ماغنسيوم ، الاضافة مرة واحدة ، الاضافة مرتين ، الاضافة ثلاثة مرات) وذلك بمعدل ٦جم / اللتر في القطع الشقية الثانية. ويمكن تلخيص اهم النتائج المتحصل عليها من هذا البحث فيما يلي: اوضحت النتائج ان زيادة معدلات التسميد الازوتي من ٧٥ الي ٩٥ كجم ن / الفدان قد ادت الي زيادة معنوية في لمعظم الصفات المدروسة مثل طول وقطر الجذر ، نسبة العرش الي الجذر ، محصول كلا من العرش و الجذور والسكر ، نسبة الشوائب في العصير من (الصوديوم والبوتاسيوم والفا امينو نيتروجين) والسكر المفقود في المولاس وايضا زيادة معامل القلوية الذي يعتبر مرشدا للتسميد النيتروجيني الامثل للبنجر .ومن ناحية اخري ادت زيادة معدلات التسميد الازوتي الي نقص معنوي في صفات الجودة مثل نسبة السكروز ، والسكر المستخلص ، نسبة الاستخلاص. ادت اضافة الخميرة رشا علي نباتات بنجر السكر بتركيز ١٥ جم / لتر الي زيادة معنوية في قيمة معظم الصفات المدروسة مقارنة بمعدل الاضافة الاخر (١٠ جم / لتر). وكان لاضافة الخميره نفس تأثير اضافة الازوت حيث كان لها تأثيرا سلبيا علي صفات جودة العصير. كما كان لعدد مرات اضافة الماغنسيوم بتركيز ٦جم / لتر اثرا معنويا موجبا علي معظم الصفات المدروسة. ادت اضافة عنصر الماغنسيوم ثلاث مرات الي زيادة محصول بنجر السكر ومكوناته ، بينما ادت الي نقص بعض صفات الجودة مثل نسبة السكروز والسكر المستخلص ونسبة الاستخلاص. ويمكن ان نستخلص من النتائج المتحصل عليها ان اضافة السماد الازوتي بمعدل ٩٥ كجم ازوت للفدان واضافة الخميره بتركيز ١٥ جم / لتر وكذلك الرش بالماغنسيوم ثلاثة مرات بمعدل ٦ جم / لتر يمكن ان ننصح به لزيادة محصول بنجر السكر وجودته تحت ظروف هذه الدراسة.