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EFFECT OF PLANT DENSITY ON SEED YIELD AND ITS COMPONENTS ON SOME GENOTYPES OF SOYBEAN (GLYCINE, MAX)

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ABSTRACT

Two field experiments were conducted at Shandweel Research Station, Sohag Govermorate, Agricultural Research Center, Egypt, during, summer seasons of 2002 and 2003, to study the performance of soybean genotypes namely: L_5, L_{12}, Giza 111 and Clark under four plant population densities, *i.e.* 105, 140, 175 and 210 thousand plants per feddan using split-plot design.

Results showed that Giza 111 surpassed all the other tested genotypes in number of branches, pods, seeds and seed yield per plant when sown at the lowest population density (105.000 plants/fed). Seed yield per feddan significantly increased by increasing plant density until (175.000 plants/fed.). Generally, increasing plant density decreased yield components but increased plant height and seed yield per feddan. Wheares plant height increased with the increase in plant density up to (210.000 plants/feddan). The greatest yield of seed per feddan was achieved when sowing Giza 111 cultivar with the population density of 175.000 plants/feddan .

Estimates of genotypic and phenotypic coefficients of variation reveald high values in number of branches/plant, number of pods/plant, seed weight/plant, number of seeds/plant and seed weight/plant. All the studied characters recorded high heritability values (more than 50%). There was highly significant and positively correlation between number of branches and each of number of pods/plant, number of seeds/plant, seed weight/plant and 100 seed wight. Path coefficient analysis revealed that plant height, number of seeds/plant and number of branches/plant had the most prominent direct effects on seed yield/feddan with relative importance of 15.78%, 8.29% and 7.35%, respectively of the total variation of seed yield/feddan.

INTRODUCTION

In Egypt, soybean acreage has dramatically decreased during the last ten years (from about 100,000 feddan in 1991 to about 14,000 feddan in 2002 seasons). This is mainly due to competition with other summer crops, increased production cost, reduced net profit per unit area and difficulties in marketing process. Consequently, the total soybean production became below the requirements of Egypt. Increasing soybean production could be achieved through growing the new high yielding, insect resistant soybean genotypes at proper plant densities .

In general, soybean produces better under low poplation densities, so that its leaves cover the entire soil surface during the seed development period. This provides maximum interception of solar radiation and maximum conversion of solar energy to store food energy (Taylor 1980) .

Several investigators (Ablett *et al.* 1984; Hassan *et al.* 1988; Boord *et al.* 1992; Abdalla *et al.* 1993; Ali 1993; Sharaf *et al.* 1993; Shafshak *et al.* 1997 and Hassan *et al.* 2001), reported that increasing plant population density decreased number of pods and seeds as well as seed weight per plant and increased plant height and seed yield per feddan.

Measurements of genetic parameters of variation i.e, phenotypic, genotypic and environmental variances, phenotypic, and genotypic coefficients of variation as well as heritability for seed yield and related characters have great importance. (Ezzat and Ashmawy 1999; Mohamed, *et al.,* 2000; Sharaan and Ghallab 2002), estimated some genetic parameters and obtained high values of the above mentioned parameters for number of branches/plant, number of pods and seeds/plant, seed index and seed yield/plant.

Correlation studies among yield of soybean and its component would help soybean breeders and agronomists to conduct further investigations on growth and yield attributes (Johanson, *et al.,* 1955; Ezzat and Ashmawy 1999; Mohamed, *et al.,* 2000; Sharaan and Ghallab 2002).

The aims of this investigation was to study the response of four soybean genotypes (L_5, L_{12}, Giza 111 and Clark) to different plant population densities.

Also, to study the variability of soybean genotypes with respect to the important characterics as well as to estimate the relative importance of yield components using path coefficient method. This would be helpful to soybean breeder to develop a suitable selecttion strategy for increasing seed yield.

MATERIALS AND METHODS

Two field experiments were carried out in a loam clay soil at Shandweel Research Station, Govermorate, Upper Egypt, during two seasons i.e., 2002 and 2003 .

A split plot design with four replications was used. Genotypes (L_5, L_{12}, Giza 111 and Clark) occupied the main plots. The sub-plots were devoted plant population densities (15, 20, 25 and 30 plants per meter) which are equivalent to 105, 140, 175 and 210 thousand plants per feddan. Each sub plot cosisted of seven rows of 60 cm apart and 4 meters length (4.2 x 4 = 16.8 m^2).

Table 1: Origin and pedigree of soybean genotypes.

Genotypes	Origin	Pedigree
L 5	Egypt	Crawford X D79-10426
L 12	Egypt	Crawford X Celest
Giza 111	Egypt	Crawford X Celest
Clark	U.S.A	Lincoln X Richland

To achieve the desired population densities for this study, plots were over seeded to insure good emergence, then plants were thinned at 15, 20, 25 and 30 plants per meter at the $V_2 – V_3$ stages of growth (2 – 3 weeks after sowing). The recommended practices for soybean production at the studied location were applied i.e., experimental plots were fertilized with phospho at a rate of 30 kg P_2O_5 / fed during seed – bed preparation. A starter dose of 15 kg of N/fed was also added prior to sowing .

Seeds were inoculated with the specific rhizobia 15 minutes prior to sowing that took place on May 14th and 23th during 2002 and 2003 summer seasons, respectively.

At harvest, ten gaurded and competitive plants were taken randomly from the central five rows gaurded and competitive from each plot to collect data on the following characters :

1- Plant height (cm)
2- Number of branches/plant
3- Number of pods/plant
4- Number of seeds/plant
5- Seed yield/plant (gm)
6- weight of 100 seeds (gm)
7- Seed yield (ton/fed) was determined from yield of five rows from the plot ($12\ m^2$).

Statistical analysis :

Analysis of variance for each variable and covariance for each pair of variables were performed assuming years and genotypes as fixed variables (Le Clerg *et al.,* 1966). The expected mean squares and mean cross products are presented in Table 2. Treatement means were tested by least significant difference test (L.S.D) at the proper level of significance. In interaction Tables capital and small letters were used to test row and column, respectively.

Table 2: Expected of mean square (E.M.S.) and mean cross products (M.C.P.) for the variance and covariance analysis of split-plot design.

Source of variance	D. F.	MS	Expected M. S.	Expectation of M. C. P.
R	r-1			
Environments (densities of planting)	d-1	Md	$\sigma^2_a + r\ G\sigma^2_d$	Cov a + r G cov d
E (A)	(r-1) (d-1)	Ma	σ^2_a	Cov a
G	(g-1)	Mg	$\sigma^2_b + r\,d\,\sigma^2_g$	Cov b + r d cov g
D X G	(d-1) (g-1)	Mdg	$\sigma^2_b + r\ \sigma^2_{dg}$	Cov b + r cov d g
E (B)	(r-1) (d-1) (g-1)	Mb	σ^2_b	Cov b

Where: r, d and g are number of replications, densities and genotypes, respectively.

The genotypic and phenotypic variances ($\sigma^2 g$ and $\sigma^2 ph$) were calculated from the pertinent mean square expectations as follows :

$\sigma^2 g = Mg - Mdg/rd$

where $\sigma^2 g$ = Genotypic variance

Mg = Mean Square of genotypes

Mdg = Mean square of the densities x genotypes interaction

R = Number of replications

D = Number of environments (densities of planting)

Phenotypic variance $\sigma^2 ph$, was computed accroding to the following formulae:

$\sigma^2 ph = \sigma^2 g + (\sigma^2 dg/d) + (\sigma^2 b/rd)$
Where $\sigma^2 dg = (Mdg - Mb)/r$
$\sigma^2 b$ = Mb (second error mean square)
Genotypic and phenotypic covariances were calculated in the same way .

Broad sense heritability (H) was calculated as described by Hanson (1963) using the following formula: $H = (\sigma^2 g/\sigma^2 ph) \times 100$.

Phenotypic correlation coefficients between all possible combination of characters were calculated from the phenotypic variance and covariance components according to the procedure obtained by Johanson *et al.* (1955) and Miller *et al.* (1958).

Phenotypic correlation coefficient :-

$(rp) = \sigma\ ph1\ ph2/SQR\ (\sigma^2\ ph1 \times \sigma^2\ ph2)$

Path coefficient analysis was used to identify the different independent characters which affect the dependent character directly as well as indirectly. It will give us the path in which an independent variable is affecting the dependent variable in a given set of independent variables. The path coefficient analysis proposed by Wright (1921) and utilized by Dewey and Lu (1959), was used in this study for the analysis of yield components. A path coefficient is simply a standardized partial regression coefficient as it measures the direct effect of one variable upon another and permits the separation of correlation coefficient of direct and indirect effects. The cofficient of multiple determination $(R^2) = p^2i + 2pi\ pj\ rij$ where i and j are the indices of independent variables p^2i is the direct of the ith variable and 2 pi pj rij is the joint effect between both ith jth variables . The relative importance (RI %) of each attribute to variation was estimated as an absolute value related to the value of R^2 according to the formula :-

$$RI\ (\%) = [(\ |\ Cdi\ |\ \times R^2\ )/(\ \Sigma^K\ |\ CDi\ |\ )\ ] \times 100$$

Where CDi is the portion of R^2 due to the direct or joint effect of involved variables.

RESULTS AND DISCUSSION

A- Effect of soybean genotypes:

Data presented in Table 3 show clearly that genotypes significantly differed in all studied characters in both seasons. Plants of Giza 111 were the tallest whereas those of clark were the shortest. Differences among genotypes in number of branches, pods, seeds, seed yield per plant and weight of 100 seeds were significant. Giza 111 surpassed all other genotypes for the studied characters followed by the lest of genotypes i.e., L12, L5 and Clark. The superiority of Giza 111 over the other genotypes may be due to the differences in genetical make up of the tested genotypes and this is a local genotypes as well as its adaptability to Egyptian environmental conditions. Many investigators reported differences among soybean genotypes in plant height, number of branches, pods and seeds per plant as well as weight of 100 seeds (Shafshak *et al.,* 1997) .

Table 3: Yield attributes and seed yield and its components as affected by soybean genotypes and plant densities during two seasons, 2002 and 2003 at Shandweel.

Characters / Factor	Yield attributes				Seed yield and its components									
	Plant height (cm)		Number of branches/plant		Number of pods/plant		Number of seeds/plant		Seed yield/plant (gm)		Weight of 100 seeds (gm)		Seed yield/fed (ton)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Genotypes (G)														
L 5	97.5	83.4	1.90	1.43	53.7	40.0	115.0	92.5	17.7	16.3	15.8	14.5	1.197	1.111
L 12	88.1	83.2	2.24	1.51	60.6	53.6	139.3	124.1	21.7	18.8	16.0	15.0	1.428	1.318
Giza 111	103.3	93.6	2.53	2.10	66.6	58.1	148.8	133.2	26.4	21.8	18.3	17.4	1.522	1.368
Chark	68.8	65.2	1.33	1.13	38.9	33.7	95.3	82.3	15.8	14.4	15.2	13.7	0.919	0.815
L.S.D.	3.5	5.2	0.34	0.34	4.0	5.8	4.7	5.0	0.8	0.8	1.3	1.2	0.024	0.031
Plant density (D)														
105.000	78.0	70.7	2.81	2.31	69.3	60.7	154.8	136.3	25.1	22.0	17.9	17.0	1.039	0.039
140.000	84.1	76.8	2.24	1.72	58.6	50.3	133.2	114.9	22.0	19.3	17.2	15.9	1.205	0.957
175.000	93.1	84.8	1.73	1.24	50.1	40.6	133.3	97.3	19.1	16.6	15.6	14.3	1.472	1.163
210.000	102.0	93.3	1.33	0.94	41.7	33.8	97.1	83.4	15.2	13.4	14.5	13.4	1.350	1.297
L.S.D.	3.3	4.2	0.1	0.2	3.4	4.2	4.0	4.5	1.4	1.0	0.9	0.9	0.039	0.053

Results showed that, seed yield followed the same trend where Giza 111 produced the highest seed yield (1.522 and 1.368 ton/feddan) followed by genotype L12 (1.428 and 1.318 ton/feddan) L5 (1.197 and 1.111 ton/feddan) and Clark (0.919 and 0.815 ton/feddan) in the first and second seasons, respectively. The superiority of Giza 111 may be due to differences exist in genetical make up and this variety exceed the other varieties in all studied characters. Similar differences among soybean genotypes were reported by Mahmoud *et al.* (1993).

B- Effect of plant population density :

Results in Table 3 show that plant height was markedly increased with increasing plant population density in both seasons. Such effect may be atributed to that in dense plant population more competition exists among plant for light, resulting in taller plants searching for light through the elongation of internods. These result are in agreement with those reported by Mohamed (1988) and Shafshak *et al.* (1997).

Number of branches, pods, seeds and seed yield per plant as well as weight of 100-seeds were significantly decreased with increasing plant density. This may be due to competition among plants for nutrients and moisture at dense populations. These results are in accordance with those obtained by Shafshak *et al.* (1997).

Concerning soybean seed yield, results in Table 3 show that seed yield per feddan significantly increased with increasing plant density up to 25 plants per linear meter (175000 plants/feddan) in both seasons as compared with other three population densities. The dense 25 plants per liner meter (175000 plants/feddan) significantly yielded more seed yield per feddan than did 15, 20 and 30 plants per liner meter yield. The increases were 41.7, 22.2 and 9 % in 2002 seasons and 35.5, 11.5 and 8.4 % in 2003 season, respectively .

These results are are similar with those obtained by Mohamed (1988) and Board *et al.,* (1992) who reported that total seed yield per unit area increased with increasing plant population density.

C- Genotype x population density :

Interaction between genotypes and population density were not statistically significant in some studied characters as shown in Table 4 which indicate similar response in the four tested genotypes to varing population density.

The effect of interaction between genotype x plant density on yield and related characters are presented in Table 4. The results indicated that number of branches and seeds/plant were significantly affected by genotype x plant density interaction only in 2002 season. Results in Table 3 showed that number of branches and seeds/plant were gradually decreased by increasing plant density for all tested genotypes. Seed yield per faddan was significantly affected by genotype x plant density interaction in both seasons. The maximum yield of seeds per feddan was achieved by combining Giza 111 with the population density of 175000 plants/fed.

Table (4): Effect of interaction between genotypes and plant population densities on yield and its component characters in soybean during seasons of 2002 and 2003.

Character Treatment	Plant height (cm)		Number of branches/plant		Number of pods/plant		Number of seeds/plant		Seed yield/plant (gm)		Weight of 100 seeds (gm)		seed yield/fed (ton)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
L5														
105000 plant/fed	85.7	74.0	2.84	2.23	70.0	59.3	148.0	118.7	22.6	21.0	17.4	16.4	1.013	0.935
140000 plant/fed	91.0	77.7	2.12	1.64	58.7	43.7	126.0	103.7	19.7	18.4	16.5	15.2	1.183	1.179
175000 plant/fed	101.3	86.7	1.60	1.14	46.5	32.0	104.0	80.7	16.0	14.4	15.8	13.8	1.383	1.280
210000 plant/fed	112.0	95.3	1.24	0.82	39.6	25.0	82.0	67.0	12.3	11.4	13.5	12.6	1.209	1.050
L12														
105000 plant/fed	76.3	72.7	2.70	2.13	76.7	68.3	173.0	156.0	26.2	23.3	18.0	16.4	1.140	1.073
140000 plant/fed	84.0	80.3	2.41	1.60	63.0	56.0	144.7	128.7	22.4	20.3	17.4	16.2	1.385	1.313
175000 plant/fed	90.7	85.7	2.13	1.34	56.3	48.0	127.7	116.0	20.4	17.4	14.7	14.5	1.605	1.462
210000 plant/fed	101.3	94.3	1.60	1.14	46.3	42.0	112.0	95.7	17.9	14.4	13.7	13.1	1.582	1.423
Giza III														
105000 plant/fed	91.7	82.7	3.53	3.04	81.0	72.7	180.0	163.0	32.4	25.3	19.7	19.3	1.283	1.168
140000 plant/fed	97.7	89.0	2.70	2.50	71.7	64.3	158.0	139.7	28.3	23.2	19.4	18.6	1.395	1.378
175000 plant/fed	108.0	97.3	2.14	1.74	62.7	51.7	135.7	121.7	25.7	21.3	17.4	16.3	1.720	1.475
210000 plant/fed	116.0	105.3	1.64	1.24	51.0	43.7	121.3	108.3	19.2	17.2	16.6	15.3	1.690	1.450
Clark														
105000 plant/fed	58.3	53.3	2.10	1.71	49.7	42.3	118.0	107.7	19.3	18.3	16.6	15.8	0.718	0.653
140000 plant/fed	63.7	60.3	1.54	1.24	41.0	37.3	104.0	87.7	17.7	15.4	15.4	13.7	0.857	0.780
175000 plant/fed	72.3	69.3	1.05	0.83	35.0	30.7	86.0	71.0	14.6	13.5	14.5	12.9	1.178	0.970
210000 plant/fed	80.7	78.0	0.75	0.45	30.0	24.3	73.0	62.7	11.5	10.5	14.2	12.5	0.920	0.860
L.s.d at 0.05 level G X PPD	Ns	Ns	0.1	Ns	Ns	Ns	7.9	Ns	Ns	Ns	Ns	Ns	0.080	0.109

From the foregoing results, it could be concluded that Giza 111 is a promising soybean cultivar and gives the maximum yield when sown it is under population density of 175000 plants/fed.

D- Genetic parameters :

Estimation of variance components for different charaters is needed for determining their magnitudes and their relation to each other, as well as, for estimating heritability and predicting gains from selection. Variance component estimates Table 5 Show that genetic variance (σ^2_G) was higher than environmental variance (σ^2_E) for all studied traits. Significant variation due to interaction genotypic x environmental variance indicated that the genotypes differed genetically in their responses to the environment.

As shown in Table 5, number of branches/plant exhibited the highest value of genetic coefficient of variation, GCV (32.65 % and 38.08 %) for the two seasons, respectively, followed by number of pods/plant (21.54 % and 25.06%), seed weight/plant (20.14 % and 20.54 %), number of seeds/plant (19.95% and 21.11 %), seed yield/feddan (15.52 % and 11.64 %) and plant height (11.95 % and 12.25 %), whereas the lowest value (9.89 % and 10.53 %) was shown by 100 seed weight. It is of interest to note that the GCV/PCV ratio was higher than 90 % for all studied traits for the two seasons except 100-seed weight. This ratio was about (98 % and 97 %) for number of pods/plant, (97% and 94 %) for seed yield/fedan,(97 % and 93 %) for number of branches/plant, (94% and 92 %) for number of pods/plant, (94 % and 90 %) for plant height, (90 % and 93 %) for seed weight and (84 % and 83 %) for 100-seed weight. These results indicated that the influence of environmental factors on seed yield/feddan and its components is less than on 100-seed weight and hence, selection would be effective for improving these components.

As consequence, heritability (in broad sense) estimates $h^2_{(b)}$ were high for number of seeds/plant (96.56 % and 94.88 %), seed yield/feddan (95 % and 90 %), number of branches/plant (93.3 % and 87.2 %), height to number of pods/plant (89.5 % and 84.4 %) plant height (87.9 % and 80.1 %), seed weight (81.61 % and 87.87 %), moderate for 100-seed weight (71.47 % and 69.97 %) for the two seasons, respectively.

E-Phenotypic correlation and path analysis :

Coefficients of phenotypic correlation among the studied characters in soybean over two seasons are presented in Table 6. Data showed that there was highly significant and positive assocstion between seed yield/feddan and each of plant height (r=0.780), number of pods/plant (r=0.278) and number of seeds/plant (r=0.288). On the other hand, number of branches/plant and 100-seed weight were found to be significant and postively correlated with seed yield/feddan with r values being 0.151 and 0.148, respectively. These results are in agreement with those obtained by Ezzat and Ashmawy (1999) and Mohamed *et al.* (2000).

Table (5) : Traits mean, genotypic variance (V_g), environmental variance (V_e), their interaction (V_{ge}), phenotypic variance (V_{ph}), genotypic (GCV%) and phenotypic (PCV%) and heritability in breoad sense $h^2_{(b.s)}$ for soyabean over seasons (2002 and 2003).

Parameter / Traits	seasons	Mean	(V_g)	(V_e)	(V_{ph})	(GCV%)	(PCV%)	$h^2_{(b.s)}$
1- Plant height (cm)	S1	89.417	114.18	15.67	129.85	11.95	12.74	87.9
	S2	82.000	100.84	25.10	125.94	12.25	13.68	80.1
2- No. of branches/plant	S1	1.985	0.42	0.029	0.45	32.65	33.79	93.3
	S2	1.531	0.34	0.051	0.39	38.08	40.79	87.2
3- No. of pods/plant	S1	54.938	140.09	16.42	156.51	21.54	22.77	89.5
	S2	46.333	134.86	24.93	159.79	25.06	27.28	84.4
4- No. of seeds/plant	S1	124.583	617.76	22.02	639.78	19.95	20.40	96.56
	S2	108.000	520.02	28.08	548.10	21.11	21.68	94.88
5- Seed weight/plant (g)	S1	20.394	16.87	3.80	20.67	20.14	22.29	81.61
	S2	17.825	13.40	1.85	15.25	20.54	21.91	87.87
6- 100 seed weight (g)	S1	16.244	2.58	1.03	3.61	9.89	11.70	71.47
	S2	15.135	2.54	1.09	3.63	10.53	12.59	69.97
7- seed yield/feddan (kg)	S1	1.256	0.038	0.002	0.04	15.52	15.92	95.00
	S2	1.153	0.018	0.003	0.02	11.64	12.26	90.00

Table 6:Phenotypic correlation coefficients between some characters and seed yield/plant in soybean over both seasons of 2002/2003.

	Seed yield/ feddan (y)	No. of Branche s/plant (x_1)	No.of pods/ plant (x_2)	No.of seeds/ plant (x_3)	Plant Height (x_4)	Seed weight/ Plant (x_5)	100 seed weight (x_6)
(y)	-	0.151	0.278**	0.288**	0.780**	0.281**	0.148
(x_1)		-	0.893**	0.908**	0.031	0.893**	0.777**
(x_2)			-	0.949**	0.102	0.905**	0.770**
(x_3)				-	0.076	0.934**	0.800**
(x_4)					-	0.070	0.031
(x_5)						-	0.816**
(x_6)							-

Also, it seems from Table 6 that there was postive and highly significant correlation between number of branches and each of number of pods/plant, number of seeds/plant, seed weight/plant and 100-seed weight. The correlation coefficients were 0.893, 0.0908, 0.893 and 0.777, respectively .

Highly significant and postive association was found between number of pods/plant and number of seeds/ plant, seed weight/plant and 100 seed weight, with estimates of 0.949, 0.905 and 0.770, respectively, also between number of seeds/plant and seed weight/plant and 100-seed weight (r=0.934 and 0.800), respectively, also between seed weight/plant and 100-seed weight (r= 0.816). These findings are similar to those obtained by Ezzat and Ashmawy (1999), Mohamed *et al.,* (2000) and Shafshak *et al.,* (1997).

Path Coefficient analysis :-

Simple correlation coefficients between seed yield/fed. and its components, namely: plant height, number of branches/plant, number of pods/plant, number of seeds/plant, seed weight and 100-seed weight were individually partitioned into their components of direct and indirect effects.

The results of direct and indirect effects of yield components and their relative importance to the seed yield are shown in Table 7.

Results in Table 7 revealed that plant height showed maximum direct effect towards seed yield/fed. recording the highest relative contribution of 15.78% to the total variation of seed yield. number of seeds/plant ranked second recording 8.29 % followed by number of branches/plant that acounted for 7.35% contributing to seed yield variation. The results also indicated that number of branches/plant and seed weight had the highest indirect effects through number of seeds/plant (15.78 and 10.89 %), respectively, contributing to seed yield variation. These results are in agreement with those obtained by Ashmawy and Ezzat (1999). Weight of 100 seeds accounted for 3.76% to the seed yield variation through number of branches/plant and 4.10% through seed weight while number of branches/plant had indirect effect through seed weight where it accounted for 2.95 % to the tot variation of seed yield Table 7.

Table 7: The direct, indirect, relative contribution % and residual effects according to path coefficient analysis for all studied characters for two seasons.

Characters	Effects	CD*	R1%**
Direct			
No. of branches/plant (X_1)	-.5054	0.2555	7.3509
No. of pods / plant (X_2)	-.0689	0.0047	0.1366
No. of seeds/ plant (X_3)	0.5367	0.2880	8.2882
Plant height (X_4)	0.7406	0.5485	15.7822
Seed weight (X_5)	0.3775	0.1425	4.1015
100 seed weight (X_6)	-.1666	0.0277	0.7987
Indirect			
X1 vs X2	-.0615	0.0622	1.7899
X1 vs X3	0.4873	-0.4926	14.1748
X1 vs X4	0.0229	-0.0232	0.6678
X1 vs X5	0.3371	-0.3408	9.8067
X1 vs X6	-.1294	0.1308	3.7656
X2 vs X3	0.5093	-0.0702	2.0198
X2 vs X4	0.0755	-0.0104	0.2995
X2 vs X5	0.3417	-0.0471	1.3550
X2 vs X6	-.1283	0.0177	0.5088
X3 vs X4	0.0562	0.0604	1.7384
X3 vs X5	0.3526	0.3785	10.8913
X3 vs X6	-.1332	-0.1431	4.1168
X4 vsX5	0.0264	0.0391	1.1264
X4 vs X6	-.0051	-0.0076	0.2201
X5 vs X6	-.1359	0.1027	2.9539
Residual effects		0.2817	8.1066

Multiple coefficient of determination = 99.99
*** CD % = Coefficient of determination**
**** RI = Relative importance**

The total relative contribution of all studied characters to the overall variation in seed yield was 91.89% .

The residual effect of the other seed yield components in this study was 8.10% .It is clear that this residual effect has slight magnitute and showed very small contribution to the seed yield variation and also to the other characters which were probably not included into this model.

Generally, the results obtained revealed that plant height, number of branches, number of seeds/plant and 100-seed weight exerted the major effects on seed yield of soybean. These results are in agreement with the results of phenotypic correlation coefficients and gentic parameters. Therefore selection for these traits would be effective in achieving a succesful breeding program for soybean.

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تأثير الكثافة النباتية على المحصول ومكوناتة فى بعض التراكيب الوراثية من فول الصويا

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**** المعمل المركزى لبحوث التصميم و التحليل الأحصائى- مركز البحوث الزراعية.**

أجرى هذا البحث فى محطة بحوث شندويل بمحافظة سوهاج التابعه لمركز البحوث الزراعية فى الموسمين الصيفين ٢٠٠٢ ، ٢٠٠٣ بهدف دراسة سلوك بعض التراكيب الوراثيه من فول الصويا وهى س$_{٥}$ ، س$_{١٢}$ ، جيزة ١١١ وكلارك تحت اربع كثافات نباتية مثل ١٠٥ و ١٤٠ و ١٧٥ و٢١٠ ألف نبات/فدان واستخدم تصميم قطع منشــقه مــرة واحدة فى أربع مكررات حيث شملت الأصناف فى القطع الرئيسية ووزعت الكثافات النباتيه على القطع الشقية وتتلخص أهم النتائج المتحصل عليها فيما يلى :

١- تفوق الصنف جيزة ١١١ تفوقا معنويا على باقى التراكيب الوراثيه فى كل الصفات المدروسة تلاة السلالتان س$_{٥}$ ، س$_{١٢}$ ثم الصنف كلارك.

٢- زاد ارتفاع النباتات بزيادة الكثافه النباتيه من١٠٥ الى ٢١٨ ألف نبات/فدان بينما ازداد محصول البذور طن/فــدان بزيادة الكثافة النباتيه من ١٠٥ الى ١٧٥ ألف نبات/فدان .

٣- أدت زيادة الكثافة النباتيه إلى نقص معنوى فى مكونات المحصول وتم الحصول على افضل مكونات للمحصول عند زراعتها بكثافة منخفضه وهى ١٠٥ آلف نبات/فدان .

٤- إعطى الصنف جيزة ١١١ أفضل محصول وذلك عند زراعته بكثافة نباتيه قدرها ١٧٥ آلف نبــات/فــدان مقارنــة بالتراكيب الوراثية الأخرى وهو من الاصناف المبشرة وينصح بزراعته تحت هذه الكثافة للوصول الى اعلى انتاجية تحت ظروف منطقة شندويل .

٥- حققت صفات عدد الأفرع و عدد القرون و وزن البذور و عدد البذور و محصول النبات أعلى قيم للتباين المظهرى و الوراثى.

٦- أرتفعت قيم كفاءة التوريث لجميع الصفات تحت الدراسة فى الموسمين .

٧-وجد أرتباط عالى المعنوية و موجب بين عدد الأفرع و عدد القرون للنبات و عدد بذور النبات و وزن ١٠٠ بذرة.

٨- أظهر تحليل معامل المرور أن صفات: أرتفاع النبات و عدد أفرع/نبات و عدد بذور النبات اعطــت اعلــى تــأثير مباشر فى محصول فول الصويا. و كانت المساهمة الكلية لهذة الصفات فــى المحصــول ١٥,٧٨ % و ٨,٢٩ % و ٧,٣٥ % على الترتيب عموما تعتبر هذة الصفات أكثر مساهمة فى المخصول و يجب على المربى أن يضعها فــى الأعتبار في برامج التربية و الأنتخاب لتحسين أنتاجية محصول فول الصرويا.