Genetic Variability for Quantitative Characters among Commercial Varieties of Sugar Beet (Beta vulgaris L.)

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ABSTRACT

Twenty six sugar beet (Beta vulgaris L.) varieties introduced from different countries were used in this investigation during three successive seasons of (2002- 2003 and 2004), at three different locations (Nubaria- Kafr El Sheik and Fayum) .

The main objectives of this study were to determine variance components for the important characters as root and sugar yields. Root yield, in particular, is a complex character dependent on many simpler components of varieties x environment interaction which were apparent in the rankings of the cultivars in the nine environments examined. Two varieties namely, H. poly and kawemena poly, were the highest yielding, 41.9 and 40.22 ton /fed, respectively for root yield. Sugar yield is the most important characters for the present study. Cultivar H. poly was the highest and Mezano poly was the lowest during three seasons at three locations where averages of sugar yield were 6.68 and 2.65 ton/fed respectively.

The present investigation was carried out to study the relationship between various morphological and economic traits in sugar beet. Data were recorded on characters associations in sugar beet as root length, root width, top weight, crown size, root number, root yield /plot, root weight and total soluble solids percentage.

The object was also subjected to study some biometrical parameters as the range, genotypic and phenotypic variance, genotypic and phenotypic coefficient of variability, heritability percentage and genetic advance percent of mean for the important characters of sugar yield component. The genetic variance calculated for the different characters was essential in determining the phenotypic variance, which ranged from 0.325 for root weight to 732.61 for yield /plot. The variance due to the interaction of genotype x environment was secondary to genetic variance, while the variance due to error was the smallest part of the phenotypic variance.

Coefficient of variability percentage estimates was the lowest for total soluble solids and the highest for root weight.

Heritability in broad sense estimates ranged from 22% for root yield to 96% for total soluble solids.

Genetic advance percent was high for sugar yield ton/fed (71%), root weight /kg (46.5%) and yield /plot/kg (38.26%) while it was lowest for top weight (10.4%) and total soluble solids (13.13%).

INTRODUCTION

The knowledge of genotype x environment interactions in sugar beet, facilitates efficient selection of better genotypes. In Egypt, sugar beet cultivation is completely depends on seed importation from different countries. The imported sugar beet varieties for the commercial production have been bred under conditions differ from those of Egypt.

Therefore the importance of these interaction and their implications often are difficult to measure on a routine basis. Comstock and Moll (1963) defined the genotype by environment interaction as the differential response of phenotypes to the change in environments. They classified the environment in two categories: macro and micro environmental variation. Macro environmental variation is caused by the fluctuation in variables which have large and easily recognized variation (i.e., years locations, planting dates and plant density), whereas micro environmental variation arises from plant to plant and variety to variety variations within macro environments. From this point of view, the idea was developed for the present investigation to study the variation of some sugar beet varieties imported from diverse climates, soils and production practices with specific recommendation. Variance components have been used to estimate the most efficient allocation of locations, years, and replications necessary to calculate the experimental error and to achieve desired goals. Various multivariate statistical methods also have been employed to provide insight into cultivar responses and location effects. The improvement program should be based on the estimation and nature of genetic variances. The development of the concept of analysis of variance and components of variance help in study of critical difference, coefficient of variation as genotypic, phenotypic coefficient of variation, and heritability in broad sense. Therefore it is well known that the variability observed in character are primary due to the genes carried by the different individuals in relation to different in the environments to which individuals have been exposed. It will be useful to know the relative importance of both heredity and environment in determining the expression of characters.

Heritability therefore represents the proportion of the total variability of a character that due to hereditary factors, and the remainder due to environmental causes. In this respect Behl *et. al.* (1978) mentioned that the genetic variability and heritability was high for root weight and root length, while they were low for sucrose content in their study on fifteen varieties of sugar beet. Bychenko and Galetskaya (1984) estimated broad and narrow sense heritability for nine characters of sugar beet in tetraploid parental varieties and their hybrids and mentioned that analysis of heritability indicated that sugar content are controlled mainly by genes with additive effect , while other characters studied are determined by non additive gene effect . El Manhaly and Younn (1986) found that root diameter, root length and root weight were higher in diploid than in tetraploid parents. Kovachev (1986) studied F_1's sugar beet obtained from 12 monogerm male sterile with 7 multigerm and found that the greatest effect on phenotypic variation for root weight was shown by environment and that additive genes played the main part in controlling root yield.Ghura (1989) reported that sugar beet varieties under study significantly differed in root yield, T.S.S.%,root number and leaf weight. Smith *et. al.*(1990) estimated a narrow sense heritability in sugar beet they found that non additive genes play an important role in the inheritance of root weight and sugar content. El-Deeb and Younan(1991)found that variance due to genetic variability was significant for sugar yield. Additive gene action was predominant in sugar yield. El-Talkhawy(1992)found significant differences among eight sugar beet genotypes in root yield. Abo El-Ghaut (1993) found that varieties differed significantly in root length , root diameter , T. S. S.%, sucrose %, top root and sugar yields of sugar beet. Ghura (1995) found that the evaluation of eight genotypes showed significant differences among the genotypes in all vegetative traits. Ghura *et al.* (1997) studied the effects of environmental and genetic variations on phenotypic variation of some important characters of sugar beet as leaf number , leaf weight, root length , root diameter , root weight and total soluble solids percent(T.S.S.%)in order to estimate the heritability of each character in broad and narrow sense , in five different croses of sugar beet. High values of narrow sense heritability was calculated for T.S.S. % and root diameter, which were suggested to be controlled by additive gene effects, while moderate narrow sense heritability were estimated for each of the other four characters which were influenced by the effect of non additive genes.El-Sheikh(1999),examined some Egyptian germplasm as compared to the imported varieties. His results showed that the studied genotypes of sugar beet differed significantly in root length, root diameter,root fresh weight, sucrose % and Total soluble solids %. Abd El Fatah (2000) found that some varieties differed significantly in individual root weight, root yield and recoverable sugar yield. . El Geddawy *et. al.* (2001) pointed out that sugar beet variety lola attained the superiority over the other three studied varieties with respect to T.S.S.%, root and sugar yields , however, this effect was insignificant with respect to sucrose %. Ghura (2001) recorded that the analysis of variance for the six multigerm sugar beet lines and the fifteen crosses were highly significant differences for root length , root diameter, root weight, total soluble solids percentage and leaf weight. Al Labbody (2003) examined ten multigerm varieties. The sugar beet varieties significantly varied in top fresh weight, top dry weight /plant, sucrose percentage, sugar and top yields. However, no significant differences were recorded among varieties in total soluble solids percentage. El Sheikh(2003) evaluated six sugar beet genotypes developed in Egypt and six commercial imported sugar beet varieties were included for the comparison. The obtained results summarised as, no significant difference between the imported varieties and the Egyptian genotypes in top yield , root ring number/plant, total soluble solids percentage, sucrose percentage and purity percentage. A significant variation among the tested sugar beet local and imported genotypes was recorded in number of leaves/plant, leaves weight (g/plant), root length (cm), root diameter (cm) , root weight (g/plant), root yield (ton/fed) and sugar yield (ton/fed). Shalaby. (2003) tested six genotypes, the results showed that Demapoly variety surpassed over all in root yield. Significant difference were found among the genotypes under this study.

The objectives of this work were to determine for the best varieties within the investigated varieties which could be the most available for the commercial cultivation. Also to calculate genetic and environmental variance components for some important characters of sugar beet, to determine the relative importance of genetic and environmental variance in influencing the phenotypic variance, and to estimate broad sense heritability and genetic advance percentage for some important characters of a plant crop in the studied sugar beet varieties.

MATERIALS AND METHODS

Twenty six sugar beet (Beta vulgaris L.) varieties of diverse origin were selected from sugar beet germplasm obtained from different countries. These varieties were received from the Sugar Crops Research Institute, Agriculture Research Center. All cultivars were replicated four times over three years at three locations. The seeds were sown in the last week of October, of 2001, 2002 and 2003 El- Nubaria, Kafr El-Sheikh and El-Fayum in a randomized complete block design. The plot size consisted of 7 rows of 6 meter length with inter row and intra row spacing of 50 and 20cm, respectively. All agricultural practices for sugar beet production were applied. At harvesting time in the first week of May for each season the data was recorded for the important three characters, root yield, sucrose percentage and sugar yield. Then after the data was transformed to ton/fed to illustrate the importance of present study. Pooled analysis was done for those three characters. Sugar yield was calculated by multiplying root yield with sucrose %. Sucrose % was determined by Sacharemeter. During harvesting time ten plants were randomly selected from each variety in each replication at each location. Phenotypic measurements of individual plants were recorded as root length, root width, top weight, crown size, root number , yield/plot, root weight and total soluble solids. Total soluble solids percent was determined by Refractometer. The data was averàged from all varieties to study some quantitative genetic parameters such as range, genotypic and phenotypic variance, genotypic and phenotypic coefficient of variability, heritability percentage and genetic advance in percent of mean. Analysis of variance components was performed for each character. Variance components were calculated by equating appropriate mean squares to their expectation , according to Singh and Chaudhary (1985). Where the mean sum of squares between varieties will consist of the genotypic difference and environmental variation among individuals of each genotype thus the expected mean sum of squares would be as follows:

$E(MS_{(v)}) = \sigma^2 e + r\,\sigma^2 g$

$E(MS_{(e)}) = \sigma^2 e$

$\sigma^2 g$ is the genetic variance and was calculated from formula

$\sigma^2 g\ (MS_{(v)} - Ms_{(e)}) / r$

Where:	$Ms_{(v)}$	= the mean square of the varieties.
	Ms(e)	= variance due to the error.
	r	= number of replicates.
	σ^2 ph	= the phenotypic variance = $\sigma^2 g + \sigma^2 e$

The components σ^2ph, σ^2g and σ^2e are used for estimation of other statistics such as:

1) Phenotypic coefficient of variation (P.C.V.) = $\frac{\sqrt{\sigma^2 ph}}{\bar{x}}$ X 100

2) Genotypic coefficient of variation (G. C. V.) = $\frac{\sqrt{\sigma^2 g}}{\bar{x}}$ X 100

3) Heritability (broad sense) : h2 = σ^2 g/σ^2 ph

4) Expected genetic improvement = Δ g

Δ g = k x σ ph x h^2 Where:

K = selection deferential (2.06) at selec. Intensity 0.05.

σ ph = standard deviation of the character under study.

h^2 = heritability in broad sense for the studied character .

Expected genetic improvement (%) = $\frac{\Delta g}{\bar{x}}$ X 100.

The treatment means were compared by using the least significant differences (L.S.D.) test (waller and Duncan 1969).

RESULTS AND DISCUSSION

Root yield and sugar content are the two main components of sugar yield in the production of commercial value of sugar beet. (Smith and Hecker, 1973). As shown in Table (1) the analysis of pertinent variance components for root yield ton/fed, sucrose % and sugar yield ton/fed of twenty six sugar beet cultivars produced at three locations for three seasons. Variety mean square were highly significant difference for all traits under study while, variety x years were no significant, significant and highly significant for root yield, sucrose % and sugar yield respectively. Variety x location mean squares were significant for root yield and highly significant for sucrose percent and sugar yield. Second order interaction (variety x year x location) were highly significant for all traits examined. Mean values of different characters for twenty six sugar beet varieties for three season at three locations are presented in Table (2). Variety x environment interactions were apparent in the rankings of the varieties in the nine environments examined. Two of the twenty six varieties were the highest yielding, 41.9 ton/fed and 40.22 ton/fed for H. poly and Kawemena poly, respectively for root yield. Five varieties ranged from 36.71 to 30.07 ton/fed. Two low yielding cultivars give 19.89 and 18.18 ton/fed for cultivars, Lola and Mareno Magna Poly. Sugar yield ton/fed is the important character for this study, cultivar H. poly was the highest and Mezanopoly was the lowest for three seasons at three locations, mean yields ranged from 6.68--2.65 ton/fed.

These results were confirmed by El Manhaly and Yonan (1986), Abd ElFatah (2000) Ghura (1995), El Labbody (2003) and El Sheikh (2003). They found significant difference among the genotypes under their studies. This results in agreement with that recorded by El-Geddawy *et. al.* (2001), he pointed out that sugar beet variety Lola attained the superiority to root yield and sugar yields.

Analysis of variance of root length , root width , top weight , crown size , root number , root yield , root weight and total soluble solids percent for the average to three years , three location and twenty six commercial sugar beet varieties are presented in table (3). In general , mean of squares for all traits examined were highly significant. Mean values of different characters for twenty six varieties are presented in table (4). Study of some major factors affecting for quantitative characters among the eight characters under study recorded high values for different varieties such as Desprez poly N, Chems , Montblenca, H.poly and Maribo prema poly. The variability in economic characters of any crop is consider the basic of improvement quantity and quality of the crop through selection programmes.

These results were confirmed by El-Manhaly and Younan (1986), Ghura (1997) , Ghura (2001), El labbody (2003) and El – Sheikh (2003). They found significant differences among the genotypes under their studies.

In the present research work the obtained results among the eleven characters under study as shown in table (5). Top weight, yield /plot and root weight recorded high values for coefficient of variability. It was therefore, expected that selection would be more effective for these three characters as compared with other characters namely, root length, root width, crown size, root number and total soluble solids percent whish possessed low genetic variability.

In the present investigation heritability in broad sense, was the highest for total soluble solids % and root weight/kg its values were 96% and 94% respectively, and the values were recorded for lowest for root yield 22%. Genetic advance (in percent of mean) was high for sugar yield ton/fed (71), root weight (46.50) and yield/plot (38.26) while it was the lowest for root yield ton/fed (9.03) and top weight /gm) (10.4). Root weight, yield/plot and root length show high heritability values accompanied with high genetic advance Panse (1957) pointer out that a high heritability accompanied with high genetic advance is due to additive gene action. However, high heritability but low genetic advance for a character is due to non-additive gene action which includes dominance and epistasis (Liang and Walters, 1968). Total soluble solids percent in the present case in thus governed by non-additive gene action. One of the practical implications form this study is that theses results indicate that selection on roots weight , yield/plot and root length will be more effective than selection on the basic of other characters.

It could be concluded from studying the genetic variability among quantitative and qualitative characters in twenty six genotypes of sugar beet are needed to be done in addition to recurrent selection among the commercial varieties especially for two characters (root yield and sugar yield). The importance of those two characters, root yield and sugar yield must be considered to select the best variety for commercial cultivation.

In general, varieties which perform well in different environments and show little genotype environment interactions are considered more stable for a long time as a commercial cultivation. The mean performance of a number of genotypes in replicated traits over years and location appears to be the best method for measuring reliable differences among genotypes (Allard and Bradshaw, 1964).

Table 1. Pertinent variance component for root yield, sucrose % and sugar yield of twenty-six sugar beet varieties at three locations for three years.

Source of variation	df	Mean of squares		
		Root yield (ton/fed)	Sucrose(%)	Sugar yield (ton/fed)
Variety	25	59.03^{**}	16.69^{**}	17.68^{**}
Variety x year	50	$18.76^{N.s.}$	2.51^{*}	28.912^{**}
Variety x location	50	39.89^{*}	3.78^{**}	17.89^{**}
Variety x year x location	100	58.964^{**}	3.41^{**}	14.97^{**}
Pooled error	675	28.11	1.73	2.03

df : degrees of freedom.

N.s. : Not significant at 0.05 level of probability.

*, ** : Significant at 0.05 and 0.01 levels of probability.

Table 2. Mean values of different characters for twenty six sugar beet varieties for three seasons (2002-2003-2004) at three locations (Nubaria – Kafr El Sheikh – Fayum) .

	Varieties \ Characters	Root yield (ton /fed)	Sucrose (%)	Gross sugar (ton/fed)
1	H. poly	41.9	15.93	6.68
2	Oscar poly	29.07	15.20	4.42
3	Kawemira	26.42	15.16	4.01
4	Ras poly	30.07	15.30	4.60
5	Gloria	23.13	14.75	3.41
6	Top	42.83	14.90	6.29
7	Pleno	26.650	19.05	5.08
8	Beta poly	27.43	12.31	3.38
9	Farida	23.23	15.90	3.70
10	Panther	27.73	15.93	4.42
11	Nejma	23.89	15.28	3.65
12	Toro	29.87	13.01	3.89
13	Gazella	31.20	11.31	3.53
14	Montblenca	24.38	13.18	3.21
15	Desprez poly n	27.33	16.58	4.53
16	Baraca	31.60	17.89	5.65
17	Lola	19.89	16.81	3.34
18	Chems	36.71	16.56	6.08
19	Dimken strop poly	29.76	15.06	4.48
20	Mezano poly	22.25	11.91	2.65
21	Kawe inter poly	27.33	11.13	3.04
22	Kawemena poly	40.22	13.73	5.52
23	Maribo prema poly	19.19	18.78	3.60
24	Mezano poly 1	28.27	16.71	4.72
25	Mareno magna poly	18.18	15.71	2.86
26	Maribo maroco poly	33.38	16.71	5.58
	Mean	28.56	15.18	4.33
L. S. D.	0.05	7.35	1.82	1.97
	0.01	9.66	2.40	2.6

Table 3. Analysis of variance of root length, root width, top weight, crown size, root number, root yield /plot, root weight and total soluble for the percent for the average to three years , three locations and twenty six commercial sugar beet varieties.

Source of variation	df	Mean of squares							
		Root length (cm)	Root width (cm)	Top weight (gm)	Crown size (cm)	Root number/plot	Yield /plot (kg)	Root weight (gm)	Total soluble solids (%)
Replication	3	2.72	1.228	0.289	1.74	22.13	44.61	0.04	1.221
Varieties	25	34.97**	31.09**	0.506**	2.758**	972.5**	2537.35**	1.249**	9.18**
Error	75	0.998	1.09	0.015	0.514	126.5	131.03	0.017	0.1

d f : Degrees of freedom .

** : Significant at 0.01 level of probability.

Table 4. Mean values of different characters for twenty six sugar beet varieties for three seasons (2002 – 2003- 2004) at three locations (Nubaria – Kafr El Sheikh – Fayum)

	Varieties \ Characters	Root length (cm)	Root width (cm)	Top weight (gm)	Crown size (cm)	Root number/ plot	Yield/plot (kg)	Root weight (gm)	Total soluble solids (%)
1-	H. poly	30.8	39.91	0.250	6.90	110	105	0.950	22.7
2-	Oscar poly	27.3	32.55	0.332	5.7	120	117	0.975	22.0
3-	Kawemira	23.8	31.8	0.523	5.90	142	130	0.916	23.1
4-	Ras poly	27.1	33.7	0.308	6.35	139	129	0.930	22.1
5-	Gloria	21.8	29.9	0.075	5.50	139	131	0.940	23.3
6-	Top	24.2	38.7	0.190	7.16	148	140	0.945	23.1
7-	Pleno	19.2	37.2	0.300	5.85	104	95	0.914	23.0
8-	Beta poly	21.3	31.6	0.089	7.30	113	109	0.965	22.1
9-	Farida	21.8	24.8	0.099	6.65	119	101	0.850	22.0
10-	Panther	22.5	34.2	0.340	5.40	101	79	0.785	21.7
11-	Nejma	22.9	31.13	0.229	5.90	134	143	1.067	21.3
12-	Toro	22.8	22.71	0.199	6.30	132	143	1.083	22.7
13-	Gazella	21.6	34.5	0.222	6.70	152	141	0.928	22.9
14-	Montblenca	19.9	22.7	0.401	7.10	144	138	0.958	23.3
15-	Desprez poly N	31.3	40.1	0.520	7.60	139	178	1.280	22.1
16-	Baraca	22.2	18.9	0.503	7.00	149	145	0.975	22.0
17-	Lola	21.9	19.7	0.380	5.10	135	105	0.778	23.3
18-	Chems	30.7	40.0	0.320	6.70	147	141	0.960	22.1
19-	Dimken strop poly	30.8	23.7	0.315	5.80	149	137	0.920	22.7
20-	Mezano poly	28.3	27.2	0.260	5.90	147	139	0.950	22.8
21-	Kawe Interpoly	29.3	26.7	0.400	5.7	150	142	0.950	22.9
22-	Kawemena poly	29.7	27.2	0.380	5.9	140	128	0.915	22.9
23-	Maribo prema poly	22.7	19.2	0.290	6.8	159	148	0.931	23.3
24-	Mazano poly1	28.10	21.0	0.240	7.1	111	111	1.000	21.0
25-	Mareno Magnapoly	24.3	18.3	0.280	6.9	113	107	0.950	23.3
26-	Maribo Marocopoly	31.4	26.9	0.330	5.7	109	117	1.073	23.1
	Mean	25.3	30.55	0.30	6.35	132	126.5	1.030	22.7
	L.S.D. 0.05	1.40	1.31	0.171	0.90	14.16	14.41	0.165	0.40
	L.S.D. 0.01	1.85	1.79	0.201	1.23	19.33	19.67	0.225	0.55

Table 5. Variability, heritability (broad sense) percent and genetic advance of yield and its components in sugar beet.

Parameters / Characters	Range		Variance		Coefficient of variability (%)		Heritability (%)	Genetic advance (%)
	Min.	Max.	Genotypic	Phenotypic	Genotypic	Phenotypic		
Root length (cm)	19.2	31.4	8.493	9.491	11.52	12.18	0.89	22.33
Root width (cm)	21	40.1	7.50	8.59	11.31	11.71	0.87	17.19
Top weight(gm)	0.076	0.523	0.337	0.495	27.30	41.80	0.68	10.4
Crown size (cm)	5.1	7.8	0.561	1.075	13.1	17.2	0.52	17.49
Root number /plot	105	159	211.5	338	11.32	14.3	0.63	18.08
Yield/plot (kg)	79	174	601.58	732.61	18.18	20.1	0.82	38.26
Root weight (kg) / plant	0.780	1.280	0.308	0.325	29.90	31.54	0.94	46.50
Total soluble solids (%)	22.1	23.3	2.27	2.37	6.58	6.72	0.96	13.13
Root yield (ton/fed)	18.18	41.9	7.73	35.84	9.26	19.93	0.22	9.03
Sucrose (%)	11.13	19.05	3.74	5.47	12.8	15.5	0.68	21.74
Sugar yield (ton/fed)	2.65	6.68	3.91	5.94	0.45	0.56	0.66	71

REFERENCES

Abd Alla, H. A. (1992). Studies on some factors affecting the productivity of sugar beet. M. Sc. Thesis, Fac. Of Agric. El- Minufiya Univ.

Abd El- Fatah, E.F.(2000). Factors affecting yield of some sugar beet varieties in newly reclaimed soil. M.Sc. Thesis Fac. Of Agric., Cairo University.

Abo El- Ghait, R. A. (1993). Evaluation of some sugar beet varieties under different environmental conditions. M.Sc. Thesis, Fac. Of Agric. El – Minufiya Univ

Al-labbody, A.H. (2003). Evaluation of some multygerm and monogerm sugar beet varieties under Fayoum governorate conditions. Ph.D. Thesis Fac. Of Agric., Al- Azhar Univ.

Behl, R.K., Singh, V.P., and Babu, G. N.(1978). Studies on variability, heritability and genetic advance in sugar beet(Pl. Breed..Abst.49(11): 10335, 1979)

By Chenko, E. A. and Galetskaya, I. B. 1984. Correlation analysis and heritability of technological quality in sugar beet. Kishinev, Moldavian SSR; Stinca 13 (Pl. Breed. Abst, 55(11) : 8842, 1985.

Comstock, R.E., and R. H. Moll (1963). Genotype- environmental interactions, PP. 164-196. In W.D Hanson and H.F. Robinson (eds). Statistical Genetics and plant breeding. NAS- NRC Pub 982.

El-Deeb, M. H. and N. Z. Younan (1991). Combining ability of some quantitative characters in 5 x 5 diallel of sugar beet. Annals of Agric. Sci. Moshtohor. 29 : 13 – 19

El-Geddawy, I. H. M, Laila, M. Saif, and F. A. Abd El – Latief (2001). Hoeing and nitrogen fertilization with respect to quality yield components of some sugar beet varieties grown in upper Egypt. J. Agric. Sci. Mansoura Univ., 26 (8) 4607-4621.

El-Manhaly. M. A and N.Z. Younan (1986). Genetics of polyploidy in sugar beet (Beta vulgaris L.)root characters. Proc. 2nd . conf. Agrom., Alex., Egypt. 2 : 921 – 932.

El-Sheikh, S.R.(1999). Evaluation of some local genotypes compared with some imported varieties of sugar beet,M.Sc. Theirs. Fac. Of Agric. Al – Azhar Univ., Egypt.

El-Sheikh, S.R.(2003). Studies on sugar beet breeding under Egyptian conditions. Ph.D. Thesis Fac. Of Agric., Al- Azhar Univ., Egypt.

El-Talkhawy, N. M.(1992). Studies on the flowering of sugar beet varieties. Ph.S Thesis Fac. Of Agric. Saba Bacha, Alexandria Univ.

Ghura, Nabawya S.A. (1989). Studies on sugar beet.
1- Varieties comparison. 2- NPK Fertilization.
M.Sc. Thesis Fac. Agric, Alex. Univ., Egypt.

Ghura, Nabawya S.A.(1995). Studies on sugar beet. Evaluation of sugar beet monogerm lines and estimation of general and specific combing ability. Ph.D. Thesis. Fac. Agric, Alex. Univ., Egypt .

Ghura,Nabawya S.A., Nabila Z.Younan, and M.A.El-Manhaly (1997). Broad and narrow sense hertability of some characters of sugar beet. Adv. Agric. Res. Vol.2 , No.1 , : 91-101.

Ghura, Nabawya S.A.(2001). Analysis of diallel cross in sugar beet. Alex. J. Agric. Res. 46 (1) : 19-29 .

Kovachev(1986). Ecological and genetic variability of quantitative characters in sugar beet. Archiv za. Polijoprivredne Nauke 47(1966)112 113. (Pl. Breed. Abst. 58 (4) : 3371 , 1787).

Liang Gerge H. L. and T.I Walter (1966). Genotype environment interactions from yield and their application to sorghum breeding programs. Can. J. Gent. Cytol 8 : 306-311

Panse , V.G. (1957). Genetics of Quantitative characters in relation to plant breeding. India J. Genet. Pl. Breeding 17:318-328.

Shalaby, N. M.(2003). Effect of environmental conditions on the behaviour of different genotypes of sugar beet for root yield and quality. Ph. D. Thesis Fac. of Agric., Al- Azhar Univ.

Singh R. K. and Chaudhary B. D (1979). Biometincal methods in quantitative genetic analysis. B.O.:4863/2, Bharat Ram Road , 24 , Darya ganj, New Delhi – 110002.

Smith,G.A., R.I.Heeker, Gw. Maag, and D.M. Rasmuson (1973). Combing ability and gene action estimates in an eight- parent diallel cross of sugar beet. Crop. Sci 13 : 312 – 316.

Smith, M. C., Cornish , M. A., and Mackay. I. J. (1990). An analysis of genetic variation in sugar beet (Beta vulgaris L.) using an augmented biparental(ABIP)mating design. Annals of Applied Biol.116 (3) 583-590.

Waller, R.A. and Duncan (1969). A boy's rule for the symmetric multiple comparison problem, Am state, Assoc j. Dec 1496 – 1503.

الملخص العربي

مكونات التباين لصفات كمية لأصناف تجارية من بنجر السكر

نبويه صالح عبده غره – مجدي سعد صالح – صلاح رفاعي الشيخ

قسم التربية والوراثة ، معهد بحوث المحاصيل السكرية ، مركز البحوث للزراعية ، الجيزة ، مصر .

استخدم في هذه الدراسة ستة وعشرون صنفا من بنجر السكر مستوردة من أماكن عديدة خلال ثلاثة مواسم متتالية هي (٢٠٠٢ – ٢٠٠٣ –٢٠٠٤) وذلك في ثلاث مواقع هي (النوبارية – كفر الشيخ – الفيوم).

وكان الهدف الأساسي من إجراء هذا البحث هو تحديد مكونات التباين لأهم الصفات التي تهمنا في بنجر السكر مثل محصول الجذور ومحصول السكر . وأيضا درست الصفات التي تؤثر على محصول الجذور ومحصول السكر مثل طول الجذر (سم) ، وعرض الجذر (سم) ووزن القمة (جم) ، وحجم التاج (سم) ، وعدد الجذور للقطعة التجريبية ، ووزن المحصول للقطعة التجريبية (كم) ، ووزن الجذر (كم) ، والنسبة المئوية للمواد

الصلبة الذائبة ومحصول الجذور (طن للفدان) والنسبة المئوية للسكروز ، ومحصول السكر (طن للفدان) . وذلك فـي البيئات التسعة المدروسة من خلال ثلاث مناطق وثلاثة سنوات للستة وعشرون صنفا حتى نحصل على أفضل الأصناف إنتاجا .

أظهرت النتائج المتحصل عليها ان اعلي الأصناف لصفة محصول الجذور كان الصنف H. poly وقد أعطـى ٤١,٩ (طـن للفدان) ثم الصنف Kawemena Poly وقد أعطى ٤٠,٢٢ (طن للفدان) . أما محصول السـكر فكـان الصـنف H. Poly هو أعلي الأصناف وقد أعطى ٦,٦٨ (طن للفدان) وكان اقل الأصناف في محصول السكر هو الصنف Mezano poly فقد أعطى ٢,٦٥ (طن للفدان).

ومـن أهداف البحث أيضا دراسة بعض الثوابت والمقاييس الاحصائية مثل المدى والتباين المظهري ، والتبايـن البيئـي ، ومعـامل التباين المظهري ، ومعامل التباين البيئي ، ودرجة توريث الصفة بالمعنى الواسع ودرجـة الـتقدم الوراثـي كنسـبة مئوية من المتوسط لهذه الصفة وذلك لأهم الصفات التي تؤثر على مكونات محصول السكر .

وأوضحت النتائج أن التباين الوراثي قد درس للصفات المختلفة فقد كان قيمة المدى ما بين ٠,٣٢٥ لصفة وزن الجذر إلي ٧٣٢,٦١ لصفة محصول الجذور للقطعة التجريبية وكان معامل التباين الوراثي ما بين ٦,٧٢% لصفة نسبة المواد الصلبة الذائبة إلي ٣١,٥٤ % لصفة وزن الجذور . أما بالنسبة لدرجة التوريث بالمعني الواسع فكانت ٩٦% لصفة نسبة المواد الصلبة الذائبة و٢٢% لصفة وزن الجذور . أعلي قيمة للتقدم الوراثي كانت ٧١% لصفة وزن الجذور و ٤٦,٥ لصفة محصول القطعة التجريبية ، وأقل قيمة للتقدم الوراثي لصفة نسبة المواد الصلبة الذائبة كانت ١٣,٣% ، وصفة وزن القمة النامية كانت ١٠,٤ % .