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SELECTING HIGH SUGAR YIELD AND STABLE GENOTYPES OF SUGAR BEET USING PHENOTYPIC AND GENOTYPIC STABILITY

A. S. Abd El Alaziz* A. A. El-Hosary, G.Y. Hamam**, A. Z. Abo kenez*, El-Saeed M. El-Gedwy** and A. A. A. El-Hosary****

* Sugar Crops Res. Inst., A. R. C. Giza

** Agron. Dep., Fac of Agric. Moshtohor, Benha Univ

ABSTRACT

Seven sugar beet cultivars (Three poly germ Sara / 2135, Dina / 2134 and Bts /302 and four mono germ genotypes i.e. Helios poly, Marathon, Ravel and Francesca) were evaluated in two successive seasons (2014/15 and 2015/16) in three different planting date using randomized complete block design with 3 replications for each of the six environments at Moshtohor Experiment research station, EL-Khalubiah. Data were recorded for root yield (ton)/ fad. and sugar yield (ton)/ fad. Estimation of phenotypic and genotypic stability parameters were made according to Eberhart and Russell (1966) and Tai (1971) methods. The obtained results may be summarized as follows:

Mean squares due to environments, genotypes and genotypes × environments interactions were highly significant for the tow studied traits. The genotype Heliospoly gave higher value of root yield, followed by Ravel and then Francesca, while the other genotypes gave the lowest mean root yields across environments. Also, the mention genotypes give high sugar productivity/ fad.

The wide range of the regression coefficient (bi) ranged were found for seven sugar beet genotypes indicating different response to environmental conditions. The genotypes of Bts/302, Marathon, Ravel and Francesca were classified as highly adapted to a wide range of planting date environments and two out of the previous stable genotypes represented in Ravel and Francesca, exhibited higher root yields, so, these ones considered preferred.

The genotype Francesca had mean values higher than grand mean, and their (bi) did not significantly differ from unity and (S2d) was insignificant and very low. This genotype exhibited more stability for all studied environments and considered the most desired genotypes. Meanwhile, Genotypes Bts/302 and Heliospoly had a degree of above average stability (α < 0) and (λ = 1) with probability 80%. These genotypes may be recommended to be released for commercial sugar production which they performed better under all environments.

Keywords**: *sugar beet, planting date, GxE, stability***

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is the second important sugar crop in Egypt after sugar cane. The importance of this crop comes from not only it's ability to grow in the Northen region and newly reclaimed lands, but also from giving high sugar recovery as well as its lower water requirement. The important of this crop is not only limited at being a supplement for a sugar production, but it's also extend to the use of it's products in producing untraditional animal feed.

Sowing date is considered one of the important factor directly affected on the yield, it's components and juice quality. Determining of sowing on great extent on the prevailing climatic conditions and ecological environments could be expectation the reliable expression for the effect of climatic conditions on growth and productivity.

Identification of a genotype with high –yield and leant seasonal fluctuation over a wide range of environments is important in any improvement program. Eberhart and Russel (1966) reported that an ideal cultivar is the one that has highest yield over abroad range of environments. They defined a stable cultivar as the one that has regression coefficient, bi equal to 1 and mean square deviation from regression sd equal to zero. Tai (1971) suggested portioning the genotype environment interaction effect of genotype into tow components α statistic that measures the liner response to environmental effects and ג statistic that measures the deviation from liner .On the other hand, stability may in fact , depends on holding certain morphological and physiological attributes steady and allowing others to very ,resulting in predictable G×E interaction quantitatively inherited and are greatly influenced by environment (Abou-Salama and El-Syiad (2000), Al-Jbawi (2000), Basha and Ouda (2000), Truberg and Huhn (2000), Vargas, et al. (2001) and Gobarfa (2001))

The present work was conducted to study performance of seven cultivars and estimate phenotypic and genotypic stability of mention cultivars across six environments.

MATERIALS AND METHODS

Two years' field experiments were conducted during the two successive season of 2014/2015 and 2015/ 2016 at Moshtohor (300 , 21- , 07 "North and 310 , 13 , 34 East) Experiment research station , EL-Khalubiah to evaluate seven sugar beet cultivars . Table (1), show the cultivar name and type of seeds.

Table 1. Name of cultivars and type of seeds.

NO.	Cultivars)	Type of seeds
1	Sara / 2135	Poly germ
2	Dina / 2134	Poly germ
3	Bts /302	Poly germ
4	Helios poly	Mono germ
5	Marathon	Mono germ
6	Ravel	Mono germ
7	Francesca	Mono germ

Seed of mentioned cultivars were sown in three different sowing dates in 3th September, 24th September and 15th October in the two seasons of 2014/2015 and 2015/ 2016 . The experimental design was a randomized complete block design with three replications for each of the six environments (three sowing dates by two years). Plot consisted of 6 rows, 3.5 m long, 65 cm wide. Recommended agronomic practices were followed.

At harvest, data recorded on mean plot basis for calculate root lenth, root diameter, root yield /fad. On the same times , ten plants chosen randomly as sample from each individual plot to send to sugar factory in Fayoum city to get sugar %. A regular analysis of variance of randomized complete block design of separate environments was carried out for each trait according to Snedecor and Cochran (1967). Combined analysis of the six environments carried out whenever homo geneity of variance was detected. The stability analysis computed according to Ebarhart and Russel (1966) and Tai (1971) to estimate the phenotypic and genotypic stability parameters for the previous traits. In the analysis of data, the genotypes and sowing dates were considered on fixed variable. While years were considered random variable. Monthly metrological data of each season were taken in Table (2). Chemical and mechanical analysis of the soil was carried out according to Piper (1955) and presented in Table (3).

Table (2): Monthly averages of temperature, relative humidity and total rain fall during 2014/2015 and 2015/2016 seasons. Kalubia (Moshtohor)

Months	Temperature C		R.H. (%)	Rain fall mm/month
	Min.	Max.		
Nov.2014	21.2	25.9	57.8	93.98
Dec.2014	14.9	19.3	56.2	4.82
Jan.2015	13.9	20.1	50.5	2.55
Feb.2015	15.5	22	56.2	2.03
Mar.2015	19.2	26	48.5	0
Apr.2015	21.8	27.8	46.1	0.76
May.2015	26.4	32.8	44.4	0
Nov.2015	20.6	23.9	71	0.76
Dec.2015	18	21.3	73.8	19.82
Jan.2016	16.1	18.6	89	0
Feb.2016	16.4	18.9	82.5	0
Mar.2016	17.7	20.7	78.7	6.35
Apr.2016	20.2	23.6	67.8	0.25
May.2016	23.4	27	70.8	5.08

Table 3. Chemical and mechanical properties of the experimental soil during the two growing seasons (2014/2015 and 2015/2016)

properties	Seasons	
	2014/2015	2015/2016
Chemical analysis		
E.C.	2.26	2.32
PH(1:2.5)	7.97	7.95
CaCo3%	2.96	2.9
O.M%	2.41	2.38
N%(total)	0.21	0.223
N(ppm) (available)	70.31	73.15
P% (total)	0.13	0.159
P(ppm)(available)	23.49	27.16
K%(total)	0.62	0.63
K(PPM) (available)	916.46	943.68
Soluble cations and anions(ppm)		
Mn^{++}	7.9	9.3
Fe^{++}	10.5	8.8
Zn^{++}	2.3	2.4
Ca^{++}	182.4	187.4
Mg^{++}	48.6	50.58
K^{+}	46.8	52.26
Na^{+}	201.94	204.24
CI^{-}	231.82	261.64
$Co3^{-}$	0	0
$H\ Co3^{-}$	357.46	378.2
$So4^{-}$	516.48	490.08
Particle size distribution (mechanical)		
Course sand%	7.26	6.59
Find sand%	26.91	27.64
Silt%	13.85	12.6
Clay%	51.98	53.17
Texture grade	Clay	Clay

RESULTS AND DISCUSSION

Analysis of Variance

The joint regression analysis of variance for root length, diameter, root yield and sugar yield for seven sugar beet genotypes across six environments is presented in Table 4. The mean squares of genotypes, environments main effect and genotype by environment. Interaction effect were highly significant for all studied traits, indicating that tested sugar beet genotypes considerably varied in their behaviors across different planting dates and years. Furthermore, highly significant mean squares of environment plus (genotype by environment) and its components (environment (linear), genotype by environment (linear) interaction and pooled deviation (non linear) from regression model), indicating that predictable (linear) and unpredictable (non-linear) components were shared in the genotype by environment interaction. Also, highly significant genotype by environment (linear) interaction, revealed that the presence of genetic differences among genotypes in their regression on environmental index, while highly significant pooled deviation means that the direction of all genotypes from linearity was highly significant. Similar results were reported by Truberg and Huhn (2000), Vargas, et al. (2001) , Gobarfa (2001), Arthirani et al. (2009), Aly (2012) and Entessar et al (2016) .

Highly significant genotype by environment interaction encourages sugar beet researcher to identify high sugar yield and stable genotypes under various environmental conditions as well as given chance prepared to determine the stability degree for each genotype by methods, of stability statistics.

Table 4. Stability analysis of root and sugar yield as well as degree of purity for seven sugar beet genotypes across six environments

SOV	Df	root length	root diameter	Root yield/ fad.	Sugar yield/ fad
Genotypes (G)	6	13.33**	0.93**	27.83**	0.74**
Environment+ G x E	35	11.58**	1.57**	40.41**	1.79**
Environment (E)	5	55.92**	7.57**	204.56**	10.44**
G x E	30	4.19**	0.57**	13.05**	0.34**
a) Env . (linear)	1	279.59**	37.84**	1022.80**	52.22**
b) G x Env. (linear)	6	2.68**	1.67**	15.28**	0.11**
c) Pooled deviations	28	3.92**	0.26**	10.70**	0.34**
Pooled error	72	0.08	0.001	0.04	0.001

** refers to significant at 1%

Selecting high sugar beet genotypes grown in three planting dates across two years using parametric stability statistics.

1.Root length

Results presented in Table (5) show that root length of sugar beet plant was significantly affected by the environments under study (three sowing dates in both seasons), sugar beet varieties as well as their interaction.

Results presented in Table (5) showed that root length was significantly affected by environments under study. The highest root length was detected at E1 and E3 and decreased significantly by delaying in sowing dates.

Results in Table (5) showed that root length of sugar beet roots was significantly affected by the studied varieties. The highest root length (42.2) was recorded by **Sara/2135** over the six environments followed by **Ravel** However, **Dina/2134** gave the lowest one. The effect of interaction between varieties and environments was significantly affected for this trait. The highest root length were detected by **Francesca and Marathon in early sowing date** at **the first sowing date followed by Sara/2135** within the environments E1 and E4 (The first and second sowing dates in the second season). On the other hand, **Dina/2134** on E3 gave the lowest values for root length. Table (6) showed that, root length regression coefficient (bi) for all genotypes were insignificant differed from unity. The No.4 (Heliospoly) gave mean value above the grand and their regression confident (bi) did not differ significantly from unity. Also, the minimum deviation squares (S^2di) were detected, revealing that this variety was more stable than other under environments studied for this trait on the other hang genetic stability showed all genotypes were unstable Fig 1.

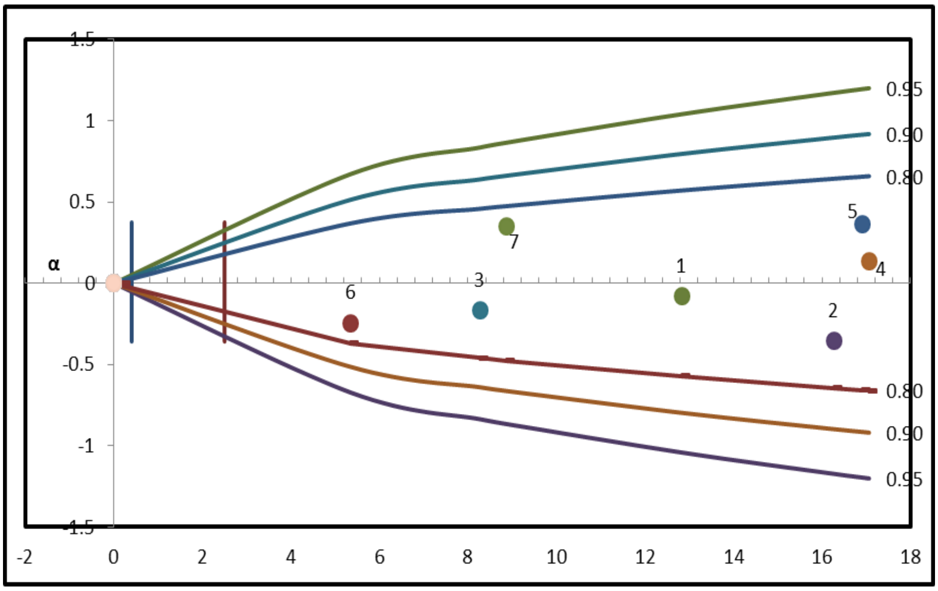
Table (5). Root length of Sugar Beet genotypes across six environments

Genotypes	E1 5/9/2014	E2 23/9/2014	E3 15/9/2014	E4 5/9/2015	E5 23/9/2015	E6 15/9/2015	X
Sara/2135	45.3	44.5	38.8	46.3	42.3	37.3	42.4
Dina/2134	40.0	38.7	31.3	36.3	39.7	38.3	37.4
Bts/302	39.2	44.2	34.7	39.0	37.7	37.0	38.6
Heliospoly	44.1	43.0	35.6	33.3	39.0	35.3	38.4
Marathon	46.5	41.6	35.8	36.3	32.7	36.3	38.2
Ravel	42.8	45.1	39.5	43.0	39.7	37.7	41.3
Francesca	47.6	43.5	36.6	43.3	36.3	38.0	40.9
X	43.6	42.9	36.0	39.7	38.2	37.1	39.6
CV							10.1

LSD=5%	E. 2.45	LSD=1%	E. 3.25
	G. 2.65		G. 3.51
	GxE 6.49		GxE .8.60

Table 6. Mean and parametric stability statistics for Root length in seven sugar beet genotypes averaged over six environments

genotypes	Mean	Bi	t=0	t=1	S^2d	α	λ
Sara/2135	40.917	1.1497	4.340*	0.565	2.727*	0.18581	0.4703664
Dina/2134	37.708	0.6696	1.439	-0.710	8.572**	-0.4102	1.4348886
Bts/302	38.278	0.9536	3.029*	-0.147	3.882**	-0.0576	0.6764055
Heliospoly	38.722	1.3768	8.459**	2.315	0.982	0.46779	0.1224631
Marathon	36.722	0.689	2.071	-0.935	4.343**	-0.3862	0.7163353
Ravel	40.433	0.9884	3.139*	-0.037	3.885**	-0.0144	0.6778468
Francesca	39.472	1.1731	4.608**	0.680	2.513*	0.21487	0.4306047



KEY: 1- Sara/2135, 2- Dina/2134, 3- Bts/302, 4- Heliospoly, 5- Marathon 6- Ravel, and 7- Francesca

Fig. 1. Distribution of Tai's stability statistics for Root length of seven sugar beet genotypes over six environments

2. Root diameter

Results presented in Table (7) show that root diameter of sugar beet plant was significantly affected by the environments under study (three sowing dates in both seasons), sugar beet varieties as well as their interaction.

Results presented in Table (7) showed that root diameter was significantly affected by environments under study. The highest root diameter was detected at E4 as well as E1 and rapidly significantly by delaying in sowing dates. Results in Table (7) showed that root diameter of sugar beet roots was significantly affected by the studied varieties. The highest root diameter (11.9) was recorded by Heliospoly over the six environments followed by Marathon However, Sara/2135gave the lowest one. The effect of interaction between varieties and environments was significantly affected for this trait. The highest root diameter were detected by Marathon in early sowing date at the second sowing date followed by Ravel within the same environment. On the other hand, Bts/302 on E2 and E3 gave the lowest values for root diameter.

Table (7). Root diameter of Sugar Beet genotypes across six environments

Genotypes	E1 5/9/2014	E2 23/9/2014	E3 15/9/2014	E4 5/9/2015	E5 23/9/2015	E6 15/9/2015	X
Sara/2135	10.6	11.5	10.2	11.1	10.9	11.0	10.9
Dina/2134	11.4	10.3	9.3	12.4	11.0	10.6	10.8
Bts/302	11.7	10.1	10.0	12.9	10.9	10.8	11.1
Heliospoly	12.6	11.8	10.3	12.9	12.6	11.0	11.9
Marathon	11.1	10.8	10.4	15.6	11.5	10.7	11.7
Ravel	10.7	10.2	9.8	14.6	10.9	11.2	11.2
Francesca	10.8	10.9	10.6	12.7	11.4	10.8	11.2
X	11.3	10.8	10.1	13.2	11.3	10.9	11.2
CV							8.2

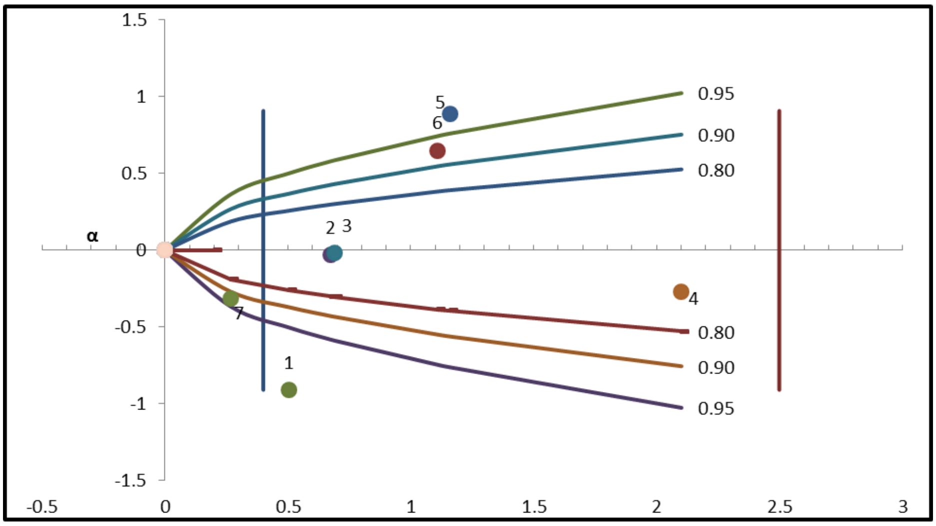
LSD=5%	E. 0.57	LSD=1%	E.0.75
	G. 0.61		G. 0.81
	GxE. 1.50		GxE . 1.99

Table 8. Mean and parametric stability statistics for Root diameter in seven sugar beet genotypes averaged over six environments

genotypes	Mean	bi	t=0	t=1	S²d	α	λ
Sara/2135	10.864	0.1676	0.854	-4.240	0.205	-0.9086	0.5057875
Dina/2134	10.828	0.9724	5.596**	-0.159	0.160	-0.0301	0.6730114
Bts/302	11.058	0.9856	5.597**	-0.082	0.164	-0.0157	0.6915917
Heliospoly	11.869	0.7559	2.445	-0.790	0.513	-0.2664	2.1009428
Marathon	11.667	1.8132	6.999**	3.139*	0.360	0.88767	1.1590096
Ravel	11.236	1.5954	6.630**	2.474	0.310	0.64996	1.1104991
Francesca	11.175	0.7099	6.004**	-2.454	0.072	-0.3167	0.2687511

According to the parameters of Eberhart and Russell model (1966) a genotype which had a unit regression coefficient (b_i =1) and non significant deviation from regression is considered (S^2d_i) as stable. From the results in Table 8, the wide range of the regression coefficient (bi) ranged from 0.167 (**Sara/2135**) to 1.813 (**Marathon**) for root diameter, indicating that the seven sugar beet genotypes had different response to environmental conditions. The four studied genotypes had regression slopes for root diameter that did not differ from 1.0, indicating good potentials of these genotypes for root diameter response under a wide range of environmental conditions. Based on the results of the regression analysis, the genotypes of Bts/302 and Francesca were classified as highly adapted to a wide range of planting date environments because the regression coefficients of these ones did not differ significantly from 1.00. However, the values of deviation from regression (S^2d_i) significantly differed from zero for all evaluated sugar beet genotypes, therefore these ones were unstable with high values relative to grand mean.

With regard to genotypic stability as outlined by Tai (1971), the estimates of α and λ displayed in Table 8 and Fig. 2. The genotypes **Dina/2134 and Bts/302** were spotted in the average stability area at probability levels of 0.20, 0.10 and 0.05 as well as the mention genotypes was very close to be stable where it touched at place of the middle confidence limit of λ. Whereas, **Heliospoly** was above stable. on the other , the other genotypes seemed to be unstable.



KEY: 1- Sara/2135, 2- Dina/2134, 3- Bts/302, 4- Heliospoly, 5- Marathon 6- Ravel, and 7- Francesca

Fig. 2. Distribution of Tai's stability statistics for Root diameter of seven sugar beet genotypes over six environments

3-Root yield (ton/ fad.)

With respect to environment, root yield of environments over genotypes ranged from **25.2** ton/fad., for E_3 to **39.8** kg/fad., for E_1 as shown in Table 3. The results illustrated that there were decrease in root yield/ fad. with delay in planting date in the two years.

The results of stability parameters based on parametric statistics and mean root yield (ton/fad.) are presented in Table 9. Considering the root yield over environments as the first parameter for evaluating the sugar beet genotypes, **Heliospoly** gave higher value of root yield **38.45** (ton/ faddan), **Ravel** ranked the second (**36.68**) followed by **Francesca** (**36.44**) than grand mean of tested genotypes, while the other ones gave the lowest mean root yields across environments.

According to the parameters of Eberhart and Russell model (1966) a genotype which had a unit regression coefficient (b_i =1) and non significant deviation from regression is considered (S^2d_i) as stable. From the results in Table 10, the wide range of the regression coefficient (bi) ranged from 0.50 (**Heliospoly**) to 1.49 (**Dina/2134**) for root yield, indicating that the seven sugar beet genotypes had different response to environmental conditions. The four studied genotypes had regression slopes for root yield that did not differ from 1.0, indicating good potentials of these genotypes for root yield response under a wide range of environmental conditions. Based on the results of the regression analysis, the genotypes of **Bts/302**, **Marathon**, **Ravel** and **Francesca** were classified as highly adapted to a wide range of planting date environments because the regression coefficients of these ones did not differ significantly from 1.00. However, the values of deviation from regression (S^2d_i) significantly differed from zero for all evaluated sugar beet genotypes, therefore these ones were unstable. It is fair to note that two out of the previous stable genotypes represented in **Ravel** and **Francesca**, exhibited higher root yields, so, these ones considered preferred.

With regard to genotypic stability as outlined by Tai (1971), the estimates of α and λ displayed in Table 10 and Fig. 3. The genotypes **Ravel** and **Francesca** were spotted in the average stability area at probability levels of 0.20, 0.10 and 0.05 as well as the mention genotypes was very close to be stable where it touched at place of the middle confidence limit of λ. Whereas, the rest of genotypes revealed unpredictable component of G x E interaction greater than predictable part, where their λ values were greater than unity, so, these genotypes were considered unstable.

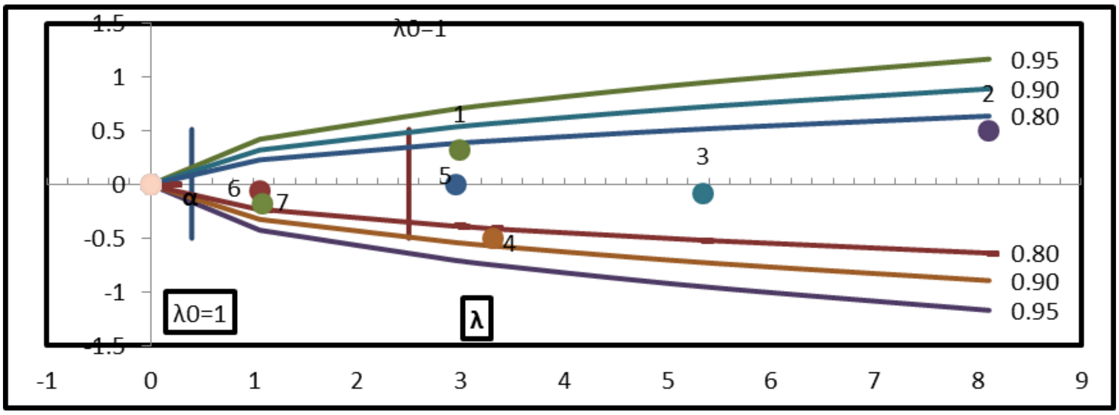
Table (9). Product /fed of sugar beet genotypes across six environments

Genotypes	E1 5/9/2014	E2 23/9/2014	E3 15/9/2014	E4 5/9/2015	E5 23/9/2015	E6 15/9/2015	Mean
Sara/2135	**42.0**	**30.1**	**23.1**	**41.0**	**37.5**	**28.5**	**33.70**
Dina/2134	**40.5**	**33.2**	**21.8**	**38.5**	**38.0**	**19.0**	**31.85**
Bts/302	**36.3**	**34.9**	**24.2**	**35.5**	**43.0**	**37.0**	**35.14**
Heliospoly	**37.7**	**43.7**	**32.6**	**41.3**	**39.5**	**36.0**	**38.45**
Marathon	**39.7**	**35.8**	**22.9**	**36.0**	**38.0**	**37.0**	**34.89**
Ravel	**42.5**	**37.2**	**26.9**	**40.0**	**37.5**	**36.0**	**36.68**
Francesca	**43.3**	**35.4**	**29.4**	**37.5**	**39.0**	**34.0**	**36.44**
Mean	**39.8**	**35.8**	**25.2**	**38.7**	**38.9**	**32.3**	**35.12**
CV							**8.3**

LSD=5%	E. 1.80	LSD=1%	E. 2.38
	G. 1.94		G. 2.57
	GxE . 4.76		GxE . 6.31

Table 10. Mean and parametric stability statistics for root yield/fad. (ton) in seven sugar beet genotypes averaged over six environments

Genotypes	MEAN	b i	Tb=0	Tb=1	S^2 di	A	Λ
Sara/2135	33.69861	1.316303	5.291**	1.271	9.006**	0.321376	2.994714
Dina/2134	31.84611	1.493859	3.650*	1.207	24.434**	0.501779	8.108215
Bts/302	35.14111	0.918099	2.770	-0.247	16.012**	-0.08321	5.347877
Heliospoly	38.45278	0.508285	1.936	-1.872	10.038**	-0.4996	3.310969
Marathon	34.8945	1.001307	4.068*	0.005	8.813**	0.001328	2.94999
Ravel	36.68417	0.939483	6.387**	-0.411	3.123*	-0.06149	1.053013
Francesca	36.43778	0.822665	5.499**	-1.185	3.231*	-0.18018	1.083579



KEY: 1- Sara/2135, 2- Dina/2134, 3- Bts/302, 4- Heliospoly, 5- Marathon 6- Ravel, and 7- Francesca

Fig. 3. Distribution of Tai's stability statistics for root yield (ton/fad.) of seven sugar beet genotypes over six environments

2. Sugar productivity (ton/ fad.)

With respect to environment, sugar yield of environments over genotypes (Table 11), its clear that, lateness in planting date in the first season 2014/ 2015 were associated with decrease in in sugar yield / fad. while, in the second season the planting date 23/ 9 / 2015 was recorded the highest sugar prod/ fad. followed by the late planting date. On the other side, the genotypes sugar product/ fad. ranged from 4.7 ton/ fad for Dina/2134 to 5.7 ton sugar/ fad. for Ravel.

The results in Table (12) indicated that, all genotypes were not differ from unity for regression coefficient (b_i = 1), which means that those lines can be classified as stable genotypes. While, the second stability parameter

(S^2d) was insignificant for all genotypes indicating that these lines were stable.

The genotype Francesca had mean values higher than grand mean, and their (b_i) did not significantly differ from unity and (S^2d) was insignificant and very low. These genotypes exhibited more stability for all studied environments and considered the most desired genotypes.

Table (12) and fig (1) showed that, genotype **Dina/2134** was unstable according to Tai (1971) because the value of $\lambda \neq 1$. Line number 9 showed average stability whereas, ($\alpha = 0$) and ($\lambda = 1$). Genotypes **Bts/302** and **Heliospoly** had a degree of above average stability ($\alpha < 0$) and ($\lambda = 1$) with probability 80% . These genotypes may be recommended to be released for commercial sugar production which they performed better under all environments. While the other genotypes have below average stability ($\alpha > 0$) and ($\lambda = 1$) with probability 80%

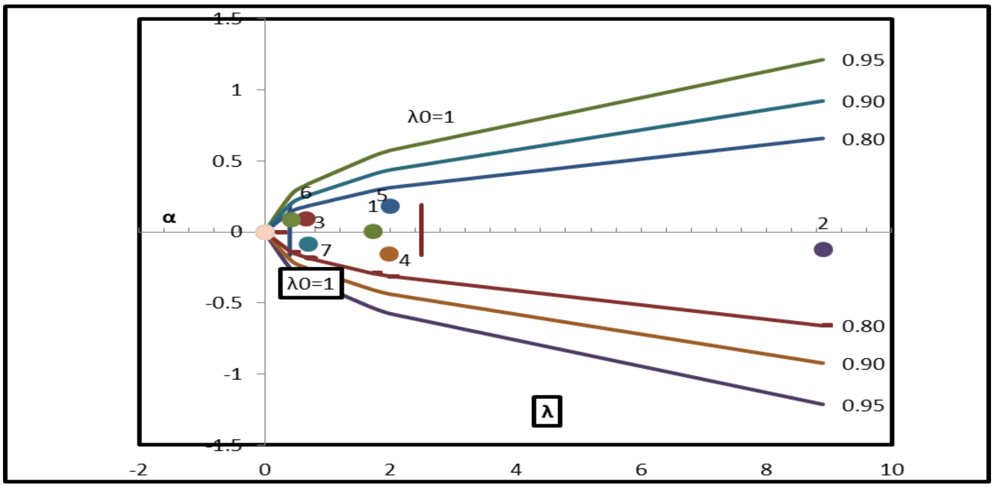
Table (11):**sugar product / fed of Sugar Beet genotypes across six environments**

Genotypes	E1 5/9/2014	E2 23/9/2014	E3 15/9/2014	E4 5/9/2015	E5 23/9/2015	E6 15/9/2015	X
Sara/2135	6.7	4.9	2.8	5.2	5.6	5.5	5.1
Dina/2134	6.7	4.7	2.7	5.5	5.5	3.4	4.7
Bts/302	5.8	5.4	3.0	4.6	5.9	5.9	5.1
Heliospoly	6.1	6.9	3.7	4.9	6.2	5.9	5.6
Marathon	6.5	6.3	2.8	4.4	5.8	6.6	5.4
Ravel	6.8	6.4	3.3	4.7	6.5	6.2	5.7
Francesca	7.0	5.9	3.3	4.8	6.5	6.2	5.6
X	6.5	5.8	3.1	4.9	6.0	5.7	5.3
CV							12.6

LSD=5%	E. 0.41	LSD=1%	E. 0.55
	G. 0.45		G. 0.59
	GxE . 1.09		GxE . 1.45

Table 12. Mean and parametric stability statistics for sugar yield/fad. (ton) in seven sugar beet genotypes averaged over six environments

genotypes	mean	b i	Tb=0	Tb=1	S^2 di	α	ג
Sara/2135	5.10	1.00	5.442**	0.009	0.251	0.00	1.73
Dina/2134	4.75	0.88	2.111	-0.282	1.301	-0.12	8.90
Bts/302	5.10	0.91	7.848**	-0.737	0.099	-0.09	0.69
Heliospoly	5.63	0.85	4.279*	-0.772	0.291	-0.16	1.99
Marathon	5.41	1.18	5.948**	0.906	0.292	0.18	2.00
Ravel	5.66	1.09	9.606**	0.810	0.095	0.09	0.66
Francesca	5.62	1.08	11.832**	0.910	0.061	0.09	0.43



KEY: 1- Sara/2135, 2- Dina/2134, 3- Bts/302, 4- Heliospoly, 5- Marathon 6- Ravel, and 7- Francesca

Fig. 4. Distribution of Tai's stability statistics for sugar yield (ton/fad.) of seven sugar beet genotypes over six environments

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الإنتخاب لتراكيب وراثية من بنجر السكر مرتفعة في محصول السكر باستخدام الثبات المظهرى و الوراثى

احمد صدقى عبد العزيز*، على عبد المقصود الحصرى، جابر يحيى همام**، احمد ذكى احمد ابو كنيز*، السعيد محمد الجدوى** و احمد على الحصرى****

1- *معهدبحوث المحاصيل السكرية- مركز البحوث الزراعية- الجيزه

2- ** قسم المحاصيل – كلية الزراعة – جامعة بنها

تم تقييم سبعة تراكيب وراثية من بنجر السكر (ثلاثة اصناف عديدة الاجنه و هم Dina / 2134, Sara / 2135 و Bts /302) (و اربعة اصناف وحيدة الجنين و هىHelios poly , Marathon، Ravelو Francesca) وذلك خلال موسمين متتاليين (2014/2015 - 2015/2016) فى ثلاثة مواعيد زراعية بكل موسم و استخدم لكل بيئة تصميم قطاعات كاملة العشوائية بثلاثة مكررات بمحطة البحوث الزراعية بمشتهر – كلية الزراعة – جامعة بنها تم تسجيل بيانات انتاجية الجذور و انتاجية السكر بالطن/فدان . تهدف الدراسة الى دراسة التفاعل بين التراكيب الوراثية والبيئة وتقدير قيم الثبات المظهرى والوراثى وفقاً لطريقة (1966) Eberhart and Russell وطريقة(1971)tai وكانت اهم النتائج المتحصل عليها ما يلى:

- **كان التباين الراجع الى البيئات والتراكيب الوراثية والتفاعل بينهما معنوياً فى الصفتين تحت الدراسة. و اعطى الصنف Heliospoly اعلى انتاجية لصفة محصول الجذور /فدان و تبعه الصنف Ravel ثم الصنف Francesca بينما الاصناف الاخرى اعطت قيم منخفضة عن المتوسط العام عبر البيئات المختلفة. و ايضا تلك الاصناف اعطت اعلى انتاجية لمحصول السكر / فدان.**
- **وجد مدى واسع من معامل الانحدار الخاص بالاصناف السبعه من بنجر السكر و هذا يدل على اختلاف استجابة التراكيب الوراثية للبيئات المختلفة. تم تصنيف الاصنافBts/302 , Marathon،Ravel و Francesca على انها اكثر الاصناف ثباتا باختلاف مواعيد الزراعة. و أظهر الصنفين Ravel و Francesca اكثر الاصناف ثبات و اكثرهم فى محصول الفدان من الجذور و السكر ولذلك ينصح باستخدام الصنفين فى المواعيد الزراعية المختلفة.**
- **اظهر التركيب الوراثى Francesca اعلى متوسط بالمقارنه بالمتوسط العام لكلا الصفتين المدروستين و كان معامل الانحدار لا يختلف معنويا عن الوحده و قيمة (S2d) صغيرة جدا و غير معنوية و لهذا السبب يكون ذلك الصنف اكثر الاصناف ثباتا. بينما كان الصنفين Bts/302، Heliospoly على درجة من الثبات فوق المتوسط (α <0) و (λ = 1) مع احتمال 80٪. و يوصى بإصدار هذه الأنماط الجينية لإنتاج السكر التجاري الذي يؤدي أداء أفضل في جميع البيئات.**

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قام بتحكيم البحث

ا.د/ محمد سعد عبد العاطى كلية الزراعة – جامعة كفر الشيخ

ا.د/ محمود الهيتى كلية الزراعة – جامعة كفر الشيخ