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# PERFORMANCE OF TWELVE SOYBEAN GENOTYPES UNDER FOUR SOWING DATES AT MIDDLE EGYPT

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## ABSTRACT

***In Beni-Sueif Governorate, many farmers plant soybean early during April, because they harvest the preceding winter crop in April and hence their lands being ready for early summer planting. This investigation was designed to study the performance of 12 soybean genotypes (Giza 22, Giza 83, Giza111, Osaka, H30, H32, H117, H127, H129, H132, H15L5 and Clark) to four sowing dates (10$^{th}$ April, 25$^{th}$ April, 10$^{th}$ May and 25$^{th}$ May) under Middle Egypt condition at Beni-Sueif Governorate during two summer seasons of 2007 and 2008. The effect of planting date was more important than other factors for no. of pods and seeds/plant and seed protein and oil contents; Whereas, the effect of genotypes was the most important for days to 50% flowering and 95% maturity and plant height. The effects of seasons and planting date were more important than other factors, for seed yield (t/fed). The highest seed yield/fed (1.28 t) was obtained from the third sowing date (May10$^{th}$), while the lowest one (1.144 t) was obtained from the last one (May 25$^{th}$). Soybean genotypes showed high differences in seed yield/fed in which Giza 111, Giza 22 and H15L5 gave higher yield 1.6, 1.5 and 1.5t/fed, respectively, and surpassed all other genotypes. The seed protein and oil contents showed opposite magnitudes. Planting on May 25$^{th}$ gave the highest seed protein of 40.4% and the lowest oil content of 19.8%. The highest value of seed protein content belonged to H132 (41.4%), while the highest seed oil content was found in Osaka (21.3%) and Giza 22 (21.2%). The obtained results suggest that the genotypes Giza 111 and H15L5 are the most promising for early planting and could be recommended for early planting in Beni-Sueif Governorate.***

Key words : ***Soybean, Glycine max,Genotype, Planting date***

## INTRODUCTION

Soybean (*Glycine max* (L.) Merr) is an important oil seed crop following cotton, in Egypt. It has high seed protein content (30-40%) and about 30% seed oil content. Soybean is very important food and feed.

In Egypt, soybean acreage has declined during the last 20 years form about 100.000 fed in 1991 to about 20000 fed in 2009 due to competition with other summer crops, increased production cost, reduced net return per unit area and difficulties in marketing chanells. Accordingly, the total production became insufficient for consumption. Therefore, it is necessary to introduce the crop to new land regions, reduce production costs and increase productivity per unit area in order to increase soybean total production at national level. This can be achieved through better agronomic treatments and growing high yielding cultivars.

Whigham *et al* (1978) stated that environmental variables (altitude, longitude, day length, and maximum and minimum temperatures) were found to be only half as important as management variables such as amount of fertilizers applied and nodulation affecting yield.

Sowing date is one of the most important agronomic factors affecting soybean. In India, Several investigators reported that sowing date plays an important role in crop productivity. Seed yield of soybean cultivars decreased with delayed sowing. They also found that higher yields were associated with more pods and higher seed weight/plant as well as higher weight of 100 seeds (Johanson *et al* 1960; Beaver and Johnson, 1981; Board and Hall, 1984; Sarmah *et al* 1984; Boquet *et al* 1985; Mohamed, 1988; Moore *et al* 1991; Ali, 1993; Shafshak *et al* 1997; Pang and Liu, 1987; Egli and Heitholt, 1987; Pfeiffer and Pilcher, 1987; Hassan *et al* 2002 and Soliman *et al* 2007).

Therefore, this investigation was designed to study the performance of 12 soybean genotypes to four sowing dates under Middle Egypt condition at Beni-Sueif Governorate.

## MATERIALS AND METHODS

The field experiments were conducted at the Experimental Farm of Sids Agricultural Research Station, ARC, Beni-Sueif Governorate (Latitude 29° 4 and longitudes 31° 6) in Middle Egypt, during two successive summer seasons of 2007 and 2008 to study the response of 12 soybean genotypes (Giza 22, Giza 83, Giza111, Osaka, H30, H32, H117, H127, H129, H132, H15L5 and Clark) to four sowing dates ($10^{th}$ April, $25^{th}$ April, $10^{th}$ May and $25^{th}$ May). The description of those genotypes is presented in Table (1).

The soil of Sids Research Station is clay with PH of 7.4 .The air temperatures recorded during the two growth seasons are presented in Table (2). Each sowing date was planted separately in randomized complete block design (RCBD) with three replications. Each plot of the experiment involved five rows each is four meters long and 60 cm a part (3 x 4m = $12m^2$). Seven days before sowing, all plots were irrigated to prepare soil for better seed germination. Seeds were inoculated with the specific soybean rhizobia, and then hand planted in a moderately moist soil. Nitrogen fertilizer was added as a starter dose two weeks after sowing at a rate of 15 kg N/fed. Hand weeding was practiced twice to control weeds during the first six weeks of the growing season.

At maturity, 10 plants from each plot were taken randomly from the three central rows to determine plant height (cm), number of branches/plant, number of pods/plant, number seeds/plant, 100-seed weight (g). Seed yield/plot was obtained and then seed yield/fed (4200 $m^2$) was calculated.

**Table 1. Description of soybean genotypes used in this study.**

| No | Genotype | Maturity group | Country of origin | Pedigree |
|---|---|---|---|---|
| 1. | Giza 22 | IV | Egypt | Crawford X Forrest |
| 2. | Giza 83 | III | Egypt | Union X L76-0038 |
| 3. | Giza 111 | IV | Egypt | Crawford X Celeste |
| 4. | Osaka | II | USA | Introduced |
| 5. | H 30 | III | Egypt | Crawford XL62-1686 |
| 6. | H 32 | IV | Egypt | Giza 21 X L86-K-73 |
| 7. | H 117 | III | Egypt | D89- 8940 X Giza 111 |
| 8. | H 127 | IV | Egypt | D89- 8940 X Giza 82 |
| 9. | H 129 | IV | Egypt | D76- 8070 X Giza 35 |
| 10. | H 132 | IV | Egypt | Giza 35 X Giza 83 |
| 11. | H 15L5 | IV | Egypt | Crawford X D79-10426 |
| 12. | Clark | IV | USA | Introduced |

*All genotypes have indeterminate growth habit.

**Table 2. Monthly average maximum (max) and minimum (Min.) air temperatures (°C) experimental site in 2007 and 2008 seasons.**

| Month | Air temperature °C | | | |
|---|---|---|---|---|
| | 2007 | | 2008 | |
| | Max. | Min. | Max. | Min. |
| April | 31.1 | 15.8 | 30.1 | 16.6 |
| May | 41.3 | 22.2 | 33.4 | 17.7 |
| June | 36.9 | 22.7 | 35.3 | 21.9 |
| July | 37.0 | 23.1 | 36.0 | 22.9 |
| August | 43.4 | 20.8 | 36.2 | 23.9 |
| September | 33.0 | 20.2 | 35.6 | 22.0 |

The combined statistical analysis of data was applied for the four sowing dates according to Snedecor and Cochran (1982). Baretelett,s test of homogeneity was adopted indicted no statistical evidence for heterogeneity. Thus, combined analysis of variance was worked out. The Zeltex ZX 800 Near-Infrared (NIR) non-destruction whole seed analyzer (manufactured by Zeltex Inc., Maryland, USA), was used for the determination of seeds protein and oil contents.

## RESULTS AND DISCUSSION

The values of mean squares of sources of variance (planting dates, seasons and genotypes) as well as their interactions for all studied characters are presented in Table (3). Most of mean square values were significant for all sources of variance, except days to 50% flowering, number of pods, seeds/plant and oil percentage for the main effect of seasons, and no. of branches/plant, 100-seeds weight, seed yield (t/fed), seed protein and oil percentages for genotype x season and genotype x season x planting date interactions. These results indicated the importance of planting dates seasons and genotypes for all studied characters.

According to the values of mean squares, the effect of planting date was more important than other factors on no. of pods and seeds/plant and seed protein and oil contents; Whereas, the effect of genotypes was the most important on days to 50% flowering, 95% maturity and plant height. Interestingly, the effects of both seasons and planting date were more important than other factors on seed yield (t/fed).

**Table 3. Mean squares of sources of variance (planting dates, seasons and genotypes) as well as planting date x genotype interaction for all studied characters.**

| Source of variance | d f | Days to 50% flower. | Days to 95% maturity | Plant height | No. of branches /plant | No. of Pods / plant | No. of seeds/ plant | 100 seeds weight | Seed yield t/fed | Prot-ein % | Oil % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Planting date (P) | 3 | 34.1** | 261.6** | 2763** | 0.82** | 1954** | 23152** | 30.6** | 4045.0** | 69.6** | 21.7** |
| season (S) | 1 | 4.753 | 316.7** | 1940** | 1.6** | 78.13 | 1565 | 19.4* | 4602.4** | 21.7* | 11.2** |
| P x S | 3 | 36.0** | 65.0** | 501** | 2.43** | 1606** | 7469** | 76.8* | 505.8** | 2.3 | 1.3* |
| Genotype (G) | 11 | 174.7** | 1081** | 6873** | 0.43** | 545** | 4491** | 24.2** | 941.6** | 22.3** | 16.2** |
| G x P | 33 | 17.3** | 23.3** | 298** | 0.27** | 161* | 1378** | 9.8** | 74.5* | 8.3** | 1.4** |
| G x S | 11 | 39.8** | 29.3** | 366** | 0.27** | 266** | 1156* | 12.6** | 243.0** | 3.292 | 0.1 |
| G x S x P | 33 | 17.7** | 12.5** | 125.7 | 0.28** | 322** | 2487** | 5.637 | 69.7 | 3.363 | 0.1 |
| Error | 176 | 1.639 | 4.065 | 114.4 | 0.114 | 95.11 | 607.78 | 4.5 | 48.4 | 4.31 | 0.45 |

*,** significant at 0.05 and 0.01 probability respectively

## Number of days to 50% flowering

Data presented in Table (4) show that little differences in number of days to 50% flowering occurred among planting dates. The planting date on May $10^{th}$ was the earliest in flowering, while the planting date on May $25^{th}$ was the latest, but with only 1.5 days different between them. The difference among genotypes in time to flowering were more wider, where genotype Osaka flowered at 26.9 days from sowing, while the genotype H 132 flowered at 37.6 days, with about 10.7 days different.

**Table 4. Average number of days to 50% flowering and 95% maturity, plant height and number of branches/plant as affected by sowing dates and soybean genotypes (combined data of 2007 and 2008).**

| | Giza 22 | Giza 83 | Giza 111 | Osaka | H 30 | H 32 | H 117 | H 127 | H 129 | H 132 | H 15 L 5 | Clark | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Planting date | Number of days to (50%) flowering | | | | | | | | | | | | |
| 10th April | 33.3 | 30.5 | 32.3 | 26.7 | 33.0 | 36.2 | 34.2 | 34.3 | 35.3 | 38.2 | 32.7 | 32.5 | 33.3 |
| 25th April | 30.3 | 32.3 | 33.8 | 28.2 | 35.2 | 33.3 | 34.0 | 32.2 | 32.7 | 37.5 | 31.5 | 33.5 | 32.9 |
| 10th May | 31.7 | 30.5 | 33.8 | 25.8 | 29.2 | 35.3 | 35.5 | 30.3 | 33.5 | 37.0 | 30.0 | 30.2 | 31.9 |
| 25th May | 32.7 | 28.0 | 34.8 | 27.0 | 32.2 | 31.3 | 39.2 | 32.5 | 37.5 | 37.8 | 34.5 | 33.8 | 33.4 |
| Mean | 32.0 | 30.3 | 33.6 | 26.9 | 32.4 | 34.0 | 35.7 | 32.3 | 34.7 | 37.6 | 32.1 | 32.5 | |
| LSD 0.05 to compare means of genotypes (G): 5.5 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 0.4 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 1.44 | | | | | | | | | | | | | |
| Planting date | Number of days to (95%) maturity | | | | | | | | | | | | |
| 10th April | 132.0 | 108.2 | 134.6 | 96.0 | 121.7 | 125.0 | 122.6 | 125.0 | 124.0 | 121.8 | 122.0 | 134.5 | 121.5 |
| 25th April | 129.0 | 103.5 | 130.0 | 94.0 | 115.7 | 123.4 | 119.0 | 121.0 | 122.3 | 116.5 | 117.0 | 131.6 | 118.6 |
| 10th May | 124.0 | 96.5 | 127.0 | 91.0 | 113.2 | 118.0 | 113.4 | 118.5 | 119.2 | 114.3 | 114.8 | 127.6 | 114.8 |
| 25th May | 118.0 | 92.6 | 122.0 | 85.7 | 108.0 | 114.8 | 109.6 | 114.5 | 115.2 | 110.0 | 112.4 | 123.8 | 110.6 |
| Mean | 125.7 | 100.2 | 128.4 | 91.6 | 114.6 | 120.3 | 113.6 | 119.7 | 120.1 | 115.6 | 116.5 | 129.4 | |
| LSD 0.05 to compare means of genotypes (G): 1.1 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 0.7 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 2.28 | | | | | | | | | | | | | |
| Planting date | Plant height (cm) | | | | | | | | | | | | |
| 10th April | 116.7 | 103.7 | 118.7 | 63.3 | 109.3 | 115.7 | 89.8 | 100.0 | 111.0 | 98.3 | 109.0 | 116.0 | 104.3 |
| 25th April | 110.7 | 100.5 | 114.2 | 56.0 | 105.0 | 112.6 | 82.3 | 96.3 | 93.2 | 95.3 | 108.0 | 106.4 | 98.4 |
| 10th May | 106.7 | 96.0 | 110.5 | 46.0 | 104.0 | 100.0 | 69.0 | 86.7 | 88.0 | 91.2 | 106.0 | 102.0 | 92.2 |
| 25th May | 106.0 | 95.0 | 108.0 | 42.0 | 101.6 | 98.0 | 68.0 | 80.0 | 82.0 | 86.0 | 102.0 | 95.0 | 88.6 |
| Mean | 110.0 | 98.8 | 112.8 | 51.8 | 104.9 | 106.5 | 77.2 | 90.7 | 93.6 | 69.9 | 106.2 | 104.8 | |
| LSD 0.05 to compare means of genotypes (G): 6.04 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 3.50 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 12.09 | | | | | | | | | | | | | |
| Planting date | Number of branches/ plant | | | | | | | | | | | | |
| 10th April | 2.5 | 2.5 | 2.0 | 1.9 | 1.6 | 2.2 | 1.7 | 2.3 | 2.0 | 1.5 | 1.3 | 1.7 | 1.9 |
| 25th April | 2.0 | 2.0 | 1.5 | 1.5 | 1.5 | 2.1 | 2.1 | 1.5 | 1.5 | 1.5 | 1.0 | 1.3 | 1.6 |
| 10th May | 2.0 | 1.7 | 1.5 | 1.4 | 1.5 | 1.9 | 1.8 | 2.4 | 1.3 | 1.0 | 1.0 | 1.2 | 1.6 |
| 25th May | 1.8 | 1.7 | 1.3 | 1.1 | 1.2 | 1.5 | 1.4 | 1.7 | 1.0 | 1.0 | 1.0 | 1.2 | 1.3 |
| Mean | 2.6 | 1.9 | 1.5 | 1.4 | 1.4 | 1.9 | 1.7 | 1.9 | 1.4 | 1.2 | 1.0 | 1.3 | |
| LSD 0.05 to compare means of genotypes (G): 0.20 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 0.10 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 0.38 | | | | | | | | | | | | | |

**Days to 95% maturing**

Data presented in Table (4) confirmed the results in Table (3), where genotype effect was more important than other factors in days to maturity, although the three main effects were highly significant but with different magnitudes 1081 for genotypes, 316.7for seasons and 261.6 for planting dates. The difference between the first sowing date on April 10$^{th}$ and the last sowing date in May 25$^{th}$ was 11 days, while difference between the earliest matured genotype Osaka (91.6 days) and the latest genotype Clark (129.4 days) was about 38 days.

**Plant height**

Plant height was significantly influenced by genotypes and larger than other factors, followed by sowing dates. The differences between the highest value of 104.3 cm for the first sowing date (April 10$^{th}$) and the lowest value of 88.6 cm for the last sowing date (May 25$^{th}$) reached about 16 cm and was significant (Table 4). The tallest soybean genotype was Giza 111 (112.8 cm), while Osaka was the shortest one with value of 51.8 cm.

**Number of branches/plant**

Number of branches/plant was significantly affected by all studied factors (Table 4). The number of branches reached the highest value at the first sowing date (1.9 branches). The differences between soybean genotypes were relatively high in this character, where Giza 22 showed the highest value of 2.6 branches.

**Yield and yield component characters**

Data presented in Table (5) showed that the highest values of number of pods and seeds/plant were obtained from the third sowing date (May 10$^{th}$) with a moderate difference between this date and the other sowing dates. For 100-seed weight, the second sowing date (April 25$^{th}$) gave the largest seed weight of 14 g/100 seeds, but with little differences with other sowing dates. The difference between soybean genotypes in yield components were relatively high, where the highest values of number of pods and seeds/plant and 100-seed weight belonged to Giza 111, Giza 22, and H15L5 with no significant differences among them. In fact both Giza111 and Giza 22 are the most acceptable varieties by the farmers in Middle Egypt

Regarding seed yield (t/fed), the data presented in Table (5) showed that the highest seed yield/fed (1.28 t) was also obtained from the third sowing date (May 10$^{th}$), while the lowest one (1.144 t) was obtained from the last one (May 25$^{th}$). Soybean genotypes showed high differences in seed yield/fed in which Giza 22, Giza 111 and H15L5 gave 1.4, 1.33 and 1.31t/fed, respectively, and surpassed all other genotypes in seed yield. The increase in seed yield may be attributed to considerable increase in number of pods and seeds/plant.

Table 5 Yield and its components as affected by sowing dates and soybean genotypes (combined data of 2007 and 2008).

| | Giza 22 | Giza 83 | Giza 111 | Osaka | H 30 | H 32 | H 117 | H 127 | H 129 | H 132 | H 15 L 5 | Clark | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Planting date | Number of pods/plant | | | | | | | | | | | | |
| 10th April | 52.8 | 41.2 | 55.9 | 22.7 | 51.6 | 51.0 | 49.2 | 43.7 | 40.2 | 47.9 | 64.4 | 45.7 | 47.2 |
| 25th April | 55.6 | 46.7 | 71.5 | 33.6 | 61.7 | 56.5 | 55.1 | 57.8 | 50.5 | 48.0 | 69.6 | 51.1 | 54.8 |
| 10th May | 83.0 | 65.5 | 79.3 | 44.7 | 70.8 | 65.7 | 70.2 | 62.6 | 52.1 | 54.6 | 69.4 | 62.7 | 65.1 |
| 25th May | 56.7 | 41.0 | 50.3 | 30.4 | 55.7 | 48.1 | 52.3 | 39.9 | 36.2 | 38.3 | 54.9 | 46.9 | 45.9 |
| Mean | 62.0 | 48.6 | 64.2 | 32.8 | 59.9 | 55.3 | 56.7 | 51.0 | 44.7 | 47.2 | 64.5 | 51.6 | |
| LSD 0.05 to compare means of genotypes (G): 5.50 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 3.20 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 11.03 | | | | | | | | | | | | | |
| Planting date | Number of seed/plant | | | | | | | | | | | | |
| 10th April | 122.3 | 111.0 | 141.0 | 63.0 | 139.7 | 128.7 | 124.0 | 118.3 | 98.3 | 122.3 | 162.3 | 127.5 | 121.5 |
| 25th April | 156.7 | 128.0 | 174.0 | 76.5 | 154.4 | 134.7 | 139.7 | 138.3 | 126.2 | 132.7 | 181.4 | 139.3 | 140.2 |
| 10th May | 195.3 | 143.7 | 183.7 | 90.3 | 165.7 | 149.2 | 164.3 | 169.7 | 134.7 | 145.3 | 169.7 | 151.7 | 155.3 |
| 25th May | 154.7 | 116.3 | 148.3 | 69.0 | 147.0 | 115.0 | 128.3 | 116.3 | 83.7 | 106.5 | 132.3 | 123.0 | 120.0 |
| Mean | 157.2 | 124.7 | 161.7 | 74.7 | 151.7 | 131.9 | 139.0 | 135.6 | 110.7 | 126.7 | 128.3 | 135.3 | |
| LSD 0.05 to compare means of genotypes (G): 13.90 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 8.10 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 27.88 | | | | | | | | | | | | | |
| Planting date | 100- seed weight (g) | | | | | | | | | | | | |
| 10th April | 14.1 | 12.5 | 15.0 | 10.6 | 13.5 | 14.6 | 13.2 | 12.8 | 12.4 | 13.6 | 15.4 | 13.0 | 13.4 |
| 25th April | 15.2 | 13.0 | 15.7 | 11.4 | 14.0 | 15.2 | 13.7 | 13.5 | 12.6 | 14.1 | 16.2 | 13.8 | 14.0 |
| 10th May | 15.2 | 14.0 | 15.2 | 11.2 | 13.3 | 13.0 | 12.0 | 13.5 | 12.0 | 13.0 | 13.4 | 12.5 | 13.2 |
| 25th May | 13.8 | 12.5 | 14.0 | 10.6 | 12.2 | 12.4 | 11.5 | 12.3 | 11.6 | 12.0 | 12.8 | 12.5 | 12.4 |
| Mean | 14.5 | 13.0 | 14.9 | 10.9 | 13.2 | 13.8 | 12.6 | 13.0 | 12.1 | 13.1 | 14.4 | 12.9 | |
| LSD 0.05 to compare means of genotypes (G): 3.70 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 0.70 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 2.40 | | | | | | | | | | | | | |
| Planting date | Seed yield (ton $fed^{-1}$) | | | | | | | | | | | | |
| 10th April | 1.52 | 1.05 | 1.69 | 0.53 | 1.15 | 1.03 | 1.13 | 1.18 | 0.90 | 0.98 | 1.58 | 1.25 | 1.166 |
| 25th April | 1.63 | 1.13 | 1.60 | 0.61 | 1.46 | 1.36 | 1.27 | 1.15 | 0.93 | 1.26 | 1.62 | 1.34 | 1.280 |
| 10th May | 1.75 | 1.34 | 1.80 | 0.76 | 1.46 | 1.35 | 1.48 | 1.32 | 1.12 | 1.20 | 1.85 | 1.38 | 1.401 |
| 25th May | 1.41 | 1.20 | 1.35 | 0.81 | 1.33 | 1.00 | 1.27 | 1.15 | 0.78 | 0.98 | 1.31 | 1.14 | 1.144 |
| Mean | 1.50 | 1.10 | 1.60 | 0.67 | 1.30 | 1.18 | 1.20 | 1.20 | 0.93 | 1.10 | 1.50 | 1.20 | |
| LSD 0.05 to compare means of genotypes (G): 0.13 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of planting dates (P): 0.07 | | | | | | | | | | | | | |
| LSD 0.05 to compare means of G x P: 0.25 | | | | | | | | | | | | | |

This superiority may be due to differences in genetically make up (Ali 1993, Hassan *et al* 2002 and Soliman *et al* 2007). Concerning genotype x planting date interaction, the mean square for genotype x planting date interaction was highly significant (Table 3). The genotypes Giza 111 and H15L5 gave the highest seed yield in early planting date (April 25$^{th}$) of 1.8 and 1.85t/fed, respectively (Table 5), hence they are the best genotypes for early planting.

In Beni-Sueif Governorate, many farmers plant soybean early during April, because they harvest wheat as the preceding winter crop in April and hence their lands being ready for early summer planting. The obtained results suggest that both genotypes Giza 111 and H15L5 are the most promising for early planting and could be recommended for early planting in Beni-Sueif Governorate.

**Seed chemical composition**

Data presented in Table (6) showed that the highest values of protein content were obtained from the last sowing date (May 25$^{th}$) (40.4%) followed by third sowing date (May 10$^{th}$) (40.1) with no significant differences between them, while the first sowing date (April 10$^{th}$) gave the lowest value (38.6%). The differences between genotypes in protein content were relatively low in which the highest value belonged to H132 (41.4%) followed by H117, H15L5, H129Giza 22 and H 40, respectively. The lowest value was obtained from Osaka (35.2%) followed by Clark. Also, data presented in Table (5) showed that seed oil content was significantly influenced by sowing date in which the differences between the highest value obtained from the first sowing date (April 10$^{th}$) (21%), while the last sowing date (May 25$^{th}$) gave the lowest value of seed oil content (19.7%). The differences between soybean genotypes in seed oil content are relatively low in which the highest values belonged to Osaka (21.3%) and Giza 22 (21.2%), while the lowest value was obtained from H127 (19.6%) and H117 (18.8%). Both of protein and oil contents were in opposite relationship, where when protein increased in late sowing the oil decreased. This relationship between protein and oil content with respect to the sowing date give the opportunity to make precise decision to the purpose of sowing soybean at specific time (Soliman *et al* 2007).

Table 6. The percentage of seed protein and oil as affected by sowing dates and soybean genotypes (combined data of 2007 and 2008).

| | Giza 22 | Giza 83 | Giza 111 | Osaka | H 30 | H 32 | H 117 | H 127 | H 129 | H 132 | H 15 L 5 | Clark | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Planting date | protein % | | | | | | | | | | | | |
| 10th April | 39.8 | 38.6 | 38.8 | 34.5 | 39.4 | 38.3 | 40.2 | 38.1 | 39.2 | 40.6 | 39.3 | 36.0 | 38.60 |
| 25th April | 40.5 | 39.4 | 39.1 | 35.0 | 40.0 | 38.9 | 41.4 | 39.0 | 40.5 | 41.4 | 41.0 | 37.3 | 39.50 |
| 10th May | 40.7 | 40.8 | 40.7 | 35.3 | 40.5 | 40.8 | 41.6 | 39.2 | 41.0 | 41.8 | 41.5 | 37.7 | 40.1 |
| 25th May | 41.3 | 41.0 | 41.3 | 35.8 | 40.5 | 41.6 | 41.6 | 39.5 | 41.3 | 41.8 | 41.5 | 38.0 | 40.4 |
| Mean | 40.5 | 39.9 | 39.9 | 35.1 | 40.1 | 39.9 | 41.2 | 38.9 | 40.5 | 41.4 | 40.8 | 37.2 | |
| LSD 0.05 to compare means of genotypes (G): 1.20<br>LSD 0.05 to compare means of planting dates (P): 0.70<br>LSD 0.05 to compare means of G x P: 2.35 | | | | | | | | | | | | | |
| | oil % | | | | | | | | | | | | |
| 10th April | 22.0 | 21.3 | 20.8 | 21.8 | 21.2 | 22.0 | 19.3 | 20.4 | 20.5 | 20.5 | 21.9 | 20.4 | 21.0 |
| 25th April | 21.5 | 21.0 | 20.4 | 21.4 | 20.8 | 21.7 | 19.1 | 19.8 | 20.3 | 20.1 | 20.8 | 20.1 | 20.6 |
| 10th May | 21.0 | 20.6 | 20.4 | 21.4 | 20.2 | 20.3 | 18.5 | 19.5 | 20.1 | 19.9 | 20.5 | 20.1 | 20.2 |
| 25th May | 20.6 | 19.5 | 20.1 | 20.8 | 20.0 | 19.5 | 18.5 | 18.8 | 20.0 | 19.5 | 20.3 | 19.5 | 19.8 |
| Mean | 21.2 | 20.6 | 20.4 | 21.3 | 20.5 | 20.8 | 18.8 | 19.6 | 20.2 | 20.0 | 20.8 | 20.0 | |
| LSD 0.05 to compare means of genotypes (G): 0.40<br>LSD 0.05 to compare means of planting dates (P): 0.20<br>LSD 0.05 to compare means of G x P: 0.76 | | | | | | | | | | | | | |

## REFERENCES


**Ali, Kh.A.M. (1993).** Response of some new early maturing soybean genotypes to planting dates and plant population densities. Pp.85-96 Ph.D. Thesis, Faculty of Agric., Cairo Univ.,

**Beaver. J.S. and R.R. Johnson (1981).** Response of determinate and indeterminate soybean to varying cultural practices in the northern USA. Agron.J. 73:833-838.

**Board, J.E. (1985).** Yield components associated with soybean yield reduction at non optimal planting dates. Agron. J., 77(1): 135-140.

**Board, J.E. and W. Hall (1984).** Premature flowering in soybean yield reductions at non optimal planting dates as influenced by temperature and photoperiod. Agron. J., 76(4): 700-704.

**Boquet, D.J.; A.B. Coco and D.E. Summers (1985).** Soybean plant density-planting date study. Annual prog. Report, Northeast Res. Station, St . Joseph, la and Macon Ridge Res. Station, Winnsboro, La. Unda, 37-48. Boton Rouge, Louisiana, USA; Louisiana State Univ. (C.F. Field Crop Abst., 40: 2722).

**Egli, D.B.; R.D. Guffy, and J.J. Heitholt (1987).** Factors associated with reduced yield of delayed planting of soybean. J. of Agron. and Crop Sci., 159: 176-185.

**Hassan, M.Z.; Kh.A. Al-Assily; M.S.A. Mohamed and A.E. Sharaf (2002).** Performance of some soybean cultivars under different sowing dates at newly recalaimed lands of East Owinat and Kharga. Arab Univ. J.Agric. Sci. Ain Shams Univ., Cairo, 10(1): 173-179.

**Johanson. H.W;. H.A. Borthwick. and R.C. Leffel (1960).** Effect of photoperiod and time of planting on rates of development of the soybean in various stages of the life cycle. Bot. Gaz., 122: 77-95.

**Mohamed, M.S.A. (1988).** Implication of genotype x planting date and row spacing interactions in soybean cultivar development. M. Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt, 72-77

**Moore, S.H.; E.E. Hartwig, and C.A. Robertson, (1991).** Increasing soybean yield at early and late planting dates by delayed flowering. Louisiana Agric., 34 (3): 4-5. (C.F. Field Crop Abst., 44:8831).

**Pang Q.Y. and H.Z. Liu (1987).** The cause of acceleration of soybean development by short day length after flowering. Acta Agriculture Univ., Pekinensis. 12:101-105.

**Pfeiffer T.W. and D. Pilcher (1987).** Effects of early and late flowering on agronomic traits of soybean at different planting dates. Crop Sci., 27: 108- 112.

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

**Shafshak, S.E.; G.M. Shams El-Din; M.Z. Hassan and M.S.A. Mohamed (1997).** Evaluation of six soybean genotypes under different population densities and two sowing dates. Annals of Agric. Sci., Moshtohor, 35(1): 115-130.

**Snedecor, G.W. and W.G.Cochran (1982).** Statistical Methods 6th ed. The Iowa state Univ. Pres. Ames., IOWA, USA: 325-330.

**Soliman, M.M.; E.M. Rabie and S.B.Ragheb (2007).** Response of soybean yield to late sowing date. Arab Univ. J. Agric. Sci. Ain Shams Univ., Cairo, 15 (1), 51-59.

**Whigham, D.K; H.C. Minor and S.G. Gamer (1978).** Effect environmental and management on soybean performance in the tropics. Agron. J., 70: 587-592.

# اداء اثنا عشر تركيب وراثي من فول الصويا تحت اربع مواعيد زراعة مختلفة فى مصر الوسطى

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قسم بحوث المحاصيل البقولية- معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية

يزرعُ العديد مِنْ المزارعين في محافظةِ بني سويف فول الصويا مبكراً خلال شهر أبريل، لأنهم يحَصدون المحصولَ الشتوي السابقَ في أبريل ولذلك تصبح أراضيهم جاهزة لزراعةَ الصيفي المبكّرِ. وقد صُمّمَ هذا البحث لدِراسةَ سلوك ١٢تركيب وراثي من فول الصويا (جيزة ٢٢، جيزة ٨٣، جيزة ١١١, أوساكا، هجين ٣٠, هجين ٣٢, هجين ١١٧, هجين ١٢٧, هجين ١٢٩, هجين ١٣٢, هجين ١٥ إل ٥، وكلارك) في أربعة مواعيد زراعة (العاشر من أبريل ، الخامس والعشرون من أبريل ، العاشر من مايو و الخامس والعشرون من مايو) تحت ظروف مصر الوسّطى في محافظةِ بني سويف في موسمي ٢٠٠٧و٢٠٠٨. كان تأثير مواعيد الزراعةَ أكثر أهميَّةً مِنْ العواملِ الأخرى على عدد الأفرع والبذورِ ونسبة البروتين والزيت بالبذرةَ. بينما كان تأثير التراكيب الوراثية أكثر أهمية لعدد الأيام من الزراعة حتى التزهير والنضج و ارتفاع النباتَ. في حين كان تأثير كل من المواسم ومواعيد الزراعة أكثر أهميَّةً مِنْ العواملِ الأخرى على محصولِ البذور. وقد تحقق أعلى محصول للبذور (١,٢٨٠طن) في ميعاد الزراعة الثالث (١٠ مايو) بينما كان اقل محصول (١,١٤٤طن) في الميعاد الأخير (٢٥ مايو). كما أظهرت تراكيب فول الصويا اختلافات عالية في محصول البذور وكانت أعلى التراكيب الوراثية جيزة ١١١، جيزة ٢٢،هجين ١٥ وأعطت ١,٦

١,٥ ، ٥, ١طن للفدان على التوالي، وكانت هناك علاقةَ عكسية بين كل من نسبة البروتين والزيت بالبذرة، وأعطت الزراعة في الميعاد الرابع (٢٥ مايو) أعلى نسبة بروتين ٤٠,٤ % واقل نسبة زيت ١٩,٨% . وكانت أعلى نسبة بروتين (٤١,٤%) في بذور هجين ١٣٢ بينما وجد اقل نسبة زيت في بذور الصنف اوساكا (٢١,٣%) وجيزة ٢٢

(٢١,٢%). وأظهرت نتائج التفاعل بين مواعيد الزراعة والتراكيب الوراثية أنه يمكن التوصية باستخدام كل من جيزة ١١١ و هجين ١٥ فى الزراعة المبكرة في محافظة بني سويف.