J. Agric. Sci. Mansoura Univ., 30 (1): 79 – 89, 2005

EVALUATION OF SOME SOYBEAN GENOTYPES IN THE NEW RECLAIMED LANDS OF EAST OWINAT

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ABSTRACT

Two field experiments were conducted at East Owinat (22º 18̀ N latitude and 28º 45̀ E longitude) during consecutive summer seasons of 2002 and 2003. This study aimed to evaluate some soybean genotypes grown under new reclaimed lands at East Owinat and to study the relationship among yield components which help for further selection in this location.

Results showed that, Patty, Dekabig, Sapporo, Osaka, Giza 82 and Giza 83 genotypes were significantly flowered and matured earlier than the other genotypes. Plants of Giza 111, Giza 21, Giza 22, L 12,H32 and L 20 genotypes were significantly taller than the other genotypes. The highest number of branches/plants were obtained by DR 101 and Toano genotypes . Giza 111 produced the highest number of pods and seeds/plant followed by Giza 22, Giza 21, L 12, L 17, L5, Giza 35 and Crawford genotypes. Giza 111 had heaviest seed weight/plant and weight of 100 seeds, followed by Giza 22, L 17, L 12, Giza 21, L5 and crawford genotypes .
As for seed yield/fed, Giza 111 was the greatest, being slightly higher than Giza 22, L 12, Giza 35, Giza 21, L 17 and Crawford. It could be recommended for new reclaimed land of E. Owinat because they a high yielding and resistant to cotton leaf worm. Growing these new genotypes would increase production costs and reduce environmental pollution through avoiding or minimizing the use of insecticides in soybean fields.

Seed weight/plant was positively and significantly correlated with days to maturity, plant height, number of branches, pods and seeds/plant and weight of 100 seeds. Factor analysis grouped seven variables of soybean into two main factors accounted for 91.19 % of the total variability of the dependence structure. Factor I accounted for 50.92 % and included number of pods and seeds/plant, plant height and weight of 100 seeds. Factor II was responsible for 40.27 % of the total variation and contained days to 50 % flowering, days to maturity and number of branches/plant.

INTRODUCTION

The soybean area in Egypt has declined drastically from about 100.000 feddan in 1991 to 19.000 feddan in 2003 season. This is mainly due to competition with other summer crops, increase of production cost, reduction of net profit per unit area and difficulties in marketing process. The total soybean production became far below the country requirements. Therefore, it is necessary to insert the crop to new land areas, reduce production cost and increase productivity per unit area in order to improve soybean total production at national level.

The Food Legume Research Program, Field Crops Res. Institute, A R C, has succeeded in developing new soybean genotypes that have resistance to cotton leaf worm, the major insect pest of soybean in Egypt, (Awadallah *et al,* 1990, Abd El- Monem *et al*, 1991 and Lutfallah et al,1998), in addition to some early maturing genotypes.

Several investigators have conducted variety evaluation experiments (Board, 1985; Mohamed, 1988; El–Attar and Sharaf, 1993; Samia *et al*, 1993; Mohamed, 1994; Eisa *et al*, 1998; Hassan *et al*, 2001 and 2002). They found significant differences among varieties in seed yield, seed index, days to flowering, days to maturity, plant height, number of branches, pods and seeds/plant.

Determination of the most important characters that influencing yield is great useful in the breeding programs. Multiple regression in both full model and step wise as well as standard partial regression known as path coefficient are statistical procedures successfully applied to identify the relative contribution of some independent variables on a dependent variable (Ashmawy, 2003). Walton (1972) critized these procedures and explained that the information obtained using these procedures may be misleading. He mentioned that biologists must search for right assistance from statistical methodology. He recommended factor analysis as a type of multivariate technique. Factor analysis reduces a large number of correlated variables to a much smaller number of clusters or patterns of variables called factors. This approach has been used in soybean by EL-Rassas and EL-Rayes (1992) and in faba bean by Ashmawy *et al* (1998) and Mehasen and Mohamed (2004).

The present investigation was designed to: 1- Evaluate performance and yield potential of twenty four soybean genotypes in the new reclaimed lands at East Owinat. 2- Use factor analysis technique to assist the dependent relationships between yield and its components in soybean, which would be helpful to plan an appropriate selection program.

MATERIALS AND METHODS

Twenty four soybean genotypes differ in origin, maturity groups (II , III , IV, V and VI) and their agronomic characters (Table 1) were grown at the Experimental Farm of East Owinat Research Station, New Valley Governorat of southern Egypt during the 2002 and 2003 summer seasons. E. Owinat soil is sandy with P^h of 7.4 and low in organic matter. Experimental plots were fertilized with phosphorus at a rate of 30 kg P_20_5/feddan during seed–bed preparation. A starter dose of 15 kg of N/ fed was also added at sowing.
Randomized complete block design with four replications was used. Each plot consisted of seven rows 60 cm apart and six meters long ($4.2x6=25.2m^2$).Seeds were inoculated with specific rhizobia is minutes prior to sowing which took place on mid May in both seasons.

At harvest, ten guarded plants were randomly taken from the five central rows of each plot to measure plant height, number of branches, pods and seeds as well as seed weight/plant. Days to flowering, days to maturity,100-seed weight and seed yield/fed were determined on the plot basis from a central area of 12 m^2 (3 x 4 m). The groups of genotypes differ in origin, days to maturity, stem termination (Indeterminate (I) and Determinate (D)), color of flowers (Purple (P) and White (W)) and days to flowering as cleared in Tables 1 and 2.

Table 1 : Maturity group, origin, stem termination (Indeterminate (I) and Determinate (D)) and color of flowers (Purple (P) and White (W)) of soybean genotypes.

NO.	Genotypes	Maturity groups	Origin	Stem termination	Flower colors
1	Patty	II	USA	D	P
2	Dekabig	II	USA	D	P
3	Sapporo	II	USA	D	P
4	Osaka	II	USA	D	P
5	H30	III	Egypt	I	P
6	H15 L5	III	Egypt	I	P
7	H54	III	Egypt	I	P
8	Giza 82	III	Egypt	I	P
9	Giza 83	III	Egypt	I	W
10	Giza 35	III	Egypt	I	P
11	H32	IV	Egypt	I	P
12	H2 L12	IV	Egypt	I	P
13	H15 L17	IV	Egypt	I	P
14	Giza 21	IV	Egypt	I	P
15	Giza 22	IV	Egypt	I	P
16	Crawford	IV	USA	I	P
17	Giza 111	IV	Egypt	I	P
18	Clark	IV	USA	I	P
19	H2 L20	IV	Egypt	I	P
20	Toano	V	USA	D	P
21	DR 101	V	Egypt	D	P
22	Forrest	V	USA	D	P
23	Holladay	VI	USA	D	W
24	Hutcheson	VI	USA	D	W

Statistical analysis:

1- Analysis of variance:

A combined analysis of variance of randomized complete blocks design over 2002 and 2003 seasons was performed according to Snedecor and Cochran (1980). Duncans multiple range test was used to detect the significant difference between treatment means.

2- Correlation analysis:

Coefficients of simple correlation were calculated among seed weight/plant and its related characters.

3- Factor analysis:

The factor analysis method, discussed by Cattell (1965), consists of the reduction of a large number of correlated variables to a much smaller number of clusters of variables called factors. After the loading of the first factor was calculated, the process was repeated on the residual matrix to find further factors. When the contribution of a factor to the total percentage of the trace was less than 10%, the process stopped. After extraction, the matrix of factor loadings was submitted to a varimax orthogonal rotation, as applied by

Kaiser (1958). The effect of rotation is to accentuate the larger loadings in each factor and to suppress the minor loading coefficient and in this way to improve the opportunity of achieving a meaningful biological interpretation of each factor. Since the object was to determine the way in which yield components are related to each other, seed yield was not included in this structure. Factor analysis was performed using SPSS computer statistical package.

RESULTS AND DISCUSSION

Results of combined analysis of variance over the seasons of 2002 and 2003 are presented in Table 2. The results revealed significant differences among soybean genotypes for all studied traits indicating wide genetic variation between genotypes.

Flowering and maturity:

Results presented in Table 2 show that patty, Dekabig, Sapporo, Osaka, Giza 82 and Giza 83 recorded fewer days to 50 % flowering ranging from 19.7 to 26.8 days. Similarly, the same genotypes matured in 82 - 92 days being earlier than the other genotypes. On the other hand, Hutcheson, Holladay, Forrest, DR101 and Toano genotypes were the latest in flowering and maturity recording an average of 38.0 – 43.2 days to flowering and 125.7 – 132.5 days to maturity, respectively. The rest genotypes were intermediate. The present study were similar to those previously reported by El- Attar and Sharaf (1993), Samia *et al* (1993) and Eisa *et al* (1998).

Plant height and number of branches per plant:

Plants of Giza 111, Giza 21, Giza 22, H2L12, H 32, and H2L20 were significantly taller than the other genotypes. On the other hand, plants of patty, Dekabig, DR101, Holladay, Osaka and Sapporo were the shortest genotypes.

Plants of DR101 genotype produced the largest number of branches/plant being 4.0 branches followed by Toano, Holladay, Hutcheson, Giza 111, Giza 22 and H2L20. In contrast, plants of Osaka, Sapporo, Patty, Dekabig, H 54 and Giza 82 gave the lowest number of branches/plant.

Plant height and number of branches/plant are important characters since they reflect plant vigour that leads to high yield and their variability would be helpful for selecting parents to be used in crossing programs. These findings are similar to those obtained by Mohamed (1994) and Eisa *et al* (1998).

Number of pods and seeds/plant:

Giza 111 produced the largest number of pods and seeds/plant recording 59.2 and 132.5, respectively, followed by Giza 22, Giza 21, H2L12, H15L17, H15L5, Giza 35 and crawford. On the other hand, Patty, Dekabig, Osaka, Sappor, Hutcheson and Holladay genotypes produced the fewest number of pods and seeds/plant. EL – Attar and Sharaf (1993), Mohamed (1994) and Eisa *et al* (1998) obtained similar results.

T2

Seed weight/plant and weight of 100 seeds:

Results shown in Table 2 clear that the heaviest seed weight/plant and weight of 100 seeds being 18.4 gm and 16.1 gm, respectively were produced by Giza 111 followed by Giza 22, H15L17, H2L12, Giza 21, H15L5, crawford and Giza 35 .On the other hand, Patty, Dekabig, Osaka, Sapporo, Hutcheson, Forrest, Holladay and H 54 genotypes produced the lightest seed weight/plant and weight of 100 seeds. These results are in good agreement with those obtained by Mohamed (1994) and Eisa *et al* (1998).

Seed yield/fed:

Giza 111 soybean genotype produced the greatest seed yield/fed recording 1.35 t/fed followed by Giza 22, H2L12, Giza 35, Giza 21, H15L17 and crawford ranging from 1.282 to 0.877 t/fed. H 30, Clark, H 32, Giza 83, H2L20, H15L5, Giza 82, Toano and Holladay genotypes were inferior to the mentioned genotypes in seed yield recording an average of 0.844 to 0.598 t/fed. In this connection, the rest genotypes significantly gave lower average of seed yield ranging from 0.564 to 0.341 t/fed.

The superiority of Giza 111, Giza 22, Giza 21, Giza 35, H15L17 and crawford in seed yield/fed could be attributed to the higher number of pods and seeds/plant as well as seed weight/plant and weight of 100 seeds. The obtained results are in agreement with those reported by Awadallah *et al* (1990), Abd El-Monem *et al* (1991), El-Atter and Sharaf (1993), Mohamed (1994), Eisa *et al* (1998) and Hassan *et al* (2001) and (2002).

In general, Giza 111, Giza 22, H2L12, Giza 35, Giza 21 , H15L17 and crawford which represent maturity groups III and IV could be recommended for the new reclaimed land of East Owinat. They are of high yielding and cotton leaf worm resistant genotypes. Growing these new genotypes would increase soybean productivity, decrease production costs and reduce environmental pollution through avoiding or minimizing the use of insecticides in soybean fields in such region.

Correlation Matrix:

Matrix of simple correlation coefficients among seed weight/plant and related characters is presented in Table 3. The results clearly indicated that seed weight/plant was positively and significantly correlated with each of days to maturity, plant height, number of branches, pods and seeds/plant and weight of 100 seeds. The corresponding values of correlation coefficients were 0.288, 0.795, 0.359, 0.940, 0.991 and 0.839, respectively.

The results also showed that there was highly significant and positive association between days to 50 % flowering and each of days to maturity, number of branches/ plant and weight of 100 seeds. Days to maturity was found to be highly significant and positively correlated with number of branches, pods/plant and weight of 100 seeds with values of r being 0.856** , 0.378** and 0.489**, respectively. Whereas the correlation between days to maturity and each of plant height and number of seeds/plant was found to be positive significant with r values of 0.256* and 0.292*, respectively. Highly significant and positive association was detected between plant height and each of pods (r = 0.816**), seeds/plant (r = 0.790**) and weight of 100 seeds (r

= 0.860**), while the correlation between plant height and number of branches/plant was significant and positive with r value being 0.270*. correlation between number of branches/plant and each of number of pods and seeds/plant and weight of 100 seeds were found to be highly significant and positive with r values of 0.488**, 0.370**, and 0.561**, respectively. Similarly, highly significant and positive association was detected between number of pods/plant and each of number of seeds/plant (r = 0.955**) and weight of 100 seeds (r = 0.892**). Also, number of seeds /plant highly significantly and positively correlated with weight of 100 seeds with value of r being 0.828**, this approach has been used in soybean by EL-Rassas and EL-Rayes (1992).

Table 3: Simple correlation coefficients between seed weight/plant and its components over both seasons of 2002 and 2003.

Characters	X1	X2	X3	X4	X5	X6	X7
Days to 50 % flowering (x1)	1.000						
Days to maturity (x2)	0.884**	1.000					
Plant height (x3)	0.112	0.256*	1.000				
No. of branches/plant (x4)	0.846**	0.856**	0.270*	1.000			
No. of pods/plant (x5)	0.223	0.378**	0.816**	0.488**	1.000		
No. of seeds/ plant (x6)	0.096	0.292*	0.790**	0.370**	0.955**	1.000	
Weight of 100 seeds (x7)	0.375**	0.489**	0.860**	0.561**	0.892**	0.828**	1.000
Seed weight/ plant (y)	0.084	0.288*	0.795**	0.359**	0.940**	0.991**	0.839**

*** Significant at 5% level of significance.**
**** Significant at 1% level of significance.**

Factor analysis:

Results of factor analysis are shown in Tables 4 and 5. Factors were constructed using the principal factor analysis procedure to achieve the dependent relationship between yield components in soybean. Factor analysis grouped seven characters of soybean into two main factors. The composition of variables of the two factors with loadings is presented in Table 4.

The results showed that the two factors accounted for 91.19 % of the total variability in the dependence structure. Factor I contained plant height, number of pods and seeds/plant and weight of 100 seeds. Factor I was responsible for 50.92 % of the total variation in the structure.

Factor II included three variables which accounted for 40.27 % of the total variability. These variables were days to 50 % flowering, days to maturity and number of branches/plant.

Table 4: Principal factor matrix after orthogonal rotation for seven characters of soybean.

Variables	Factors		Communality (h^2)
	Factor I	Factor II	
Days to 50% flowering	0.025	0.969	0.939
Days to maturity	0.201	0.935	0.915
Plant height	0.919	0.058	0.848
Number of branches/plant	0.284	0.908	0.905
Number of pods/ plant	0.948	0.215	0.945
Number of seeds/ plant	0.948	0.094	0.908
Weight of 100 seeds	0.894	0.351	0.922

Variables arranged in table 5 as follow :

Generally, number of pods and seeds/plant, plant height and weight of 100 seeds were the most important variables in factor I which had a large communality value (h^2 = 50.92 %). These findings are similar to those obtained by EL- Rassas and EL-Rayes (1992).

Days to 50% flowering, days to maturity and number of branches/plant were the second important variables in factor II which had a communality value (h^2= 40.27%).

Table 5: Summary of factor loading for seven variables of soybean.

Factors	Loading	% Total Communality
Factor I:		50.92
1- Number of pods/plant.	0.948	
2- Number of seeds/plant.	0.948	
3- Plant height	0.919	
4- Weight of 100 seeds.	0.894	
Factor II:		40.27
1- Days to 50% flowering	0.969	
2- Days to maturity	0.935	
3- Number of branches/plant	0.908	
Commulative variance		91.19

From the previous results, it could concluded that factor analysis indicates both grouping and percentage contribution to the total variability in the dependent structure. Using factor analysis by plant breeders has the potential of increasing the comprehension of causal relationship of variables and can help to determine the nature and sequence of traits to be selected in a breeding program. This may be helpful in planning a suitable selection strategy to improve soybean crop.

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J. Agric. Sci. Mansoura Univ., 30 (1), January, 2005

تقييم بعض التراكيب الوراثية من فول الصويا في الأراضي الجديدة بشرق العوينات

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Table 2: Mean values of yield and some agronomic characteristics of some soybean genotypes grown at East – owinat ccording to combined analysis over both 2002 and 2003 seasons.

Genotype	Days to flowering	Days to maturity	Plant height (Cm)	No. of branches/ plant	No. of Pods/plant	No. of seeds/ Plant	Seed weight /plant (gm)	Weight of 100 seeds (gm)	Seed yield/ fed (ton)
H 30	[illegible] L	[illegible] I	[illegible] H	[illegible] H	[illegible] K	[illegible] I	[illegible] H	[illegible] J	[illegible] G
H 32	[illegible] J	[illegible] G	[illegible] D	[illegible] L	[illegible] MN	[illegible] J	[illegible] I	[illegible] F	[illegible] I
H 2 L12	[illegible] J	[illegible] G	[illegible] C	[illegible] G	[illegible] D	[illegible] C	[illegible] C	[illegible] D	[illegible] C
H 15 L5	[illegible] L	[illegible] K	[illegible] GH	[illegible] IJ	[illegible] G	[illegible] F	[illegible] E	[illegible] H	[illegible] J
H 15 L17	[illegible] L	[illegible] FG	[illegible] I	[illegible] H	[illegible] E	[illegible] D	[illegible] C	[illegible] D	[illegible] E
H 54	[illegible] H	[illegible] H	[illegible] L	[illegible] N	[illegible] PQ	[illegible] P	[illegible] M	[illegible] N	[illegible] O
Giza 82	[illegible] N	[illegible] NO	[illegible] J	[illegible] M	[illegible] L	[illegible] N	[illegible] L	[illegible] K	[illegible] K
Giza 83	[illegible] M	[illegible] L	[illegible] F	[illegible] K	[illegible] J	[illegible] L	[illegible] M	[illegible] I	[illegible] I
Giza 21	[illegible] J	[illegible] EF	[illegible] B	[illegible] EF	[illegible] C	[illegible] E	[illegible] D	[illegible] B	[illegible] D
Giza 22	[illegible] J	[illegible] FG	[illegible] C	[illegible] D	[illegible] B	[illegible] B	[illegible] B	[illegible] C	[illegible] B
Crawford	[illegible] K	[illegible] E	[illegible] F	[illegible] F	[illegible] F	[illegible] G	[illegible] F	[illegible] E	[illegible] F
Giza 111	[illegible] G	[illegible] D	[illegible] A	[illegible] D	[illegible] A	[illegible] A	[illegible] A	[illegible] A	[illegible] A
Toano	[illegible] E	[illegible] C	[illegible] N	[illegible] B	[illegible] I	[illegible] K	[illegible] KL	[illegible] L	[illegible] L
DR101	[illegible] D	[illegible] B	[illegible] R	[illegible] A	[illegible] OP	[illegible] N	[illegible] M	[illegible] M	[illegible] N
Holladay	[illegible] B	[illegible] B	[illegible] Q	[illegible] C	[illegible] R	[illegible] O	[illegible] N	[illegible] N	[illegible] M
Hutcheson	[illegible] A	[illegible] A	[illegible] M	[illegible] C	[illegible] Q	[illegible] P	[illegible] O	[illegible] N	[illegible] N
Clark	[illegible] I	[illegible] FG	[illegible] G	[illegible] J K	[illegible] M	[illegible] M	[illegible] K	[illegible] L	[illegible] H
Giza 35	[illegible] L	[illegible] J	[illegible] F	[illegible] I	[illegible] H	[illegible] H	[illegible] G	[illegible] G	[illegible] C
Forrest	[illegible] C	[illegible] C	[illegible] K	[illegible] G	[illegible] O PQ	[illegible] M	[illegible] NO	[illegible] O	[illegible] N
H2 L20	[illegible] F	[illegible] D	[illegible] E	[illegible] E	[illegible] NO	[illegible] L	[illegible] J	[illegible] F	[illegible] GH
Patty	[illegible] Q	[illegible] P	[illegible] R	[illegible] P	[illegible] V	[illegible] T	[illegible] Q	[illegible] Q	[illegible] Q
Dekabig	[illegible] P	[illegible] O	[illegible] R	[illegible] O	[illegible] U	[illegible] S	[illegible] Q	[illegible] Q	[illegible] P
Sapporo	[illegible] O	[illegible] LM	[illegible] O	[illegible] P	[illegible] S	[illegible] Q	[illegible] P	[illegible] P	[illegible] O
Osaka	[illegible] O	[illegible] MN	[illegible] P	[illegible] Q	[illegible] T	[illegible] R	[illegible] P	[illegible] P	[illegible] O
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Duncans multiple range test was used to detect the significant difference between treatment means.