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EVALUATLON OF PERFORMANCE AND STABILITY OF SOME SOYBEAN GENOTYPES UNDER DIFFERENT ENVIRONMENTS

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ABSTRACT

Eleven soybean genotypes were evaluated for mean performance and stability of seed yield, pod number per plant and 100-seed weight under two sowing dates; mid-April and mid-May and five fertilization levels including biological inoculation with Bradyrhizobium japonicum and mineral nitrogen fertilizer during 1998 season (at Benha, Kalubia Governorate) and 1999 (at Kotour, Gharbia Govern.). Wide variation existed among genotypes for the 3 studied traits. Seed yield and 100-seed weight were higher in favor of mid-April, while pod number was increased in mid-May date. Rhizobium inoculation only produced the highest pod number and seed yield at Benha site, while adding inoculum + starter N of 15 Kg/fed produced the highest values in poorer soil at Kotour site. Phenotypic stability according to **Kang and Magari (1995)** indicated that L70 and L29 lines and cv. Crawford were the most stable for seed yield. Line L29 was also the best yielder across the 20 environments and thus deserve to be distributed as a commercial cultivar.

Key Words: Soybeans, Sowing dates, Inoculation, N-fertilizer, Stability.

INTRODUCTION

The soybean, Glycine max (L.) Merrill. is the world's leading source of vegetable oil and protein meal. The oil extracted is used for cooking oil, margarine and salad dressings. The protein meal remaining is processed and used mainly as feed for poultry and livestock, but products processed for human consumption are increasing. In Egypt, the soybean initiated its production in 1970 in an area of 3261* fed. and reached its peak in 1983 by growing 147155 fed., then declined progressively till it reached 12678 fed. in 2001. Therefore, increasing the devoted land for soybean either in old or in newly reclaimed lands, as well as, increasing yield per unit area, is indispensable to restore the prominent *rank* of this

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viable crop in Egyptian Agriculture. Choosing the promising lines or varieties and planting them in the proper date with applying the optimum biological and mineral nitrogen fertilizers are among the most important factors affecting the productivity of soybean. The majority of investigators either in Egypt or abroad reported that delaying sowing date reduced seed yield and seed index but increased pod number per plant in some genotypes (**Hussein *et al* 1978; Eid *et al* 1979; Zeyada *et al* 1980; Beaver and Johnson, 1981; Sarmah *et al* 1984; El-Attar, 1993, and El-Karamity, 1996**). With regard to the effect of fertilization, several workers like **Saad *et al* (1980); Papakosta & Veresoglou (1989) and Starling *et al* (1998)** reported that application of a starter N (15-20 Kg / fed) along with inoculation with rhizobia produced the highest seed yield.

Stability of performance is one of the most desirable properties of a genotype to be released as a variety for wide cultivation. A number of statistical methods are now known for estimation of phenotypic stability. Recently, **Kang and Magari (1995)** proposed an integrated yield and stability of performance statistics (Ysi) for simultaneous selection for yield and yield stability.

The present study was designed to evaluate the performance of eleven soybean genotypes under two sowing dates and five fertilizer levels and to detect the highest yielding and stable genotype across 20 environments.

MATERIAL AND METHODS

Two field experiments were carried out in 1998 and 1999 growing seasons. In the first season, the trial was conducted at Benha Agric. Res. Station, Kalubia Governorate. In the second season, the trial was conducted at Kotour,located at the north of Gharbia Governorate to evaluate the performance and stability of 11 soybean genotypes under two sowing dates and five fertilization levels in two seasons. Prior to sowing, the physical and chemical proprties of the soil of the two experimental sites were analyzed mechanically and chemically. The characteristics in both sites are presented in Table (1). Preceding crop at Benha site was clover, while it was cabbage at Kotour site.

Table 1. Mechanical and chemical analysis of soil at Benha and Kotour sites at a depth of 30 cm

Mechanical analysis

Site	Season	Coarse Sand %	Fine Sand %	Silt %	Clay %	Class
Benha	1998	5.88	12.26	22.98	58.88	Clay
Kotour	1999	5.36	15.41	24.83	54.40	Clay

Chemical analysis

Site	pH	EC	Soluble cations Me/L				Soluble anions Me/L		
	25:1	Ds/m	++Ca	++Mg	+Na	+K	$--SO_4$	-Cl	$-HCO_3$
Benha	8.3	1.1	4.0	0.8	6.5	0.2	2.3	4	5.2
Kotour	8.5	2.5	6.5	3.1	17.6	0.6	6.85	15	6.0

Site	Main element ppm			Micro element ppm			
	N	P	K	Mn	Zn	Cu	Fe
Benha	71	55	528	2.3	0.06	1.7	1.4
Kotour	37	8	232	2.0	0.06	1.3	0.92

The genetic materials used in each season consisted of 5 cultivars commercially grown in Egypt, viz., Clark, Crawford, Giza 82, Giza 21 and Giza 35 and 2 cultivars introduced from Illinois, U.S.A, namely; Holiday and DR 101. The materials contained also 4 lines, namely; L70, L29, H22 and MBB 80-133, the latter was introduced from Illinois. The 11 genotypes were subjected to ten different environments in each season as combination between two sowing dates (D) and five fertilization levels (F). The two sowing dates used were mid-April (D1) and mid-May (D2) in each season. Bioloigcal fertilizer as inoculation with *Bradyrhizobium japonicum* and mineral nitrogen fertilizer were used as follows:

(1) F0: Unfertilized control
(2) F1: Inoculum only
(3) F2: Inoc. + 15 Kg N / fed. (starter N) at 1st irrigation
(4) F3: Inoc. + 15 Kg N at 1st irrigation + 15 Kg N at 2nd irrigation
(5) F4: Inoc. + 15 Kg N at 1st irrigation + 45 Kg N splitted into two parts, each part was added at 2nd and 3rd ones.

Seeds were treated with inoculum in the field directly before sowing as recommended and nitrogen was added as ammonium nitrate 33.5%N.

Split plot design with four replications for each sowing date was assumed. Fertilization levels were allocated to main plots and genotypes to the sub-plots. The experimental plot consisted of one row, 4m in length and 60 cm apart. Plants spaced 5 cm within the row and one plant was left per hill.

At harvest ten guarded individual plants were randomly taken for recording data on the following traits: 1- Number of pods per plant.2- Weight of seed yield per plant (gm) and 3- 100-seed weight (gm).

Statistical analysis for split plot design was separately carried out for each sowing date as well as combined analysis over both sowing dates in each growing season was performed according to **Snedecor and Cochran (1981).** L.S.D was computed to compare differences among means of sowing dates, fertilizer levels and genotypes and their interactions at 5% level. Combined analysis of variance was also made for stability analysis assuming 20 environments (2 sowing dates x 5 fertilizer levels x 2 seasons). Homogeneity of variances for the two seasons was tested using Bartlettes test for homogeneity of variance as outlined by **Steel and Torrie (1980)**.

Kang and Magari (1995) procedure that depended only on **Shukla (1972)** was used to investigate the degree of stability of higher performance via three statistics; i.e. S^2, σ^2 and Yi that were confounded into one measure called Ysi where:

S^2= Cultivars variance over environments before removing residual effects.

σ^2= Cultivars variance over environments after removing residual effects.

Ysi= Yield stability statistic for cultivars number I, the cultivars greater than Ysi is characterized by stability of high performance i.e. stable and high yielding.

RESULTS AND DISCUSSION

A- Performance of genotypes

Mean squares of analysis of variance over the two sowing dates and five fertilization levels in 1998 and 1999 seasons for seed yield, pod number per plant and 100-seed weight of 11 genotypes are given in Table (2).

Table 2. Mean squares of combined analysis of variance over 2 sowing dates (D) and fertilization levels (F) in 1998 and 1999 for the studied characters of soybean genotypes (G).

Source of variance	d.f	Seed yield / plant gm		Pod number / plant		100-seed weight gm	
		1998	1999	1998	1999	1998	1999
F	4	219.01**	239.17**	3047.92**	2990.10**	6..32**	22.64**
Error	12	2.29	3.05	19.70	46.54	0.374	1.36
G	10	1636.88**	310.33**	9907.74**	829.30**	78.158**	122.51**
FG	40	2.04ns	4.45**	241.47**	80.69**	6.69**	4.20**
D	1	9.91*	116.68**	28.48 ns	9361.07**	15.05**	893.85**
FD	4	3.98ns	9.25**	40.51 ns	255.19**	2.13**	8.46**
GD	10	74.39**	36.62**	1074.82**	459.47**	9.28**	10.88**
DFG	40	2.13ns	4.17**	151.30**	78.47**	5.06**	3.18**
Error	315	1.89	2.38	31.77	34.49	0.47	0.683

*** : Denote significant differences at 5% and 1% levels , respectively

Examining this Table, it was found that fertilization levels (F) mean squares were highly significant in the two seasons for the three traits studied. Mean squares of genotypes (G) were highly significant for all traits in both seasons, suggesting the presence of wide range of differences between genotypes concerning all traits. Mean squares of sowing dates (D) were also significant for the 3 traits except pod number in the first season. Most of the first order interactions were significant. Also, second order FxGxD interactions were significant except for seed yield in the first season.

A test of homogeneity of error variances was made using error mean squares of the two seasons for the 3 traits, which revealed that error mean squares are heterogeneous. In such case, combined analysis over seasons is expected to be misleading. So the data of each season should be discussed separately.

1. Seed yield per plant

Means of seed yield per plant (gm) as affected by sowing dates, fertilization levels and soybean genotypes and their interactions for 1998 and 1999 growing seasons are recorded in Table (3).

The analysis of variance of the first season revealed that the effects of main sources of variation; i.e. sowing dates (D), fertilizer levels (F) and genotypes (G) on this trait were significant, whereas all first and second order interactions were insignificant, except DXG interaction which was significant. On the other hand, analysis of variance of the second season revealed that all effects of the main sources; D, F and G and all ranks of interactions were significant.

With regard to the effect of sowing dates on seed yield per plant in 1998 season, the mean seed yield obtained from mid-April and mid-May sowing dates amounted to 30.6 and 30.3 gm respectively, showing a slight increase in favor of mid- April over mid- May but the small difference reached the level of significance. In 1999 season, the mid- April date also surpassed mid- May date, giving mean values of 22.5 and 21.4 gm, respectively.

Wide differences in seed yield / plant between the eleven genotypes existed in the combined analysis of the two sowing dates as well as within each sowing date in both seasons. The combined analysis of 1998 season indicated that L29 genotype followed by Crawford outyielded the other genotypes giving mean values of 39.7 and 37.6 gm, respectively. These two genotypes showed the same superiority and ranking in mid- April and mid-May sowing dates. The combined analysis also showed that Giza 21 and Giza 35 produced relatively high seed yields of 34.3 and 34.2 gm, respectively. On the other hand, Holiday and MBB-80-133 produced the lowest seed yield/plant with respective values of 19.7 and 20.8 gm as displayed by the combined analysis.

In 1999 season L29 genotype proved to be again the best yielder with mean seed yields of 30.1, 25.3 and 27.7 in D1, D2 and combined, respectively. DR101 which gave low yield in the first season ranked second in the 1999 season with mean values of 25.0, 23.2 and 24.2 gm in D1, D2 and combined, while MBB-80-133 gave the lowest yield in the second season with mean values of 15.5, 16.9 and 16.2 gm in D1, D2 and combined, respectively.

Table 3. Response of seed yield per plant (gm) of different soybean genotypes (G) to sowing dates (D) and fertilization levels (F) in 1998 and 1999.

1998 season

Genotype (G)	F0	F1	F2	F3	F4	Mean
			Mid-April (D1)			
Clark	27.2	32.7	31.4	30.2	29.8	30.3
Crawford	35.1	39.8	38.3	38.2	37.1	37.7
G iza 82	29.6	33.9	33.3	31.3	31.7	31.9
G iza 21	32.4	37.0	36.4	35.3	34.8	35.2
G iza 35	29.7	34.9	33.7	31.8	32.3	32.5
L 70	28.5	32.5	32.5	30.4	30.9	30.9
L 29	37.1	42.5	40.8	39.5	40.3	40.0
MBB 80-133	21.0	25.7	25.6	24.3	21.1	23.5
H 22	29.8	34.0	32.9	32.2	32.7	32.3
Holiday	17.5	19.8	19.2	18.6	18.7	18.7
DR 101	22.8	25.1	25.1	23.6	22.7	23.8
Mean	**28.2**	**32.5**	**31.7**	**30.5**	**30.2**	**30.6**
			Mid-May (D2)			
Clark	30.4	35.0	34.7	33.4	33.8	33.4
Crawford	33.2	39.7	39.2	37.7	38.2	37.6
G iza 82	27.8	29.6	31.6	29.9	30.2	29.8
G iza 21	32.3	34.9	34.3	32.5	32.8	33.3
G iza 35	33.3	37.3	38.4	35.3	35.0	35.9
L 70	28.9	31.5	30.3	29.7	30.1	30.1
L 29	37.0	41.0	40.4	39.1	39.5	39.4
MBB 80-133	16.6	18.9	19.1	17.7	17.9	18.0
H 22	26.1	30.9	31.2	30.9	29.4	29.7
Holiday	18.3	21.6	21.5	21.2	20.9	20.7
DR 101	22.4	26.6	27.6	25.8	26.2	25.7
Mean	**27.8**	**31.6**	**31.7**	**30.3**	**30.3**	**30.3**
			Combined			
Clark	28.8	33.8	33.1	31.8	31.8	31.8
Crawford	34.1	39.7	38.7	38.0	37.6	37.6
G iza 82	28.7	31.7	32.5	30.6	31.0	30.9
G iza 21	32.3	36.0	35.3	33.9	33.8	34.3
G iza 35	31.5	36.1	36.0	33.6	33.6	34.2
L 70	28.7	32.0	31.4	30.0	30.5	30.5
L 29	37.0	41.7	40.4	39.3	39.9	39.7
MBB 80-133	18.8	22.3	22.3	21.0	19.5	20.8
H 22	27.9	32.5	32.0	31.5	31.1	31.0
Holiday	17.9	20.7	20.3	19.9	19.8	19.7
DR 101	22.6	25.8	26.3	24.7	24.4	24.8
Mean	**28.0**	**32.0**	**31.7**	**30.3**	**30.3**	**30.5**

Table 3. Cont.

1999 season

Genotype (G)	F0	F1	F2	F3	F4	Mean
			Mid-April (D1)			
Clark	19.3	21.4	23.6	20.2	19.8	20.9
Crawford	19.0	23.5	24.0	20.4	21.0	21.6
G iza 82	19.9	21.6	23.5	20.5	21.2	21.3
G iza 21	21.8	24.7	26.7	24.4	22.8	24.1
G iza 35	19.0	23.0	25.6	21.5	19.1	21.6
L 70	22.9	22.6	25.1	23.9	21.8	23.3
L 29	26.7	30.0	34.1	29.8	29.7	30.1
MBB 80-133	13.9	14.5	19.0	15.0	15.0	15.5
H 22	18.1	23.4	24.7	20.8	22.3	21.9
Holiday	19.2	20.2	24.7	21.9	23.2	21.8
DR 101	23.3	24.6	27.7	24.8	25.0	25.1
Mean	**20.3**	**22.7**	**25.3**	**22.1**	**21.9**	**22.5**
			Mid-May (D2)			
Clark	19.0	20.2	23.9	19.8	19.8	20.5
Crawford	21.8	22.5	24.8	22.3	25.6	23.4
G iza 82	17.8	18.5	20.5	19.9	19.6	19.2
G iza 21	19.5	21.9	23.7	20.9	20.4	21.3
G iza 35	18.4	18.7	21.9	21.5	21.0	20.3
L 70	20.4	22.5	23.8	20.4	21.1	21.6
L 29	23.0	26.7	27.2	26.1	23.6	25.3
MBB 80-133	15.4	17.4	18.6	17.7	15.6	16.9
H 22	18.9	20.5	24.5	24.0	23.9	22.4
Holiday	18.3	19.8	24.6	21.9	21.8	21.3
DR 101	21.3	22.2	26.0	24.1	23.4	23.4
Mean	**19.4**	**21.0**	**23.6**	**21.7**	**21.4**	**21.4**
			Combined			
Clark	19.1	20.8	23.8	20.0	19.8	20.7
Crawford	20.4	23.0	24.4	21.4	23.3	22.5
G iza 82	18.8	20.0	22.0	20.2	20.0	20.3
G iza 21	20.7	23.3	25.2	22.6	21.5	22.7
G iza 35	18.7	20.8	23.7	21.5	20.0	21.0
L 70	21.6	22.5	24.4	22.2	21.5	22.4
L 29	24.9	28.3	30.6	28.0	26.6	27.7
MBB 80-133	14.6	16.0	18.8	16.4	15.3	16.2
H 22	18.5	22.0	24.6	22.4	23.1	22.1
Holiday	18.7	20.0	24.6	21.9	22.5	21.5
DR 101	22.3	23.4	26.8	24.4	24.2	24.2
Mean	**19.8**	**21.8**	**24.5**	**21.9**	**21.7**	**21.9**

* F0 = Unfertilized control F1 = Inoculation F2 = Inoc. + 15 kg N / fed. F3 = Inoc. + 30 kg N/fed.
F4 = Inoc. + 60 kg N/fed.

LSD 5%	1998	1999	1998	1999	1998	1999
D					0.26	0.29
F	0.65	0.92	0.60	0.71	0.45	0.57
DF					NS	0.64
G	0.87	1.03	0.84	0.85	0.60	0.68
DG					0.852	0.96
FG	NS	2.30	NS	1.90	NS	1.51
DFG					NS	2.14

Effect of fertilization levels on seed yield / plant was clear in both seasons. The combined analysis of D1 and D2 in 1998 season revealed that the highest seed yield / plant of 32.0 gm was produced from plants fertilized with Bradyrhizobium only (F 1) without application of any N fertilizer, whereas gradual reduction in seed yield was attained when adding N with the rates of 15,30 and 60 Kg N / fed. On the other hand, the unfertilized control (Fo) which received neither rhizobium nor N fertilizer produced the lowest seed yield / plant of 28.0 gm. This trend was noticed in D1 and D2. As for 28.0 gm. This trend was noticed in D1 and D2. As for the second season 1999, the soybean genotypes showed different response to fertilization treatments as compared to the first season. The combined analysis revealed that the highest seed yield/plant of 24.5 gm was obtained form plants fertilized with Bradyrhizobium + starter N of 15 kg / fed (F 2 level), while the lowest yield of 19.8 gm was obtained from the unfertilized control. The same trend was observed in D1 and D2. Observations were made on roots of plants of different fertilization treatments indicated that abundant numbers of nodules were formed on the roots of plants biofertilized with Bradyrhizobium and / or plants inoculated and later received mineral fertilizer of 15,30 or 60 kg N/fed, while very few nodules were formed or rarely found on the roots of the uninoculated or unfertilized control which may explain the lowest yield or the lowest number of pods per plant produced from the unfertilized control in both seaseons.

It is Known that soybeans like other legume crops benefits from nitrogen fixing sympiosis formed with *Bradyrhizobium japonicum*. Effective bacterial strains that are capable of fixing large quantities of atmospheric nitrogen potentially can satisfy all of or a great part of the nitrogen requirements of soybeans and thus preclude the need for chemical fertilizers. Unfortunately, the Egyptian soils are devoid of this sort of bacterium which nodulate soybeans. Thus, from the result obtained herein it is important to inoculate soybean with *B. japonicum* especially in old land having no history of cultivating soybeans or in new land intended for soybean production.

The data recorded in Table (3) also indicated that the overall mean of the eleven genotypes across sowing dates and fertilization levels amounted to 30.5 gm for the experiment grown in 1998 season at Benha and 21.9 gm for the experiment grown in 1999 at Kotour, giving a reduction of 28.2% in seed yield/plant at the latter site. This reduction in yield may be explained by the analysis of soil conducted prior to sowing at the two sites (Table1) which indicated that the soil at Benha is relatively fertile, being higher in the major nutrient elements (NPK) and micro elements (Mn, Zn, Cu and Fe). Ec as an indication of salinity level was also lower at Benha in addition to that the preceding crop at Benha was clover while it was cabbage at Kotour. This analysis of soil may explain, in part, in addition to weather seasonal fluctuations, the higher yield in favor of Benha as compared to Kotour. The higher N level at Benha site may explain also why inoculation with rhizobium was sufficient to produce maximum yield at Benha and the need for applying starter N of 15 Kg / fed. at Kotour to maximize seed yield per plant. However, applying excess nitrogen as 30,60 units or more seemed to be detrimental to the efficiency of rhizobium in fixing atmospheric nitrogen and hence reduced yield as mentioned earlier.

The interactions D x G in 1998 season and D x F, D x G, FG and D xF x G in 1999 season were significant, indicating that in the first season the line L29 gave the highest seed yield / plant (42.5 gm) at mid –April sowing date when fertilized with *B. japonicum* only, while the lowest yielding genotype was MBB 80 – 133 giving 16.6 gm at the late sowing date of mid– May and at the unfertilized control. Again in the second season, the line L 29 gave the maximum seed yield (34.1 gm) when grown in mid- April and fertilized with rhizobium + 15 kg N / fed., meanwhile MBB–80- 133 produced the lowest seed yield (13.9 gm) at mid –April with no fertilizers applied.

The higher seed yield per plant in this study in favor of April than May sowing dates was also reached by **Hussein *et al* (1978)**; **Zeyada *et al* (1980)** and **El-Attar (1993)**. Other investigators especially in foreign countries began sowing soybeans mostly in May and found that delaying sowing date than May caused reduction in seed yield (**Beaver and Johnson, 1981** and **Sarmah *et al* (1984)**.

With regard to the effect of fertilization, **Starling *et al* (1998)** reported that application of starter N of about 15 to 20 kg/fed. along with inoculation produced the highest seed yield which agree with our second season results. Also, **Papakosta and Veresoglou (1989)** reported that cultivars generally performed better when they were inoculated than when received mineral N application only, which confirm our first season data.

2. Number of pods per plant

The mean values of number of pods per plant of eleven soybean genotypes as affected by sowing date, fertilization levels and their interactions in 1998 and 1999 season are presented in Table (4). The combined analysis of the two sowing dates in 1998 indicated that mean number of pods of the late mid-May date, amounted to 92.3 pods per plant which was higher than the early mid-April date with a mean value of 91.8 pods but the difference between the two dates was not significant. In 1999 season, mid-May sowing date surpassed appreciably and significantly mid-April in pods/plant with mean values of 72.0 and 62.7 pods, respectively.

With regard to genotype effects in 1998 season, each of Crawford and L 29 showed higher number of pods/plant in the combined analysis of 108.7 and 108.4, respectively, and both were consistently high in D1 and D2, Giza 21 tended to produce high pods in D1 and combined and Giza 35 in D2 and combined analysis. On the other hand, the determinate genotypes Holiday and DR101 as well as the indeterminate genotype MBB 80-133 produced the lowest pods / plant. In 1999 season, L70 and L29 gave the best number of pods / plant over D1, D2 and combined while Crawford and Clark gave high numbers only in D2. On the other hand MBB 80-133 and DR101 produced the lowest pods/ plant in the second season.

Fertilization levels markedly affected number of pods / plant in both seasons. In 1998 season the data pointed out that the highest number of pods / plant was attained at the application of Bradyrhizobium only (F1 level) and this

Table 4. Response of number of pods per plant of different soybean genotypes (G) to sowing dates (D) and fertilization levels (F) in 1998 and 1999.

1998 season

Genotype (G)	F0	F1	F2	F3	F4	Mean
			Mid-April (D1)			
Clark	74.8	93.1	91.4	93.6	85.3	87.6
Crawford	89.5	109.7	116.4	105.4	100.3	104.3
G iza 82	81.7	95.4	102.1	94.9	87.5	92.3
G iza 21	96.3	117.5	107.3	117.6	103.1	108.4
G iza 35	80.6	104.4	100.3	97.5	90.1	94.6
L 70	82.2	94.1	98..7	107.8	106.7	97.9
L 29	110.7	131.5	101.8	108.4	108.3	112.2
MBB 80-133	65.8	84.5	100.0	83.7	86.0	84.0
H 22	91.5	104.9	108.3	105.6	99.3	101.9
Holiday	57.8	66.5	62.6	57.4	59.7	60.8
DR 101	65.5	62.9	64.8	60.9	72.2	65.3
Mean	**81.5**	**96.8**	**95.8**	**93.9**	**90.8**	**91.8**
			Mid-May (D2)			
Clark	78.7	113.8	115.7	116.6	101.4	105.3
Crawford	107.2	121.5	106.6	114.5	115.9	113.1
G iza 82	83.7	91.0	97.81	93.3	94.4	92.0
G iza 21	87.6	108.8	93.0	91.4	104.0	96.9
G iza 35	92.0	117.6	120.1	105.7	100.3	107.1
L 70	101.2	109.4	98.1	89.1	99.8	99.5
L 29	101.5	117.9	104.6	104.3	95.1	104.7
MBB 80-133	62.2	60.9	89.6	71.5	70.2	70.9
H 22	84.8	91.8	96.9	92.8	86.6	90.6
Holiday	55.3	69.8	72.8	72.3	64.0	66.8
DR 101	66.0	73.1	70.0	66.1	64.1	67.9
Mean	**83.7**	**97.8**	**96.8**	**92.5**	**90.6**	**92.3**
			Combined			
Clark	76.8	103.5	103.6	105.1	93.3	96.5
Crawford	98.3	115.6	111.5	109.9	108.1	108.7
G iza 82	82.7	93.2	100.0	94.1	90.9	92.2
G iza 21	92.0	113.2	100.2	104.5	103.6	102.7
G iza 35	86.3	111.0	110.2	101.6	95.2	100.8
L 70	91.7	101.7	98.4	98.5	103.2	98.7
L 29	106.1	124.7	103.2	106.3	101.8	108.4
MBB 80-133	64.0	72.7	94.8	77.6	78.1	77.4
H 22	88.1	98.3	102.6	99.2	93.0	96.2
Holiday	56.5	68.1	67.7	64.9	61.8	63.8
DR 101	65.8	68.0	67.4	63.5	68.2	66.6
Mean	**82.6**	**97.3**	**96.3**	**93.2**	**90.7**	**92.0**

Table 4. Cont.

1999 season

Genotype (G)	F0	F1	F2	F3	F4	Mean
			Mid-April (D1)			
Clark	61.1	59.8	65.6	59.2	51.8	59.5
Crawford	55.5	61.2	66.4	64.2	58.2	61.1
G iza 82	63.0	63.9	68.7	57.9	56.9	62.1
G iza 21	60.5	56.9	68.4	57.0	57.5	60.0
G iza 35	52.7	57.3	74.6	61.0	51.0	59.3
L 70	70.6	68.0	81.8	73.5	61.9	71.2
L 29	69.9	71.4	83.9	73.9	72.4	74.2
MBB 80-133	48.3	47.9	65.5	51.9	49.8	52.7
H 22	55.8	64.9	72.3	58.0	66.3	63.5
Holiday	57.5	56.3	76.0	62.4	62.6	63.0
DR 101	65.4	64.8	67.5	61.9	58.2	63.6
Mean	**60.0**	**61.1**	**71.8**	**61.9**	**58.8**	**62.7**
			Mid-May (D2)			
Clark	73.2	76.9	91.5	75.0	73.2	77.9
Crawford	69.0	70.8	88.8	76.4	85.3	78.0
G iza 82	62.5	66.2	81.2	67.6	70.7	69.6
G iza 21	63.2	54.1	83.7	68.8	67.1	67.4
G iza 35	58.2	61.5	77.7	61.0	73.6	66.4
L 70	72.0	85.1	82.9	78.3	75.1	78.7
L 29	67.5	74.1	94.3	73.6	63.5	74.6
MBB 80-133	62.8	61.8	79.0	81.5	70.2	71.1
H 22	68.0	64.8	88.0	76.9	78.5	75.3
Holiday	60.5	70.1	77.1	75.9	72.9	71.3
DR 101	56.9	58.3	65.6	64.8	61.1	61.3
Mean	**64.9**	**67.6**	**82.7**	**72.7**	**71.9**	**72.0**
			Combined			
Clark	67.1	68.4	78.5	67.1	62.5	68.7
Crawford	62.2	66.0	77.6	70.3	71.7	69.6
G iza 82	62.7	65.1	74.9	62.8	63.8	65.9
G iza 21	61.9	55.5	76.0	62.9	62.3	63.7
G iza 35	55.5	59.4	76.1	61.0	62.3	62.8
L 70	71.3	76.6	82.3	75.9	68.5	74.9
L 29	68.3	72.8	89.1	73.7	68.0	74.4
MBB 80-133	55.5	54.9	72.3	66.7	60.0	61.9
H 22	61.9	64.9	80.2	67.5	72.4	69.4
Holiday	59.0	63.2	76.6	69.2	67.7	67.1
DR 101	61.1	61.6	66.5	63.3	59.6	62.4
Mean	**62.4**	**64.4**	**77.3**	**67.3**	**65.4**	**67.4**

* F0 = Unfertilized control F1 = Inoculation F2 = Inoc. + 15 kg N / fed. F3 = Inoc. + 30 kg N/fed. F4 = Inoc. + 60 kg N/fed.

LSD 5%	1998	1999	1998	1999	1998	1999
D					NS	1.10
F	2.87	3.14	1.73	2.79	1.5	2.23
DF					NS	2.45
G	3.09	3.58	3.06	3.67	2.47	2.57
DG					3.49	3.64
FG	8.69	8.01	6.84	8.18	1.99	5.57
DFG					7.81	8.13

trend was true in mid-April (D1), mid-May (D2) dates and their combined with mean values of 96.8, 97.8 and 97.3 pods / plant, respectively. On the other hand, the unfertilized control (F0) gave the least numbers of pods in D1, D2 and combined with respective values of 81.5, 83.7 and 82.6 pods per plant. The F2, F3 and F4 levels which contained 15, 30 and 60 kg N / fed in addition to inoculation with Bradyrhizobium produced lower numbers of pods as compared to the F1 treatment (Inoculation only). Data of the effect of fertilization levels in 1999 season showed a different trend to that of 1998 season, since the highest numbers of pods/plant were attained at the F2 level, i.e., inoculation with rhizobium in addition to applying 15 kg N / fed. (Starter N) giving mean numbers of 71.8, 82.7 and 77.3 in D1, D2 and combined, respectively.

All first order interactions were significant in 1998 season, except D x F. The second D x F x G was significant indicating that the highest number of pods per plant of 131.5 pods was obtained in mid-April date for L29 genotype when only inoculated with rhizobium (F1), while in 1999 season the same L29 genotype produced the highest number of 94.3 pods in mid-May when received starter N in addition to rhizobium (F2 level).

The increase of pods/plant in favor of late sowing in mid-May was also found by **Eid *et al* (1979) and El-Karamity (1996)** who found that some genotypes gave higher pods in first April while other gave higher pods in first May dates. On the contrary, **Zeyada *et al* (1980) and El-Attar (1993)** reported that delaying sowing date decreased number of pods per plant.

With regard to the effect of fertilization, **Mohamed (2000)** obtained significant increase in pod number per plant of the inoculated seeds of cv. Giza 21 by adding starter N of 15 kg/fed. as compared to zero N level which agree with the data of the second season of this study.

3. 100-seed weight

Analysis of variance for 1998 season (Table, 5) indicates that 100-seed weight was significantly affected by sowing date, fertilization levels and genotypes and their interactions, except F levels in mid-April. In the second season 1999 the three main sources, D, F and G and all ranks of interactions were significant.

In both seasons, the early dates of mid-April produced heavier seeds than mid-May dates especially in the second season. Mean values in 1998 season were 16.9 and 16.5 gm for D1 and D2, respectively while the mean values in 1999 season were 17.7 and 15.1 gm in the same order.

With regard to the effect of genotypes, the data of the combined analysis of the two sowing dates in 1998 season indicated that the determinate genotype DR101 followed by L29 genotype gave the heaviest seed weight with 100-seed weight of 18.6 and 18.5 gm, respectively, while the lightest seeds were obtained from MBB-80-133 with a mean value of 13.5 gm. These three mentioned genotypes proved to be consistent in D1 and D2, while some genotypes like Crawford and Giza 21 showed inconsistency being heavy in one date and moderate in the other exhibiting G x D interaction. In 1999 season, the same trend was

Table 5. Response of 100 seed weight (gm) of different soybean genotypes (G) to sowing dates (D) and fertilization levels (F) in 1998 and 1999.

1998 season

Genotype (G)	F0	F1	F2	F3	F4	Mean
			Mid-April (D1)			
Clark	18.2	17.6	17.4	16.0	17.5	17.3
Crawford	19.6	18.1	16.5	18.2	18.5	18.2
G iza 82	18.1	17.8	16.3	16.5	18.2	17.4
G iza 21	16.8	15.7	17.0	15.0	16.9	16.3
G iza 35	18.4	16.7	16.8	16.3	17.9	17.2
L 70	17.0	17.3	16.5	14.1	18.9	16.8
L 29	16.8	16.2	20.0	18.3	18.6	18.0
MBB 80-133	15.9	15.2	12.8	14.5	12.3	14.1
H 22	16.3	16.3	15.2	15.3	16.4	15.9
Holiday	15.1	16.1	15.3	16.2	15.6	15.7
DR 101	17.6	20.0	19.4	19.4	15.7	18.4
Mean	**17.3**	**17.0**	**16.7**	**16.3**	**17.0**	**16.9**
			Mid-May (D2)			
Clark	19.3	15.4	15.0	14.3	16.7	16.1
Crawford	16.6	16.4	18.4	16.5	16.5	16.9
G iza 82	16.3	16.1	16.2	16.0	16.0	16.1
G iza 21	18.4	16.1	18.4	17.8	15.8	17.3
G iza 35	18.2	15.9	16.0	16.5	17.5	16.8
L 70	14.3	15.1	15.5	16.6	15.1	15.3
L 29	18.3	17.4	19.4	18.8	20.8	18.9
MBB 80-133	13.4	15.5	10.7	12.4	12.7	12.9
H 22	15.4	16.9	16.1	16.7	17.0	16.4
Holiday	16.6	15.5	14.8	14.7	16.4	15.6
DR 101	16.9	18.2	19.1	19.5	20.5	18.8
Mean	**16.7**	**16.2**	**16.3**	**16.3**	**16.8**	**16.5**
			Combined			
Clark	18.7	16.5	16.2	15.2	17.1	16.7
Crawford	18.1	17.2	17.5	17.3	17.5	17.5
G iza 82	17.2	16.9	16.3	16.3	17.1	16.9
G iza 21	17.6	15.9	17.7	16.4	16.3	16.8
G iza 35	18.3	16.3	16.4	16.4	17.7	17.0
L 70	15.6	16.2	16.0	15.4	17.0	16.0
L 29	17.5	16.8	19.8	18.5	19.7	18.5
MBB 80-133	14.6	15.3	11.7	13.4	12.5	13.5
H 22	15.9	16.6	15.7	16.0	16.7	16.2
Holiday	15.9	15.8	15.0	15.5	16.0	15.6
DR 101	17.3	19.1	19.2	19.5	18.1	18.6
Mean	**17.0**	**16.6**	**16.5**	**16.3**	**16.9**	**16.7**

Table 5. Cont.

1999 season

Genotype (G)	F0	F1	F2	F3	F4	Mean
			Mid-April (D1)			
Clark	15.9	17.9	18.1	17.2	19.2	17.7
Crawford	16.7	19.2	18.3	18.7	18.0	18.2
G iza 82	15.8	16.8	17.0	17.7	18.7	17.2
G iza 21	18.1	21.8	19.6	21.4	19.9	20.2
G iza 35	18.1	20.0	17.4	17.6	18.2	18.2
L 70	16.2	16.7	15.3	16.3	17.6	16.4
L 29	19.3	21.0	20.4	20.4	20.5	20.3
MBB 80-133	14.4	15.2	14.5	14.5	15.0	14.7
H 22	16.2	17.8	17.1	18.0	16.9	17.2
Holiday	16.7	18.0	16.2	17.5	18.5	17.4
DR 101	17.8	19.0	20.6	20.1	20.7	19.6
Mean	**16.8**	**18.2**	**17.7**	**18.1**	**18.5**	**17.7**
			Mid-May (D2)			
Clark	13.0	13.2	13.1	13.2	13.5	13.2
Crawford	15.8	15.9	14.0	14.7	15.1	15.1
G iza 82	13.5	14.0	12.6	14.9	14.0	13.8
G iza 21	15.4	20.2	14.2	15.2	15.3	16.1
G iza 35	15.8	15.2	14.1	17.6	14.2	15.4
L 70	14.2	13.3	14.4	13.2	14.1	13.8
L 29	17.1	18.0	14.4	18.4	18.6	17.3
MBB 80-133	12.3	14.1	11.8	10.9	11.2	12.0
H 22	14.0	15.8	14.0	15.6	15.4	15.0
Holiday	15.1	14.2	15.9	14.5	15.0	14.9
DR 101	18.7	19.1	19.9	19.1	19.2	19.2
Mean	**15.0**	**15.7**	**14.4**	**15.2**	**15.0**	**15.1**
			Combined			
Clark	14.5	15.6	15.6	15.2	16.4	15.4
Crawford	16.3	17.6	16.1	16.7	16.5	16.6
G iza 82	14.7	15.4	14.8	16.3	16.3	15.5
G iza 21	16.7	21.0	16.9	18.3	17.6	18.1
G iza 35	17.0	17.6	15.8	17.6	16.2	16.8
L 70	15.1	15.0	14.9	14.7	15.8	15.1
L 29	18.2	19.5	17.4	19.4	19.5	18.8
MBB 80-133	13.3	14.6	13.1	12.7	13.1	13.4
H 22	15.1	16.9	15.5	16.8	16.1	16.1
Holiday	15.9	16.1	16.1	16.0	16.7	16.2
DR 101	18.3	19.1	20.2	19.6	20.0	19.4
Mean	**15.9**	**17.2**	**16.0**	**16.7**	**16.3**	**16.4**

* F0 = Unfertilized control F1 = Inoculation F2 = Inoc. + 15 kg N / fed.
F3 = Inoc. + 30 kg N/fed.
F4 = Inoc. + 60 kg N/fed.

LSD 5%	1998	1999	1998	1999	1998	1999
D					0.13	0.15
F	NS	0.48	0.25	0.37	0.02	0.38
DF					0.13	0.35
G	0.43	0.50	0.44	0.53	0.18	0.36
DG					0.29	0.51
FG	0.96	1.11	0.96	1.19	0.18	0.81
DFG					0.43	1.15

observed since the combined analysis indicated that DR101 followed by L29 gave the heaviest seeds of 19.4 and 18.8 gm, respectively, whereas MBB-80-133 gave the lightest seeds of 13.4 showing consistent permanence in D1 and D2 and stability in both seasons.

The differences in 100-seed weight due to fertilization treatments were small but significant in both seasons, except in the case of D1 in 1998 season which was not significant.

All the first order interactions in the two seasons were significant as well as the second order interactions D x F x G indicating that in the first season the L29 genotype produced the heaviest 100-seed weight of 20.8 gm in D2 and under F5 level, and 21.8 gm for Giza 21 in D1 and under F1 level in the second season.

Previous studies on the effect of date of sowing on 100-seed weight reported by **Hussein *et al* (1978) and Eid *et al* (1979),** have shown that April sowing gave heavier seed weight than other dates, which agree with the present results, while **El-Attar (1993)** found that 100-seed weight was not significantly affected by sowing date.

With regard to the effect of fertilization, inoculation was reported to be important by **Saad *et al* (1980)** who found that seed index increased by increasing N level up to 60 kg / fed. but N had no significant effect on seed index when it is combined with rhizobia.

B. Stability analysis

Stability analysis of variance for seed yield, 100-seed weight and pod number per plant was made according to **Kang and Magari (1995)** who upgraded the procedure of **Shukla (1972).** The results are given in Table (6).

Table 6. Stability analysis of variance for yield and its components according to Kang and Magari.

Source	D.F	Mean of squares		
		Seed yield	Pod number	100-seed weight
Total	219			
Genotypes	10	1375.63 **	6766.80 **	185.52 **
Environments	19	950.41 **	8864.02 **	55.92 **
Interaction	190	38.61 **	405.93 **	5.85 **
Heterogeneity	10	522.17 **	3749.58 **	14.89 **
Residual	180	11.74 **	220.17 **	5.35 **
Pooled error	600	2.16	33.09	1.64

* and ** : Significant at .05 and .01 levels, respectively

Examining this Table, it was found that all variance sources are highly significant, it implies that genotypes, environments and genotype x environment interactions are highly significant. It means that genotypes are genetically different with variable performance from environment to another. Residual and pooled error was significantly different. So, conclusions will be made using both sources.

Necessary statistics for evaluating cultivars according to **Kang and Magari (1995)** for seed yield, pod number per plant and 100-seed weight are given in Table (7).

This Table includes means, stability variance, S. squares, ecovalence and Ysi. It should be noted here that, the main statistic is Ysi that expresses stability of high performance and ranks of Ysi are given as positive and negative values, however, it is preferable to express Ysi as positive ranks. These positive ranks are given in Table (8) on pooled error (P) basis as well as on residual basis (R).

Cultivars with the ranks 1, 2 and 3 are categorized as good stable, whereas those with ranks 9, 10 and 11 are considered weak stable cvs. The ranks 4, 5, 6, 7 and 8 denote medium stability. Inspecting the ranks in Table (8) it is obvious, in the case of seed yield per plant, that the two lines L70 and L29 and cv. Crawford are good stable since they occupied the ranks 1, 2 and 3, respectively, while DR101, Holiday and MBB 80-133 with respective ranks 9, 10 and 11 are weak stable. The other genotypes occupied the medium stable category. With regard to pod number / plant, some changes in ranking existed where L29 ranked first. Crawford second and L70 ranked third. 100-seed weight showed additional changes in ranking but with L29 being the first. It could be concluded that L70, L29 and Crawford are the best stable but among the three genotypes L29 is considered to be the most important from the breeding standpoint, since it is good stable and gave the highest seed yield among all genotypes across sowing dates and fertilizer levels in both seasons (Table, 3), therefore the line L29 is recommended to be propagated and distributed as a good commercial soybean cultivar.

Soybean genotypes were evaluated in Egypt for stability performance across varying environments and showed different trends in this respect. For instance, **Shafik and Taha (1993)** reported that cvs. Crawford and Clark were high yielding and most stable among 12 genotypes evaluated under nine environments (years and locations), while **El-Hosary *et al* (1994)** found that Clark was more stable than Crawford under different 12 environments (sowing dates and years).

Table 7. Necessary statistics for evaluating soybean genotypes according to Kang and Magari for yield and its components.

Genotype	Mean	Stability variance	S. Square	Ecovalence	YS (i)	
					P*	R
			Seed yield			
Clark	26.28	13.90	9.71	282.71	-2	-2
Crawford	30.06	61.61	16.62	1024.50	5+	5+
G82	25.58	5.74	4.60	155.92	-6	-2
G21	28.47	13.07	5.45	269.92	4+	4+
G32	27.56	36.03	13.04	626.71	3+	3+
L70	26.48	0 .47	3.00	73.99	7+	7+
L29	33.69	23.18	9.70	427.07	6+	6+
MBB 80-133	18.49	41.00	26.13	704.07	-10	-10
H22	26.56	5.60	8.82	153.68	4+	4+
Holiday	20.63	141.25	19.43	2262.54	-9	-9
DR 101	24.50	82.85	12.69	1354.62	-8	-8
Mean =	26.21					
LSD(P=0.5)=	0.38					
			Pod number			
Clark	82.60	370.25	365.93	6456.79	0+	0+
Crawford	89.12	402.32	171.03	6955.31	5+	5+
G82	79.02	4.18	26.52	766.11	3+	3+
G21	83.18	435.19	255.64	7466.40	3+	3+
G32	81.85	380.35	165.96	6613.77	-10	-1
L70	86.81	157.54	181.79	3150.10	4+	4+
L29	91.40	400.52	385.02	6927.33	6+	6+
MBB 80-133	69.66	449.99	452.38	7696.36	-8	-8
H22	82.81	108.461	130.26	237.18	2+	2+
Holiday	65.47	1049.77	244.72	1702.23	-9	-9
DR 101	64.50	700.372	42.67	1161.98	10-	-10
Mean = LSD	79.68					
(P=0.5)=	1.50					
			100-seed weight			
Clark	16.08	7.75	5.98	130.61	-6	2
Crawford	17.08	3.42	3.59	63.33	2+	9+
G82	15.99	2.94	2.84	55.97	-1	3+
G21	17.45	11.44	10.58	188.11	4+	3+
G32	16.78	3.74	4.04	68.39	0+	8+
L70	15.58	6.03	6.40	103.87	-9	-2
L29	18.63	6.66	7.11	113.72	5+	11
MBB 80 –133	13.45	7.26	7.71	123.06	-10	-4
H22	16.12	1.37	1.27	31.54	4+	5+
Holiday	15.90	2.67	2.56	51.65	-4	1
DR 101	19.03	11.77	7.52	193.25	6+	6+
Mean =	16.57					
LSD(P=0.5)=	0.33					

* P = pooled error R = residual

Table 8. Ranking of genotypes according to Ysi indicating stability of high performance for yield and its components using pooled error (P) and residual (R).

Genotype	Seed yield		Pod number		100-seed weight	
	P	R	P	R	P	R
Clark	7	7	7	5	9	8
Crawford	3	3	2	2	5	2
G82	8	8	4	9	7	7
G21	4	4	5	4	3	6
G35	5	6	8	6	6	3
L70	1	1	3	3	10	10
L29	2	2	1	1	2	1
MBB 80 –133	11	11	9	11	11	11
H22	6	5	6	8	4	5
Holiday	10	10	10	7	8	9
DR 101	9	9	11	10	1	4

P = pooled error R= Residual
1, 2, 3 = Good stability
4, 5, 6, 7, 8 = Medium stability
9, 10, 11 = Weak stability

REFERENCES

Beaver, J.S. and R.R. Johnson (1981). Yield stability of determinate and indeterminate soybean adapted to the northern United States. *Crop Sci., 21: 449-454.*

Eid, M.H.; F.I. Gab-Alla; K.M. Rizk and R. Kh. Khalil (1979). Effect of sowing dates on plant characters. Yield and yield components of some soybean cultivars. *Annals of Agric. Sci., Moshtohor, Egypt, 12: 35-41.*

El-Attar, A.H. (1993). Varietal response to planting date in soybean. *Zagazig J. Agric. Res., 20 (2A): 559-569.*

El-Hosary, A.A.; S.H.M. El-Hefni; D.M. El-Hariri; M.A. Ahmed and M.E.S. Hassanein (1994). Stability parameters for comparing soybean cultivars. *Proc. 6th Conf. Agron., Al-Azhar Univ., Cairo, Egypt, Vol. 2: 509-522.*

El-Karamity, A.E. (1996). Potential productivity of some soybean genotypes at different dates of planting and harvesting. *Assiut J. Agric. Sci., 27(4): 57-76.*

Hussein, M.A.; M.S. Abdel-Raouf; A.A. Ibrahim and A.H. Essmail. A.H. (1978). Effect of sowing date and harvest time on soybean growth, yield and yield components. *Research Bull., No. 839, Fac. Agric., Ain Shams Univ., Cairo.*

Kang, M.S. and R. Magari (1995). Stable: a BASICA program for calculating stability and yield-stability statistics. *Agron. J., 87*: 276-277.

Mohamed, M.N.H. (2000). ***Soybean Productivity under Minimum Ecological Pollution with Rationalize and Maximize Efficiency of Water Irrigation. pp. 21-40.*** Ph.D. Thesis, Instit. Environ. Studies & Res., Ain Shams Univ., Abbasiya, Cairo.

Papakosta, D.K. and D.S. Veresoglou (1989). Response of soybean cultivars to inoculation and nitrogen application in Greece. ***J. Agronomy & Crop Sci., 163: 275-283.***

Saad, A.O.M.; A.T. Thalooth; N.I. Ashour and A.F. Sehab (1980). Effect of seeds inoculation and fertilization with different forms of nitrogen on growth, nitrogen uptake and yield of soybean. ***Proc. of the First Conf. of Agron., Egypt. Soc. of Crop Sci. Sept. 10-13, 2: 451-464.***

Sarmah, S.C.; M.M. Kalita and N.N. Kakati (1984). Effect of dates of planting on five soybean varieties. ***Soybean Genet. Newsletter, 11: 34-37.***

Shafik, M.M. and R.S. Taha (1993). Stability of seed yield in soybean. ***Egypt. J. Appl. Sci., 8(12): 540-552.***

Shukla, G.K. (1972). Some statistical aspects of partitioning genotype-environmental components of variability. ***Heredity*, 29: 237-245.**

Snedecor, G.M. and W.G. Cochran (1981). ***Statistical Methods.*** 7[th]Ed., Iowa State Univ. Press, Ames, Iowa,U.S.A.

Starling, M.E.; C.W. Wood and D.B. Weaver (1998). Starter nitrogen and growth habit effects on late-planted soybean. ***Agron. J., 90: 658-662.***

Steel, R.G.D and J. H. Torrie (1980). ***Primciples and Procedurse of Statistics.*** McGrow-Hill Book Co., New York, USA.

Zeyada, A.H.; M.S. El-Harroun and M.S. Abdel-Aal (1980). Effect of sowing date and population density on growth and yield of some soybean varieties. ***Res. Bull. No. 1245, Fac. Agric., Ain Shams Univ., Cairo.***

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تقييم أداء وثبات بعض التراكيب الوراثيه من فول الصويا تحت بيئات مختلفه

[٤٠]

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تم تقييم ١١ تركيبا وراثيا شملت خمسة أصناف منزرعه تجاريا بمصر وثلاث سلالات محليه وثلاثة أصناف وسلالات مستورده وذلك تحت ميعادين للزراعه (١٥إبريل ، ١٥مايو) وخمسة مستويات تسميد :

١- كنترول بدون اضافة عقدين أو أزوت معدنى

٢- عقدين فقط
٣- عقدين + ١٥ كجم ن/ فدان
٤- عقدين + ٣٠كجم ن
٥- عقدين + ٦٠ كجم ن

زرعت تجربتان الأولى موسم ١٩٩٨ بمحطة تنفيذ التجارب فى بنها (قليوبيه) والثانيه فى موسم ١٩٩٩ فى إحدى المزارع بمركز قطور (شمال الغربيه) وذلك فى تصميم القطع المنشقه مره واحدة حيث وزعت معاملات التسميد بالقطع الرئيسيه والتراكيب الوراثيه بالقطع المنشقه حللت بيانات كل ميعاد على حدة كما حللت بيانات الميعادين معا لكل موسم وتم تقدير الثبات المظهرى بطريقة **Kang and Magari (1995)** لصفات محصول البذور وعدد القرون بالنبات ووزن المائة بذرة.

وفيما يلى أهم النتائج

١- أعطى ميعاد منتصف إبريل أعلى محصول بذور للنبات ووزن مائة بذرة بينما أعطى ميعاد منتصف مايو أعلى عدد قرون بالنبات خلال موسمى الزراعه.

٢- أعطى التسميد الحيوى بالعقدين فقط أعلى محصول بذور وعدد قرون بالنبات بالزراعه فى بنها الموسم الاول بينما أعطت المعامله بالعقدين + ١٥ كجم ن/ فدان أعلى محصول وعدد قرون فى المنطقة الاقل خصوبه والاكثر ملوحه فى قطور فى الموسم الثانى. كما أدت إضافة أى سماد أزوتى فى الموسم الاول أو ٣٠ أو ٦٠ وحدة أزوت فى الموسم الثانى إلى إنخفاض نسبى فى المحصول.

٣- تفوقت السلاله L70 , L29 على جميع الاصناف والسلالات فى محصول البذور خلال ميعادى وموسمى الزراعه.

٤- أظهرت السلالتين L70 , L29 والصنف Crawfard ثباتا عاليا تحت ٢٠ بيئة (٢ موسم × ٢ ميعاد زراعه × ٥ مستويات تسميد) وتعتبر السلاله L29 أفضل التراكيب الوراثيه لتميزها بالثبات وأرتفاع المحصول وأثبتت تفوقها بالاكثار والتوزيع كصنف تجارى ممتاز.

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