PERFORMANCE OF SOME SUGAR BEET VARIETIES UNDER DIFFERENT SOWING DATES

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ABSTRACT

Two field experiments were conducted at Sakha, Kafer El-Sheikh, Governorate in 2009/2010 and 2010/2011 seasons to evaluate five multigerm sugar beet varieties sown at three sowing dates (1st September, 1st October and 1st November). The tested sugar beet varieties were imported from Germany (Del 937 and Carolla), France (LP13), Netherlands (Samba) and Sweden (Baraca). Split plot design with four replicates was applied in both seasons. Sowing dates were arranged in the main plots and varieties in the sub plots. The results indicated that sowing sugar beet on the 1st of October significantly surpassed the other two dates in root length, diameter and fresh weight, sucrose% as well as root and sugar yields/fed., while impurities% in roots (α- amino N, K and Na%) were increased by delaying sowing date up to the 1st of November in both seasons. The tested sugar beet varieties differed significantly in root length, diameter and fresh weight, sucrose%, root and sugar yields/fed., and impurities% in both seasons. Carolla variety was the best one where it gave the highest root and sugar yields/fed. The interaction between the three sowing dates and five varieties had a significant effect on sucrose%, root and sugar yields. Sowing Carolla variety on the 1st October was recommended for cultivation in Kafer EL-Sheikh as it gave the highest sucrose%, as well as sugar and root yields/fed in both seasons.

Key words: Sugar beet varieties under different sowing dates.

INTRODUCTION

There are many factors affecting yield and quality of sugar beet as nutritional status as well as some agro practices applications, such as sowing dates and methods. **Allam *et al* (2005)** showed that the highest values of root and sugar yields were obtained when sugar beet was sown on the 1st of October. **Ismail *et al*. (2006)** found that early sowing date on 1st October led to a significant increase in root fresh weight, sucrose%, purity%, sugar and root yields/fed compared with late sowing date on 15th October and 1st November. **El-Geddawy *et al*. (2007)** showed that sowing sugar beet early on 15th September significantly attained the higher root length, diameter, root fresh weight/plant as well as root and sugar yields/fed than late sowing date on 15th October. **Mosa (2009)** cleared that early sowing on 15th September significantly increased root length, diameter, root and sugar yields/fed as compared with late sowing on 15th October or November. **El-Hosry *et al.* (2010)** revealed that root length and root yield/fed were significantly larger with sowing on 15th October as compared to 15th Sepember and 15th November.

All sugar beet genotypes cultivated in Egypt were imported from foreign countries, so, it is preferable to evaluate them under Egyptian conditions especially under different sowing dates to select the best ones characterized with high yield and quality traits. **Osman (2005)** evaluated some sugar beet varieties and observed that Toro significantly surpassed Pleno variety in root diameter, root fresh weight, top and root yields/fed. **Aly (2006)** found that Marathon

variety significantly surpassed the other varieties in root length, diameter, fresh weight, root and sugar yields/fed, while, Kawemira variety was the best in sucrose%, purity%, extractable sugar% and extractability%. **Ismail *et al*. (2006)** and **Allam *et al*. (2007)** indicated that sugar beet genotypes significantly differed in growth, yield and quality characteristics. Farida and Gazella gave the highest values of root yields/fed, as well as, root fresh weight, sucrose% and purity%. **Ismail *et al.* (2007)** evaluated some sugar beet varieties (Gloria, Mont bianco, Carolla, Desprezpoly, LP 13, Pleno, Baraca, Shems, Farida and Samba) and found that varieties significantly differed in root length, diameter, sucrose%, purity% as well as, root and sugar yields/fed. Montbianco variety surpassed the other varieties in growth, yield and quality traits. **Shalaby *et al.* (2008)** tested twenty sugar beet varieties namely Demapoly, Carola, Tteri, Kawemira, Desprez poly N, B 2001, FD 9902, FD 9901, FD 0405, FD 4901, Meridio, Mahara, Desprez mono N, Anema, LP 11, LP 12, LP 13, LP 14, LP 15 and LP 16. They found that LP 15 variety significantly surpassed the other ones in root length, diameter, fresh weight, root and sugar yields/fed, while, LP 12 showed the superiority in sucrose, purity% and extractability% compared with those showed by other sugar beet varieties. **Soha (2010)** studied some sugar beet genotypes, and recorded that Toro variety surpassed other genotypes in root length and diameter, as well as, fresh and weight/plant, root and sugar yields/fed, while Lp11 recorded the lowest results.

The objective of the present work was to find out the appropriate sowing date and the best sugar beet variety to obtain the maximum root and sugar yields/fed.

MATERIALS AND METHODS

This work was carried out in the experimental field of Agriculture Research Center at Sakha, Kafer El-Sheikh Governorate during 2009/2010 and 2010/2011 seasons to investigate the effect of three sowing dates on growth, yield and quality of five sugar beet varieties. The tested sugar beet varieties were imported from Germany (Del 937 and Carolla), France (LP13), Netherlands (Samba) and Sweden (Baraca). Sowing dates were 1st September, 1st October and 1st November. Mean of temperature degree and relative humidity% are illustrated in Table (1).

Table 1. Mean of temperature degree and relative humidity percentage during two growing seasons at Kafer El-Sheikh.

Months	2009-2010 season						2010-2011 season					
	Temperature (°C)			Relative humidity (%)			Temperature (°C)			Relative humidity (%)		
	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.
September	33.2	20.4	26.8	86	34	60.0	33.5	19.3	26.4	82	28	55.0
October	32.1	18.4	25.2	85	31	58.0	31.8	18.3	25.1	81	27	54.0
November	27.7	15.5	21.6	88	40	62.0	28.1	13.7	20.9	80	29	54.5
December	22.4	9.3	15.9	80	36	58.0	21.2	8.2	14.7	81	36	58.5
January	21.2	8.8	15	82	35	58.5	21.1	7.6	14.3	77	33	55.0
February	23.8	8.6	16.2	85	35	60.5	21.0	6.9	13.9	86	35	60.5
March	27.2	12.4	19.8	81	31	56.0	25.2	9.4	17.3	78	28	53.0
April	29.7	13.1	21.4	80	23	51.5	30.1	13.0	21.5	76	24	50.0
May	30.2	14.7	22.5	79	22	50.5	31.7	14.6	23.15	75	22	48.5

Source: Agro-meteorological Station, Agric. Res. Center, Giza, Egypt.

A Split plot in a randomized complete block design with four replicates was applied in both seasons. Sowing dates were applied in the main plots and varieties in the sub plots. The sub plot area was 21 m^2 including six rows spaced 50 cm and 7 m long. Nitrogen fertilizer in the form of urea (46.5% N) was applied at the recommended rate (80 kg N/fed) in two equal doses; after thinning and 30 days later. Potassium fertilizer was added after thinning in the form of potassium sulfate (48% K_2O) at the rate of 24 kg K_2O/fed, while phosphorus fertilizer was added during land preparation in the form of calcium super phosphate (15.5% P_2O_5) at a rate of 30 kg P_2O_5/fed. Other agricultural practices required for growing sugar beet were carried out as usually practiced in the region.

Recorded data

Sugar beet plants of the three guarded rows were up-rooted, topped, weighed and a random sample of ten roots was taken from each sub- plot to determine:

1. Root growth characters:
   - Root length.
   - Root diameter.
   - Root fresh weight/plant.
2. Juice quality characteristics:
   - Sucrose% was polarimetrically determined at the laboratory according to the methods of **Le-Docte (1927).**
   - Impurities%: α- amino N, Na and K% in root fresh matter weight were determined using Flame Photometer at the laboratory as described by **Page (1982),** while α- amino N % was determined according to the method of **Carruthers *et al.* (1962).**
3. Yields (ton/fed).
   - Root yield (t/fed).
   - Theoretical sugar yield was calculated by multiply root yield (t/fed) x sucrose%.

All collected data were statistically analyzed according to the procedures used by **Snedecor and Cochran (1981)**.

RESULTS AND DISCUSSION

Effect of sowing date:

1. Root growth characters (length, diameter and fresh weight/plant)

Data in Table 2 clear that root growth characters were significantly affected by sowing dates variation in two seasons. October 1st sowing date surpassed the other two sowing dates in root length and root fresh weight/plant, while, sowing sugar beet on 1st September was the best for root diameter. These results may be attributed to favorable conditions prevailed during the early growth stage of seedlings that could boost their growth. Similar results were recorded by **Allam *et al*. (2005), Ismail *et al.* (2006), El-Geddawy *et al*. (2007), Mosa (2009)** and **El-Hosry *et al*. (2010).**

2. Juice quality:

2.1. Sucrose%

Data in Table 2 clear that the studied sowing dates significantly affected sucrose% in 1st and 2nd seasons. The early sowing on 1st September surpassed the other two sowing dates for sucrose%, where the high mean value was (17.33 and 15.66) in both seasons. These results may be attributed to the suitable conditions

at harvest as a result to early sowing where the temperature degree at harvest in on March encouraged the accumulation of sucrose in root%. Data also showed insignificant differences between sowing beets on 1st September and 1st October for sucrose%. Similar results were evidenced by **Allam *et al*. (2005), Ismail *et al*. (2006), El-Geddawy *et al.* (2007), Mosa (2009)** and **El-Hosry *et al*. (2010).**

2.2. Impurities% (α- amino N, Na and K %)

Data illustrated in Table 2 clear that the three sowing dates significantly differed in their effects on impurities% in two seasons. 1st October sowing date was the best where it gave the lowest impurities% than other two sowing dates. The lowest mean values were (1.36 and 1.12) for α- amino N, (1.06 and 0.88) for Na% and (1.72 and 1.10) for K% in both seasons, respectively. While, the late date on 1st November attained the highest impurities% and the lowest sucrose%. These results may be attributed to unsuitable conditions at harvest, where, the maximum of temperature degree and relative humidity which led to sucrose analysis and hence decrease in sucrose% and increase in impurities%. Theses results coincide with those reported by **Allam *et al* (2005), Ismail *et al*. (2006), El-Geddawy *et al*. (2007), Mosa (2009)** and **El-Hosry *et al*. (2010).**

Table 2: Effect of sowing dates on roots growth, quality% and yields (t/fed) at harvest.

Sowing dates	Root growth characters			Sucrose (%)	Impurities (%)			Yields (t/fed)	
	Length (cm)	Diameter (cm)	Fresh weight /plant (kg)		α– aminoN	Na	K	Root	Sugar
2009/2010 season									
1st Sept.	27.43	13.30	0.90	17.33	1.76	1.77	2.00	28.44	4.93
1st Oct.	30.89	12.75	1.01	16.97	1.36	1.06	1.72	30.76	5.22
1st Nov.	24.75	11.71	0.85	15.70	2.10	1.88	2.44	25.94	4.07
LSD 5%	**1.12**	**0.85**	**0.11**	**0.94**	**0.45**	**0.53**	**0.39**	**1.75**	**0.77**
2010/2011 season									
1st Sept.	28.00	14.45	0.81	15.66	1.88	1.43	2.24	26.14	4.09
1st Oct.	33.64	13.10	1.29	14.92	1.12	0.88	1.10	28.46	4.25
1st Nov.	25.00	12.15	0.79	13.66	2.20	1.65	2.70	23.66	3.23
LSD 5%	**2.10**	**0.79**	**0.09**	**0.77**	**0.38**	**0.21**	**0.25**	**0.66**	**0.23**

Impurities%, N= Nitrogen, Na= Sodium, K= Potassium.

3. Root and sugar yields/fed:

Data in Table 2 show that sowing dates had significant different effect on root and sugar yield/fed in 1st and 2nd season. Sowing sugar beet on 1st October, the highest mean values of root and sugar yields in both seasons. This result could be attributed to the increase in yield components in the middle sowing date (1st October) and hence root and sugar yields. On the contrary, the late sowing date on 1st November led to the exposure of plant tops to hot weather and high temperature degrees by the end of the growing season, which increased transpiration rate and dehydration of leaves and in turn decreased root yield. These results are in line with those reported by **Allam *et al* (2005), Ismail *et al* (2006), El-Geddawy *et al* (2007), Mosa (2009)** and **El-Hosry *et al* (2010).**

Differences among the evaluated sugar beet varieties:

1. Root growth characters (length, diameter and fresh weight/plant)

Data in Table 3 show that the five varieties differed significantly in root growth characters in both seasons. Carolla variety surpassed the other varieties in all traits where, it produced the highest root length, root diameter and root fresh weight in both seasons, followed by Samba and Baraca. While, LP 13 recorded

the lowest values in root length, diameter and fresh weight as compared with Carolla or Samba only. The differences among the tested sugar beet varieties in these traits might be due to the differences in their gene make up. These findings are in agreement with those obtained by **Ismail *et al*. (2006), Allam *et al.* (2007), Ismail *et al*. (2007), Shalaby *et al.* (2008)** and **Soha (2010).**

2. Juice quality:

2.1. Sucrose%

Data in Table 3 show that the five sugar beet varieties differed significantly in sucrose% in both seasons. Carolla variety gave the highest value of sucrose% compared to the other varieties followed by Samba and Baraca, while, LP 13 gave the lowest values of this trait in both seasons. These results may be due to the variation in the genetic structure of the evaluated genotypes. These results are in agreement with those obtained by **Ismail *et al*. (2006), Allam *et al*. (2007), Ismail *et al.* (2007), Shalaby *et al.* (2008)** and **Soha (2010).**

Table 3. Root growth, quality% and yields (t/fed) at harvest of the tested sugar beet varieties.

Varieties	Root growth characters			Sucrose (%)	Impurities (%)			Yields/fed (t)	
	Length (cm)	Diameter (cm)	Fresh weight /plant (kg)		α– aminoN	Na	K	Root	Sugar
2009/2010 season									
Carolla	29.25	13.23	1.18	18.60	1.46	1.31	2.06	30.20	5.62
Samba	28.80	13.20	1.07	17.96	1.56	1.32	2.09	29.23	5.25
Baraca	27.61	13.09	1.06	16.48	1.78	1.42	2.10	28.47	4.69
Del 937	26.75	12.40	0.99	15.67	1.85	1.70	2.11	27.83	4.36
LP 13	26.03	11.87	0.85	15.30	1.95	1.78	2.16	26.17	4.00
LSD 5%	**1.65**	**0.70**	**0.18**	**1.75**	**0.23**	**0.19**	**0.09**	**1.85**	**0.90**
2010/2011 season									
Carolla	32.60	14.56	1.13	16.53	1.67	1.22	2.23	27.93	4.62
Samba	29.92	14.32	1.08	16.00	1.70	1.24	2.39	26.93	4.29
Baraca	28.70	13.36	1.04	15.93	1.73	1.35	2.42	26.17	3.78
Del 937	27.24	12.79	0.99	14.43	2.23	1.46	2.45	25.53	3.47
LP 13	25.95	12.31	0.97	14.10	2.36	1.60	2.60	23.87	3.37
LSD 5%	**1.22**	**0.15**	**0.11**	**0.55**	**0.18**	**0.15**	**0.07**	**0.66**	**0.26**

Impurities%, N= Nitrogen, Na= Sodium, K= Potassium.

2.2. Impurities% (α- amino N, Na and K%):

Data in Table 3 show that varieties differed significantly in juice impurities% (α amino N, Na and K%) in both seasons. Carolla variety was the best variety where, it had the lowest values of impurities% in both seasons, while, LP 13 attained the highest values in impurities% as compared with other varieties. The variation among genotypes in these characters could be attributed to the difference in their gene make-up. Similar results are obtained by **Ismail *et al*. (2006), Allam *et al*. (2007), Ismail *et al.* (2007), Shalaby *et al.* (2008)** and **Soha (2010).**

3. Root and sugar yields/fed:

Data in Table 3 show that varieties differed significantly in root and sugar yields in both seasons. Carolla variety surpassed the other varieties, in root and sugar yields in both seasons, followed by Samba and Baraka, while, LP 13 attained the lowest values of these traits. These results may be due to the increase in yield components. These results coincide with those reported by **Ismail *et al***

(2006), Allam *et al.* (2007), Ismail *et al*. (2007), Shalaby *et al*. (2008) and **Soha (2010).**

4. Interaction effects:

Data in Table 4 clear that the interaction between the five sugar beet varieties and the three sowing dates affected significantly sucrose%, sugar and root yields/fed in both seasons. Carolla variety sown in October 1st gave the highest values of the studied traits compared to other combinations, while, LP 13 variety sown on November 1st recorded the lowest values

Table 4: The interaction between the tested sugar beet varieties and sowing dates at harvest

Sugar beet Varieties	Sowing dates								
	1st Sept.	1st Oct.	1st Nov.	1st Sept.	1st Oct.	1st Nov.	1st Sept.	1st Oct.	1st Nov.
	Sucrose (%)			Root yield/fed (t)			Sugar yield/fed (t)		
2009/2010 season									
Carolla	18.68	19.77	17.36	30.80	32.30	27.50	5.75	6.39	4.77
Samba	18.21	18.56	17.10	29.00	31.40	27.30	5.28	5.83	4.67
Baraca	16.90	17.17	15.36	28.40	31.00	26.00	4.80	5.32	3.99
Del 937	15.57	16.99	14.45	28.10	30.40	25.00	4.38	5.16	3.61
LP 13	15.49	16.18	14.22	25.90	28.70	23.90	4.01	4.64	3.40
LSD 5%		**1.35**			**1.80**			**0.75**	
2010/2011 season									
Carolla	16.60	17.70	15.30	28.50	30.00	25.20	4.73	5.31	3.86
Samba	16.20	16.50	15.10	26.70	29.10	25.00	4.33	4.80	3.78
Baraca	14.90	15.10	13.30	26.10	28.70	23.70	3.89	4.33	3.15
Del 937	13.50	14.90	12.40	25.80	28.10	22.70	3.48	4.19	2.81
LP 13	13.40	14.10	12.20	23.60	26.40	21.60	3.16	3.72	2.64
LSD 5%		**1.13**			**1.80**			**0.65**	

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أداء بعض أصناف بنجر السكر تحت مواعيد زراعة مختلفة

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أقيمت تجربتان حقليتان بمحطة بحوث سخا بمحافظة كفر الشيخ خلال موسمى الزراعة ٢٠١٠/٢٠٠٩ و ٢٠١١/٢٠١٠ لتقييم خمسة أصناف من بنجر السكر مستوردة من ألمانيا (كارولا وديل٩٣٧) وفرنسا (LP13) وهولندا (سامبا) والسويد (بركة) تحت ثلاثة مواعيد زراعة هى أول كل من سبتمبر وأكتوبر ونوفمبر. استخدم تصميم القطع المنشقة مرة واحدة حيث شغلت مواعيد الزراعة القطع الرئيسية ووزعت أصناف بنجر السكر عشوائيا فى القطع المنشقة. أوضحت النتائج وجود اختلافات معنوية بين مواعيد الزراعة فى جميع صفات الدراسة وكان أفضل ميعاد للزراعة هو الأول من أكتوبر حيث أعطى أعلى قيم لطول وقطر والوزن الطازج للجذر والنسبة المئوية للسكروز وحاصل الجذور والسكر/فدان. بينما تأخير الزراعة إلى الأول من نوفمبر أدى إلى زيادة الشوائب (الفا أمينو نيتروجين والبوتاسيوم والصوديوم%). تباينت الأصناف المختبرة فيما بينها معنويا فى كل الصفات المدروسة واظهر الصنف كارولا تفوقه على باقى الأصناف حيث اعطى أعلى قيم لطول وقطر ووزن الجذر الطازج كجم/نبات كما أعطى أعلى نسبة سكروز واقل نسبة شوائب (ألفا امينو نيتروجين وصوديوم وبوتاسيوم) كما أعطى أعلى حاصل سكر وجذور/فدان. اظهر التفاعل بين الأصناف ومواعيد الزراعة وجود اختلافات معنوية فى النسبة المئوية للسكروز وحاصل الجذر السكر/فدان فى الموسمين وان زراعة الصنف كارولا فى الأول من أكتوبر كان أفضل حيث أعطى أعلى القيم بالمقارنة للتوليفات الآخرى. يوصى هذا البحث بزراعة صنف بنجر السكر كارولا بسخا بمحافظة كفر الشيخ فى الأول من أكتوبر للحصول على أعلى حاصل جذور وسكر للفدان.