Seed Quality Evaluation of Some Soybean Genotypes under Different Planting Dates

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ABSTRACT

Soybean seed quality as expressed by physiological, physical and chemical properties was found to be affected by planting date. This study was conducted at Sakha Agricultural Research Station, Kafr El-Sheikh, Egypt during 2013 and 2014 summer seasons to determine the effect of three planting dates (from mid-May to mid-June at 15-day intervals) on seed quality of fifteen soybean genotypes namely; Giza 35, Giza 83, H30 and H117 (Maturity group III), Giza 22, Crawford, Clark, H_2L_{12}, and H_2L_{20} (Maturity group IV) and L105, L 153, L155, Toano, Holladay, DR101 (Maturity group V). Combined data showed that delaying planting date until mid-June was significantly increased germination percentage of the produced seed for all genotypes. Toano cv. recorded the highest value of seed germination, followed by DR101, while Giza 35 was the lowest one followed by H30. These differences were directly related to number of days from seed planting to maturity, so that the later-maturing cultivars might produce seed with higher quality and better germination than did earlier ones. The high seed germination of late- planting dates and late-maturing cultivars were accompanied with increases in aging germination with weight reduction in seeds and its electrical conductivity as well as seed density. Delaying soybean planting until mid-June was significantly decreased seed oil percentage and acidity, but increased protein content. The low viability of soybean seed produced from early- planting dates or from early-maturing genotypes was accompanied with significant increases in acidity. The differences in seed viability proved that the more viable soybean seeds, the higher the seed protein content, but the lower the oil and acidity. Accordingly, the early-maturing cultivars such as Giza 83, Giza 35, Clark, Crawford, H117 should be planted in June, while, Toano, Holladay, L155, L153 and L105 could be planted over a longer period of time from the second half of May in order to produce high seed quality.

Key words: *Glycine max* L., planting date, seed germination, oil and protein content.

INTRODUCTION

Soybean (*Glycine max* (L.), Merrill) crop supplies represented more than 60 (%) of the global demand for vegetable oil and protein (USDA, 2016), with a worldwide production of about 330 million metric tons. Soybean has economic importance as well. Production of viable and vigorous seed is an important goal for soybean seed producer. In Egypt, soybean is planted over a relatively longer period of time extending from mid-April to mid –June depending on the time of cleaning the field from the preceding crop (El-Borai *et al.*, 2006). Delayed planting decreased economic return ha^{-1}(Jason and Palle, 2008; David *et al.*, 2016; and Salmeróna *et al.*, 2016), produced lower 100-seed weight, and lower seed yields than early planting (Kandil *et al.*, 2013; Scott *et al.*, 2013; and Morsy *et al*., 2016).

Planting date not only influences the seed yield, but also the quality of soybean seeds such as germination, oil, and protein contents. Germination of soybean seed is influenced by the genotypes and their planting dates (Morsy *et al*, 2016). It was noticed that soybean seeds obtained from delayed planting were higher in germination than those obtained from earlier ones. Some previous studies showed that the early or late planting dates significantly affected germination, physical properties, and chemical composition of the soybean seed (Green *et al*, 1965). Seeds produced from later planting dates, generally exhibited higher germination and field emergence (Hu and Wiatrak, 2012, and Muzammal *et al*, 2014). Similar results were reported by (Harris et al, 1965 and Moosavi *et al.*, 2011). The late planting date produced seeds with high germination and vigor for all cultivars (Amir *et al.*, 2007; Rahman *et al*, 2013). Planting dates influence the seed composition by changing the content of oil (Muhammad *et al.*, 2009), and protein (Kumar *et al*., 2006). El-Borai *et al.*, 2006; Kumar *et al.*, 2006; and Tremblay *et al.*, 2006 found that oil content decreased with delayed planting dates and temperature is thought to be related to this response. Delaying planting date usually results in higher seed protein content (kane *et al.*, 1997), although Bastidas *et al.*, (2008) reported an inconsistent effect of planting date on protein content. Oil and protein contents could change according to the cultivar (Bastidas *et al.*, 2008), but environmental conditions seem to have the greatest effect. It was also demonstrated that seed quality of earlier maturing cultivars is generally lower than that of later maturing cultivars (Smith *et al*, 1961, Green *et al*, 1965, Mondragon and Postts 1974, Ross 1975 and Grau and Oplinger, 1981).

Tekrony *et al*., (1984) evaluated six cultivars of varying maturity in three planting dates for four years and found positive linear relationship between the date of maturity and standard germination and seed vigor. In Egypt, Safia Abdalla and Hassan (1989) studied the effect of nine planting dates (April, 10^{th} to June, 30 th) on seed quality of four soybean varieties for two years and found that delaying planting after (June, 10 th) significantly increased the germination percentage.

The objective of this work was to study the changes in seed germinability, physical properties and chemical composition of some soybean genotypes planted at different planting dates.

MATERIAL AND METHODS

A two-year field experiment was conducted during 2013 and 2014 summer seasons at the Experimental Farm of Sakha Agricultural Research Station, Kafr El-Sheikh, Egypt, to study the influence of three planting dates (May15^{th}, June1^{st}, and May15^{th}) on seed yield and seed quality of 15 soybean genotypes. The studied soybean genotypes were Giza 22, Giza 35, Giza 83, Clark and Crawford (five cultivars), H30, H_2L_{12}, DR101, H_2L_{20}, L105, L153, L155 and H117 (eight promising lines), and two exotic varieties (Toano and Holladay). These genotypes represent different maturity groups according to the U.S. Classification, i.e. Giza 35, Giza 83, H30 and H117 (Maturity group III), Giza 22, Crawford, Clark, H_2L_{12}, and H_2L_{20} (Maturity group IV), and the others are Maturity group V. A detailed description of the code, name, pedigree, maturity group, flower color, seed coat color, pubescence color, hilum color and origin of the tested genotypes are presented in Table (1).

The experimental design was split plot with three replications. The planting dates were devoted to main plots and genotypes to sub plots. Each sub plot consisted of six ridges, 4 m long and 0.70 m apart. Seed of all genotypes were inoculated with the specific rhizobia prior to planting, and other agricultural practices were applied as recommended. In each growing seasons, a seed sample was taken at harvest from each genotype on each planting date to determine the standard germination, seedling vigor, physical properties and chemical composition.

All seed properties were determined at Giza and Sakha Seed Technology Research Section as follow:

The seeds obtained from the treatments were tested for laboratory germination conducted according to international rules (I.S.T.A., 1993). At final count, ten normal seedlings were selected at random from each replication to measure root and shoot length in centimeters (cm) and the same seedlings were oven dried at 80^{o}C for 17 h and weighed (mg) to record seedling dry weight. Electrical conductivity (E.C.) was measured according to (A.O.S.A., 1986). Seed index was determined as a weight of hundred seeds, while, relative density of one seeds was calculated according to Kramer and Twigg (1962) as follows:

Relative density (g/mm^2) =

$$\frac{100 - \text{seed weight (g)}}{100 - \text{see? volume (mm}^3)}$$

For determining accelerated ageing germination (%): Seeds were kept in an ageing chamber at 40^{o}C and 100(%) relative humidity for three days. then, the standard germination test was carried out at 20^{o}C and the mean normal seedling percentages were calculated (A.O.S.A. 1983). At final germination count, ten normal seedlings were selected at random in each replication to measure root and shoot lengths in centimeters (cm) and then, the same seedlings were oven dried at 80^{o}C for 17 h and weighed (mg) to record seedling dry weight.

A part from each seed sample was taken and ground to pass through two mm mesh for chemical analysis. Fat and protein (%) and acidity were determined according to the procedures outlined by A.O.A.C. (1990). All data collected were subjected to standard analysis of variance procedures according to Snedecor and Cochran (1981) and combined analysis was done when the assumption of error heterogeneity cannot be rejected Barllett (1937).

RESULTS AND DISCUSSION

Data in Table (2) show clearly that planting dates had a highly significant effect on soybean seed viability by as e×pressed germination (%). Delaying planting from May15^{th} to June15^{th} significantly increased the percentage of seed germination (92.49 %) regardless of soybean cultivars and promising lines. In this connection, Green *et al.*, (1965) concluded that soybean seeds from later planting dates, which reached maturity after hot dry weather had ended, generally e×hibited higher germination and field emergence than seed matured during hot dry weather. Similar results were obtained by Safia Abdalla and Hassan (1989), El-Borai *et al.*, (2006), Wrather *et al*., (2003), Rahman *et al.*, (2013), Zlatica *et al.*, (2014) and Sadeghi and Sheidaei (2016). The seed physical properties were also significantly affected by planting dates that the shoot length (12.04 cm), root length (9.94 cm), seedling dry weigh (170.17 mg), aging germination (91.28 %), shoot length (9.88 cm), root length (9.83 cm) and seedling dry weight of seed (138.17 mg) were significantly increased by delaying planting date, while the electrical conductivity (17.53 µmhos/g), 100-seed weight (13.22 g) and seed density (1.19 %) were significantly decreased.

Table 1: The pedigree, maturity group, flower color, seed coat color, pubescence color, hilum color and origin of tested soybean genotypes.

Genotype	Pedigree	Maturity group	Flower color	Seed coat color	Pubescence color	Hilum color	Origin
H 30	Crawford x L62-1686	III	Purple	Yellow	Tawny	Black	FCRI *
H_2L_{12}	Crawford x Celest	IV	Purple	Yellow	Tawny	Gray	FCRI *
Giza 22	Crawford x Forrest	IV	Purple	Yellow	Tawny	Gray	FCRI *
Giza 35	Crawford x Celest	III	Purple	Yellow	Light	Gray	FCRI *
Crawfor	Williams x Columbus	IV	Purple	Yellow	Tawny	Black	USA ***
Toano	Ware x Essex	V	Purple	Yellow	Gray	Yello	AES,
Holladay	N 77-179 x Johnston	V	Purple	Yellow	Light	Yello	AES,
DR101	Selected from Elgin	V	Purple	Yellow	Tawny	Black	FCRI *
Giza 83	Selected from MBB-133-9Union x L 76-0038(Williams x PI 171451)	III	White	Yellow	Tawny	Black	FCRI *
Clark	Lincoln x Richland	IV	Purple	Yellow	Tawny	Gray	USA ***
H_2L_{20}	Giza 83 X H_5L_{23}	IV	Purple	Yellow	Light	Gray	FCRI *
L105	Giza 35 x Lamar	V	Purple	Yellow	Gray	Black	FCRI *
L153	Giza 83 x Giza 21	V	Purple	Yellow	Gray	Black	FCRI *
L155	L86-K-73 x Giza 21	V	Purple	Yellow	Tawny	Black	FCRI *
H117	D89-8940 x Giza 111	III	Purple	Yellow	Gray	Black	FCRI *

* FCRI = Field Crops Research Institute, Giza, Egypt.
** AES, USA = Agricultural Experiment Station, USA.
*** USA = U. S. Regional Soybean Laboratory at Urbana, Illinois, and Stoneville, Mississipi.

Table 2: Effect of planting date on seed germination (%), seedling vigor, aging germination and physical properties of some soybean genotypes (data are combined over two growing seasons 2013 and 2014)

Character	Normal test				Aging test						
Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Seedling dry weight (mg)	Germination (%)	Shoot length (cm)	Root length (cm)	Seedling dry weight (mg)	E.C. (µmhos /g)	100-seed weight (g)	Relative density (%)
Planting dates											
D1	72.57^{c}	6.15^{c}	7.45^{c}	119.27^{c}	84.48^{b}	4.60^{c}	4.15^{c}	90.00^{c}	29.27^{a}	17.77^{a}	1.21^{a}
D2	76.52^{b}	7.79^{b}	8.80^{b}	136.01^{b}	85.64^{b}	5.60^{b}	5.75^{b}	94.38^{b}	26.71^{b}	14.93^{b}	1.21^{a}
D3	92.49^{a}	9.94^{a}	12.04^{a}	170.17^{a}	91.28^{a}	9.83^{a}	9.88^{a}	138.17^{a}	17.53^{c}	13.22^{c}	1.19^{b}
F. Test	**	**	**	**	**	**	**	**	**	**	**
Genotype											
H30	66.38^{h}	6.24^{h}	8.94^{d}	99.61^{i}	76.00^{f}	5.08^{h}	6.93^{bc}	88.61^{bc}	39.13^{a}	13.55^{h}	1.208^{de}
H2L12	81.44^{d}	7.66^{f}	8.80^{d}	131.68^{e}	86.77^{c}	6.66^{de}	5.24^{h}	80^{h}	24.89^{d}	14.15^{g}	1.20^{de}
Giza 22	71.33^{fg}	8.41^{cd}	9.74^{c}	160.27^{c}	89.55^{b}	7.15^{c}	5.82^{g}	114.72^{g}	18.99^{fg}	16.66^{ab}	1.22^{c}
Giza 35	80.33^{de}	6.84^{gh}	8.68^{d}	117.80^{f}	81.66^{e}	5.45^{e}	6.50^{de}	12.22^{de}	32.97^{b}	16.89^{a}	1.19^{ef}
Crawford	81.55^{d}	8.21^{def}	9.69^{c}	139.44^{d}	89.55^{b}	6.92^{cd}	6.27^{ef}	90.27^{ef}	20.11^{f}	14.35^{g}	1.18^{gh}
Toano	92.94^{a}	9.88^{a}	10.93^{a}	185.00^{a}	94.44^{a}	8.46^{a}	7.64^{a}	114.72^{a}	18.00^{g}	15.37^{e}	1.17^{hI}
Holladay	83.88^{bc}	8.91^{bc}	10.15^{b}	173.33^{b}	90.66^{b}	7.64^{b}	7.67^{a}	116.38^{a}	18.71^{fg}	16.13^{c}	1.19^{ef}
DR101	84.66^{b}	9.25^{b}	10.74^{a}	191.94^{a}	93.55^{a}	7.85^{b}	7.23^{b}	9.55^{a}	18.48^{fg}	15.25^{e}	1.20^{de}
Giza 83	70.55^{g}	6.51^{gh}	8.90^{d}	106.66^{hi}	80.44^{e}	5.15^{gh}	5.32^{h}	81.11^{b}	22.76^{e}	16.55^{b}	1.19^{fg}
Clark	81.55^{d}	7.80^{ef}	8.87^{d}	131.66^{e}	98.11^{b}	6.72^{de}	6.74^{cd}	110.88^{h}	22.69^{e}	15.84^{cd}	1.23^{b}
H2L20	80.33^{de}	7.59^{f}	8.78^{d}	127.30^{e}	85.44^{cd}	6.43^{f}	6.00^{fg}	121.11^{cd}	27.69^{c}	14.93^{f}	1.16^{hi}
L105	81.91^{cd}	8.71^{bcd}	9.83^{bc}	166.38^{bc}	90.00^{b}	7.09^{c}	7.10^{b}	119.16^{fg}	18..99^{fg}	15.54^{de}	1.22^{b}
L153	79.00^{e}	6.91^{g}	8.66^{d}	109.42^{gh}	84.44^{cd}	5.98^{f}	7.13^{b}	123.61^{b}	32.87^{b}	14.80^{f}	1.21^{d}
L155	83.72^{bc}	8.85^{bcd}	9.94^{bc}	170.83^{b}	90.66^{b}	7.74^{b}	7.10^{b}	126.38^{b}	19.43^{fg}	12.74^{i}	1.26^{a}
H117	80.33^{de}	7.62^{f}	8.77^{d}	115.95^{fg}	86.11^{cd}	5.86^{f}	6.35^{e}	118.05^{e}	31.85^{b}	16.88^{ab}	1.17^{hi}
F. Test	**	**	**	**	**	**	**	**	**	**	**

Means designated by different letters in the same column are significantly different at 0.05 level of probability according to Duncan's multiple range tests.

Furthermore the soybean cultivars and promising lines highly significantly differed in seed germination (%). Toano recorded the highest value (92.94 %), while, H30 (66.38 %) was the lowest in this trait. These results demonstrated that there was a direct relationship between the cultivar differences in seed viability, as e×pressed by germination percentage and the number of days to maturity within each cultivar. It was obvious that the seeds of the long-duration cultivars were more viable than those of the short duration cultivars. Toano gave the highest values of seed vigor, aging germination, shoot length; root length and seedling dry weight. These results agreed with those reported by Smith *et al.,* (1961), Green *et al.,* (1965), Mondragon and Potts (1974), Ross (1975), Grau and Oplinger (1981), Tekrony *et al.*, (1984), El-Borai *et al.*, (2006), Wrather *et al*., (2003), Rahman *et al.*, (2013), Zlatica *et al.,* (2014) and Sadeghi and Sheidaei (2016) who reported that seed quality of earlier maturing cultivars at a given location is generally lower than that of later maturing cultivars. Moreover data in Table (2) also show that Giza 22, Toano, Holladay, DR101 and L105 genotypes were lowest in EC. Giza 35 gave the heaviest 100-seed weight (16.89 g), while line L155 gave the lowest value (12.74 g). Line L155 gave the highest relative density (1.26 %), while Toano, H_2L_{20} and H117 gave the lowest values (1.17, 1.16 and 1.17 %), respectively.

Furthermore, data in Table (3), indicated that oil and protein contents (%) of soybean seed were highly significantly affected by different planting dates. Delaying soybean planting had significantly decreased oil content, while protein content significantly increases. This result could be e×plained by the report of El-Borai *et al.,* (2006). Delaying planting date reduced the percentage of acidity in soybean seeds (10.79 %). Low seed viability produced from early planting dates was accompanied by the increase of acidity. Concerning soybean cultivars, Toano was the highest in oil content (24.62 %), while Giza 83 was the lowest (20.32 %). Also, H30, Giza 35 and Giza 83 were the highest in protein content (37.17, 37.09 and 37.11 %), respectively, while line H_2L_{20} was the lowest (32.73 %). Toano and line DR101 were the lowest in acidity. It could be concluded that there was a direct relationship between genotypes differences in seed viability and the genotypes differences in seed acidity as shown in Table (3).

Table 3: Effect of planting date on seed chemical composition of some soybean genotypes (data are combined over two growing seasons, 2013 and 2014)

Character / Treatment	Oil (%)	Protein (%)	Acidity (%)
Planting date			
D1	25.16 ^{a}	32.38 ^{c}	13.75 ^{a}
D2	20.01 ^{b}	35.57 ^{b}	11.19 ^{b}
D3	19.69 ^{c}	38.31 ^{a}	10.79 ^{c}
F. Test	**	**	**
Genotype			
H30	20.19^{j}	37.17^{a}	13.05^{a}
H2L12	21.13^{g}	35.88^{cd}	12.09^{d}
Giza 22	21.56^{f}	34.98^{ef}	11.62^{f}
Giza 35	20.32^{ij}	37.09^{a}	12.71^{b}
Crawford	21.52^{f}	35.23^{e}	11.83^{e}
Toano	24.62^{a}	35.91^{cd}	10.93^{h}
Holladay	23.60^{c}	33.95^{h}	11.05^{gh}
DR101	23.94^{b}	33.80^{h}	10.98^{h}
Giza 83	20.32^{ij}	37.11^{a}	12.77^{b}
Clark	21.21^{g}	35.82^{cd}	12.10^{d}
H2L20	20.58^{h}	32.73^{i}	12.12^{d}
L105	21.83^{e}	34.74^{g}	11.23^{g}
L153	20.51^{hi}	36.36^{b}	12.62^{b}
L155	22.34^{d}	34.35^{g}	11.22^{g}
^{H}117	20.52^{hi}	36.25^{bc}	12.32^{c}
F. Test	**	**	**

Means designated by different letters in the same column are significantly different at (0.05 level) of probability according to Duncan's multiple range tests.
** Significantly different at (0.01) level.

Table 4: Interaction effect of planting date and soybean genotypes on seed germination, physical properties and some chemical composition (data are combined over two growing seasons, 2013 and 2014)

Interaction	Germination (%)	Aging (%)	EC µmhos/g	100-seed weight (g)	Oil (%)	Protein (%)	Acidity (%)
H30× first	69.33	72.00	22.29	16.93	22.74	38.59	13.45
H30×second	76.00	80.00	17.80	14.60	21.30	39.30	13.20
H30×third	91.67	89.33	15.35	10.93	19.50	40.52	11.48
H_2L_{12}× first	56.67	71.33	21.64	19.51	21.50	36.64	13.96
H_2L_{12}× second	61.33	80.67	19.92	13.28	20.70	38.29	13.08
H_2L_{12}× third	96.00	93.00	16.73	10.27	19.37	39.26	12.12
Giza 22× first	84.67	79.33	20.36	20.90	25.12	33.64	12.38
Giza 22× second	75.00	92.33	19.76	15.45	20.87	36.02	11.26
Giza 22× third	92.00	95.67	16.87	14.29	19.53	39.09	9.29
Giza 35× first	70.67	84.67	23.38	17.53	24.44	31.34	12.25
Giza 35× second	83.00	91.00	19.41	15.44	20.09	37.08	10.82
Giza 35× third	91.00	93.00	14.20	13.46	21.50	42.85	11.22
Crawford× first	81.33	81.67	23.23	16.32	23.11	34.45	14.78
Crawford× second	77.67	86.33	20.41	14.73	20.11	36.37	12.02
Crawford× third	95.00	87.33	12.52	11.37	19.53	40.50	11.51
Toano× first	64.67	84.33	26.70	20.36	22.85	32.76	13.58
Toano× second	64.00	86.67	24.60	17.81	21.17	36.41	10.20
Toano× third	83.00	91.33	17.00	12.56	20.40	38.75	9.92
Holladay× first	75.00	74.33	26.88	17.29	22.93	32.92	14.46
Holladay× second	80.00	86.33	17.24	14.63	19.68	35.50	11.89
Holladay× third	89.76	95.67	16.23	12.87	18.60	41.08	10.93
DR101× first	77.33	80.33	23.13	19.72	24.34	29.69	13.71
DR101× second	75.67	83.00	18.30	15.92	20.48	34.23	11.63
DR101× third	88.00	85.00	12.57	11.89	18.16	41.77	10.17
Giza 83× first	49.00	70.00	54.26	16.54	21.08	29.42	14.34
Giza 83× second	70.50	75.00	42.75	14.48	20.30	36.32	12.06
Giza 83× third	79.67	79.00	20.37	12.65	20.17	38.10	10.56
Clark × first	92.50	91.00	30.77	18.87	24.70	31.15	14.14
Clark × second	92.67	95.33	22.84	16.44	20.64	35.71	11.95
Clark × third	73.67	97.00	14.27	15.38	18.30	37.37	10.42
H_2L_{20}× first	62.50	82.00	41.54	17.97	25.14	32.83	12.94
H_2L_{20}× second	74.50	90.00	37.84	16.78	20.47	34.34	11.58
H_2L_{20}× third	82.67	95.00	16.19	15.23	19.09	36.78	9.33
L105× first	69.00	85.33	43.72	13.94	25.05	32.51	13.32
L105× second	82.50	90.33	37.74	12.39	20.21	36.68	11.82
L105× third	94.33	94.33	17.17	12.00	18.55	38.54	9.66
L153× first	78.67	84.33	41.17	19.50	24.91	32.63	13.45
L153× second	74.67	88.00	30.44	15.94	22.53	33.23	10.08
L153× third	87.66	92.33	25.28	14.23	19.43	40.78	9.63
L155× first	76.67	84.00	30.93	17.34	23.81	32.75	13.36
L155× second	77.33	91.67	24.32	16.09	20.60	35.55	10.76
L155× third	90.33	96.33	19.44	12.70	19.41	40.77	9.54
H117× first	80.50	89.67	44.03	14.95	24.74	31.43	14.14
H117× second	83.00	92.00	29.29	13.31	19.14	36.58	12.45
H117× third	87.67	99.00	25.61	12.40	17.71	39.46	11.26
LSD (0.01)	3.353	3.030	3.000	0.548	0.401	0.689	0.326

The interaction effect of planting dates and soybean genotypes on seed germination was highly significant as shown in Table (4). Seeds of H_2L_{12} produced from late-planting date (July 1st) were the best in germination (96.00 %), while seeds of Giza 83 produced in early planting date (May 15th) were the lowest in this respect (49.00 %). Line H117 produced the highest aging germination percentage (99.00 %) with the late planting date; while Giza 83 produced in the early planting date was the lowest in aging germination (70.00 %). Crawford cultivar and line DR101 produced the lowest E.C. with early planting date (12.52 and 12.57 µmhos/g), while Giza 83 with the early planting date gave the highest value (54.26 µmhos/g). Giza 22 and Toano cultivars with early planting date (first May) produced the highest 100-seed weights (20.90 and 20.36 g), respectively. While, H30 and H_2L_{12} lines had the lowest 100-seed weights (10.93 and 10.27 g) with the late planting date (July 15th).

Data in Table (4), also, revealed that viable soybean seeds of either late-maturing genotypes or produced from late planting dates were also higher in protein, but they were lower in oil content and acidity. These findings agreed with those obtained by El-Borai *et al.*, (1993) who found a direct relationship between the reduction in viability of soybean seeds during storage and the increases in acidity. Such results suggested that, viable seeds of the early-maturing cultivars Giza 83, Giza 35, H30, H117, Clark, Crawford, H_2L_{12}, H_2L_{20} and L153, could be obtained from June planting. In addition, the viable seeds of Toano, Holladay, L105, L155 and DR101could be produced over a longer period, starting from the onset of May.

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الملخص العربي

تقييم جودة البذور لبعض التراكيب الوراثية لفول الصويا تحت مواعيد زراعة مختلفة

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أجريت هذه الدراسة في محطة البحوث الزراعية بسخا– كفر الشيخ– مصر. خلال موسمي الزراعة الصيفي ٢٠١٣ و ٢٠١٤م لدراسة تأثير ثلاثة مواعيد زراعة على جودة البذور لخمسة عشر تركيبا وراثيا من فول الصويا. كانت التراكيب الوراثية كالآتي: جيزة ٣٥ وجيزة ٨٣ وH30 وH117 (مجموعه نضج III) وجيزة ٢٢ وClark وCrawford وH_2L_{12} و H_2L_{20} (مجموعة نضج IV) والتراكيب Toano وHolladay و L105 و L153 وL155 و DR101 (مجموعة نضج V) . أوضحت النتائج أن تأخير ميعاد الزراعة حتى منتصف يونيو أدي الي زيادة معنوية في نسبه الإنبات و أن الصنف Toano أعطي أعلي نسبة إنبات يليه السلالة DR101 بينما الصنف جيزة ٣٥ والسلالة H30أعطت أقل قيمه. وترجع هذه الاختلافات إلي العلاقة المباشرة لتأثير عدد أيام النضج حيث أن الأصناف المتأخرة النضج تعطي بذور عالية الجودة و أفضل في نسبة الإنبات عن الأصناف المبكرة النضج. وترجع أعلي نسبه إنبات لمواعيد الزراعة المتأخرة و الأصناف المتأخرة في النضج إلي زيادة القدره التخزينية للبذور مع النقص في وزن البذور وقيمة التوصيل الكهربي والكثافة النوعية. وقد أدى تأخير الزراعة حتى منتصف يونيو إلي نقص نسبة الزيت والحموضة الكلية، ولكن أدت الي زيادة نسبة البروتين.و يرجع انخفاض الحيوية في بذور فول الصويا إلي الزراعة المبكرة والأصناف مبكرة النضج و ذلك لزيادة الحموضة الكلية. كما أن زيادة حيوية البذور لابد وأن تكون مصاحبة لزيادة نسبة البروتين في البذرة مع انخفاض الحموضة الكلية. لذلك ينصح بزراعة الأصناف مبكرة النضج مثل جيزة ٨٣، جيزة ٣٥، H30، H117، جيزة ٢٢و Clark و Crawfordو H_2L_{12} و H_2L_{20} وL153 في شهر يونيو بينما Toano وHolladay و L105 وL155 وDR101 المتأخرة النضج تحتاج لفترة نمو أطول لذلك يفضل زراعتها في شهر مايو لإنتاج بذور عاليه الجودة والحيوية.