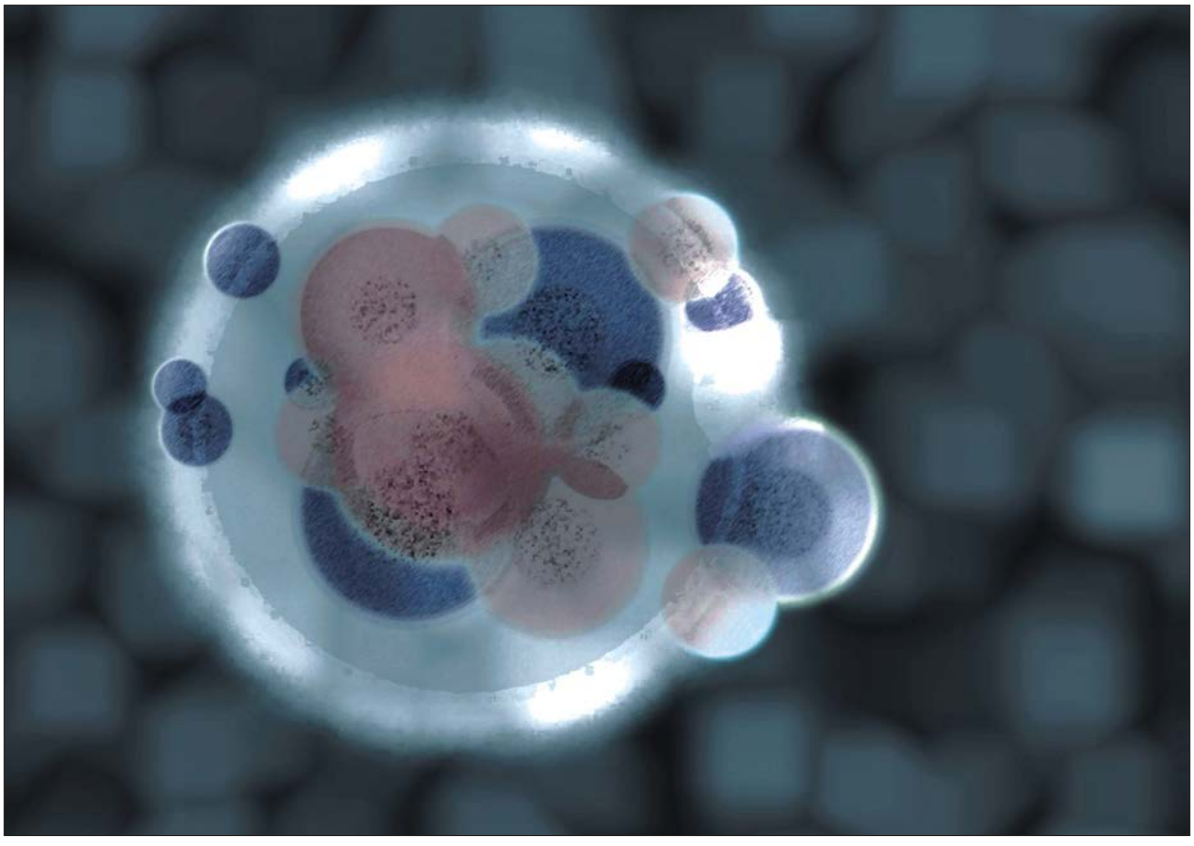

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Influence of Planting Date on Some Genotypes of Soybean Growth, Yield and Seed Quality

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Abstract: Planting date affects different growth stages as one of the important factors in determining maximum cultivar Delaying planting date and unfavorable environmental conditions have a negative effect on soybean growth, development and yield. Four separate experiments were carried out in each season at the experimental farm of Sakha Research Station, Kafr El-Sheikh during 2010 and 2011 summer seasons to evaluate seed quality and growth of six soybeans genotypes i.e. Giza 21, Giza 22, Giza 111, H_2L_{12}, H30 and H32 under different planting dates i.e., 20th April, 5th May, of 20th May and 5th June. Planting on 5th May recorded highest values in all studied characters, except highest values of crop growth rate and net assimilation rate was obtained from planting on 5th June. Giza 21 cultivar was consistently produced higher 100-seed weight, seed yield (t ha^{-1}), protein and oil yields (kg ha^{-1}) than those of other genotypes. H30 line had a consistently higher rate of vegetative abscission and a generally lower 100-seed weight, seed, protein and oil yields (kg ha^{-1}) than other genotypes. Delaying planting until 5th June altered vegetative stage significantly increase with the line H30 of crop growth rate and net assimilation rate and the same line H30 gave the high rate of relative growth rate and leaf area index on 5th May. Planting in the first May is an effective management strategy to increase soybean yield in Egypt.

Key words: Soybean genotypes, oil and protein yields, planting dates and growth parameters

INTRODUCTION

Soybean is the main source of supplying protein and oil plant in the world, which can provide complete protein, containing essential amino acids for human health. In order to reduce the gap between oil production and its consumption which reach 10% from our production only. Recently interest has improved in the potential of rising soybean in the new reclaimed areas outside the Nile valley, where diverse environments of agriculture may be available. Seeding date has more influence on soybean seed yield than any other production practice. The global warming climate change ongoing to confine not only the expansion of the cultivated area, but also the stability of the current agricultural production and may be different in seeding date. So, this study was conducted to study enactment of some soybean genotypes under different planting dates in north Egypt. Planting on mid-May produced heaviest weight of 100-seed as well as seed yield than did planting on mid-June (Radi *et al*., 1996; Yasari *et al*., 2009; Morsy, 2010; Kandil *et al*., 2012 and Mengxuan and Wiatrak, 2012). Early planting on first May increased germination and protein content (El-Borai *et al*., 2008). Delaying sown from late April or early May to June or July usually results in higher seed protein content (Kane *et al*., 1997). Bastidas *et al*. (2008) reported an inconsistent effect of planting date on protein concentration. They added that oil and protein concentration can change according to cultivar. High temperature during reproductive stages R5 and R6 enhanced oil content and generally reductions of protein content (Dornbos and Mullen, 1992; Mengxuan and Wiatrak, 2012). Presented moisture during reproductive stages of R5 and R6 is important issue. The objectives of this study was aimed to investigate quantify the effects of planting date on soybean growth parameters, seed, protein and oil yields/ha.

MATERIALS AND METHODS

This investigation was conducted at the experimental farm of Sakha Research Station, Kafr El-Sheikh, during

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2010 and 2011 summer growing seasons. The objective of this investigation was aimed to study response of soybean genotypes i.e., Giza 21, Giza 22, Giza 111, H_2L_{12}, H_{30} and H_{32} to different sowing dates 20th April, 5th May, of 20th May and 5th June on growth, seed, oil and protein yields/ha. The experimental design was conducted in Randomized Complete Block Design (RCBD) with four replications. Four separate experiments in each seasons in 20th April, 5th May, 20th May and 5th June was done and then combined analysis was conducted between sowing dates to obtain the main effect of planting dates and the interaction between cultivars and planting dates. Each plot consisted of four ridges, 60 cm apart and four m long. Seeds of all genotypes were inoculated by specific *Rhizobia* and then hand planted at density of 15 plants per a meter of a linear ridge on the sowing dates. All other recommended agricultural practices were conducted for Sakha region.

The data of Crop Growth Rate (CGR), relative growth rate (RGR) and net assimilation rate (NAR) were measured according to (Radford, 1967). Leaf Area Index (LAI) was measured according to Watson (1952). Data of seed yield/ha was determined from the central area (4.2 m^2) in each plot, then transformed to ton/ha and seed protein and oil content were determined according to (AOAC, 1980) then multiplied with seed yield/ha to obtained protein and oil yields in kg ha^{-1}.

Statistical analysis: All collected data were subjected to statistical analysis of variance as described by Sendcor and Cochran (1967). Combined analysis of sowing dates experiments to obtain the mean effects of sowing dates and their interaction with cultivars according to Waller and Duncan (1969). The mean values were compared according to Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Soybean genotypes in all planting dates were significantly differed in seed, oil and protein yields/ha as well as growth parameters, indicating the extended of genetic diversity in the material selection for this study (Table 1, 2). Significant means due to the interaction between genotypes and planting dates were obtained for all the studied traits. These results therefore, might reveal the performance of genotypes differed from one planting date to another. Seed, oil and protein yields/ha as will as growth parameters were differed between cultivars and planting dates in both seasons. The results in Table 1 clearly indicated that highest CGR and NAR values (187.04, 199.22 and 48.35, 50.60) in both seasons, respectively was obtained from planting on 5th June. In addition, highest RGR and LAI values (0.24, 0.23 and 3.51, 3.67) in both seasons, respectively was produced from planting on 5th May. Moreover, sown H30 line produced highest values of CGR, NAR and LAI, which were 209.22, 230.1 and 54.22, 59.49 and 3.26, 3.52 in both seasons, respectively. Delaying planting dates decreased yields, with greater reductions measured for Giza 21 cultivar in both seasons. Others have noted genotypes by planting date interaction (Beaver and Cooper, 1982). There were

Table 1: Means of vegetative growth parameters as affected by genotypes and planting dates during 2010 and 2011 seasons

	CGR		RGR		NAR		Leaf area index	
Treatments	2010	2011	2010	2011	2010	2011	2010	2011
Sowing dates								
20th April	151.09^{c}	163.59^{c}	0.24^{a}	0.24^{a}	32.87^{c}	32.98^{d}	2.67^{b}	2.71^{c}
5th May	127.72^{d}	132.82^{d}	0.24^{a}	0.23^{a}	39.61^{b}	44.62^{b}	3.51^{a}	3.67^{a}
20th May	162.85^{b}	176.65^{b}	0.18^{c}	0.19^{c}	36.40^{b}	41.03^{c}	1.91^{c}	1.95^{d}
5th June	187.04^{a}	199.22^{a}	0.22^{b}	0.21^{b}	48.35^{a}	50.60^{a}	2.66^{b}	3.02^{b}
F. Test	*	*	*	*	*	*	*	*
LSD 5%	8.63	12.88	0.014	0.018	3.39	3.42	0.07	0.13
Soybean cultivars								
Giza 21	182.08^{b}	196.62^{b}	0.24^{b}	0.25^{b}	44.27^{b}	48.82^{b}	2.68^{c}	2.82^{c}
Giza 22	129.47^{e}	137.92^{d}	0.20^{c}	0.19^{d}	31.85^{cd}	33.98^{e}	2.24^{e}	2.39^{e}
Giza 111	141.56^{d}	147.53^{d}	0.19^{c}	0.17^{d}	34.33^{c}	34.90^{e}	2.53^{d}	2.61^{d}
H2L 12	112.62f	116.88^{e}	0.17^{d}	0.17^{d}	28.00^{d}	28.44^{d}	2.50^{d}	2.54^{de}
H 30	209.22^{a}	230.16^{a}	0.29^{a}	0.31^{a}	54.22^{a}	59.49^{a}	3.26^{a}	3.52^{a}
H 32	168.13^{c}	180.83^{c}	0.23^{b}	0.23^{c}	43.18^{b}	48.41^{b}	2.92^{b}	3.16^{b}
F. Test	*	*	*	*	*	*	*	*
LSD 5%	10.57	15.77	0.01	0.02	4.15	4.19	0.08	0.16
F. Test Interaction	*	*	*	*	*	*	*	*

*, ** and NS indicate $p<0.05$ and not significant, respectively Means designated by the same letter within columns are not significantly different at the 5% level according to Duncan's multiple range test

Table 2: Means of 100 seed weight, seed, protein and oil yields /ha as affected by genotypes and planting dates during 2010 and 2011 seasons

	100-Seed weigh (g)		Seed yield (t ha^{-1})		Protein yield (kg ha^{-1})		Oil yield (kg ha^{-1})	
Treatments	2010	2011	2010	2011	2010	2011	2010	2011
Sowing dates								
20th April	15.87^{b}	16.19^{c}	4143.58^{c}	4386.34^{c}	1588.24^{c}	1572.38^{b}	85.41^{b}	899.11^{b}
5th May	17.27^{a}	17.92^{a}	5059.88^{a}	5331.2^{a}	1468.12^{a}	1911.07^{a}	1003.99^{a}	1055.16^{a}
20th May	17.05^{a}	16.47^{b}	4526.76^{b}	4793.32^{b}	1640.00^{b}	1811.74^{a}	843.74^{b}	892.84^{b}
5th June	14.03^{c}	14.69^{d}	4107.88^{c}	4236.4^{c}	1384.78^{c}	1461.46^{c}	730.07^{c}	753.47^{c}
F. Test	**	**	**	**	*	*	*	*
LSD 5%	0.26	0.20	184.21	271.58	84.52	98.20	21.56	41.80
Soybean cultivars								
Giza 21	17.28^{a}	17.28^{a}	4936.12^{a}	5164.6^{a}	1682.29^{a}	1790.25^{a}	952.29^{a}	987.91^{a}
Giza 22	15.92^{c}	15.88^{c}	4248.3^{c}	4464.88^{cd}	1503.26^{b}	1577.81^{b}	819.28^{cd}	856.70^{cd}
Giza 111	16.46^{b}	16.29^{b}	4717.16^{ab}	4845.68^{ab}	1678.75^{a}	1760.33^{a}	907.54^{b}	933.92^{b}
H2L 12	15.42^{d}	16.22^{b}	4674.32^{b}	4786.18^{bc}	1710.61^{a}	1866.13^{a}	898.30^{b}	918.45^{b}
H 30	15.66^{cd}	16.12^{b}	4079.32^{c}	4545.8^{bcd}	1442.34^{b}	1630.37^{b}	778.16^{d}	870.49^{c}
H 32	15.60^{cd}	16.10^{bc}	4105.5^{c}	4314.94^{d}	1502.07^{b}	1591.45^{b}	782.34^{d}	825.24^{cd}
F. Test	**	**	**	**	*	*	*	*
LSD 5%	0.32	0.25	225.86	332.72	1.3.51	120.29	41.77	51.19
F. Test Interaction	**	**	**	**	*	*	*	*

*,**and NS indicate p<0.05 and not significant, respectively, Means designated by the same letter within columns are not significantly different at the 5% level according to Duncan's multiple range test

significant effects for planting dates and genotypes. The effect of planting date and cultivar on yield components and growth characteristics were significant in each year (Table 2), indicated that planting date on 5th June significantly produced highest values of crop growth rate and net assimilation rate in both seasons. Planting on 5th May gave the lowest values of crop growth rate in both seasons. The lowest net assimilation rate values were produced from sowing on 20th April. The results clearly showed that highest values of crop growth rate and net assimilation rate were obtained from late planting than those of early planting, which could be attributed to short of the stature of late planting of soybean and then decrease in crop duration, especially the vegetative growth period and the fast transfer to reproductive stage and maturity (De Bruin and Pedersen, 2009). The results indicated that planting on 5th May significantly produced highest values of relative growth rate and leaf area index in both seasons. Whereas, the lowest rate was obtained from planting on 20th May of relative growth rate and leaf area index in both seasons. For a given planting date, vegetative production by H30 line at all studied characters were consistently the greater among studied genotypes, although the difference was quite small for Giza 21 cultivar, however, the lowest rate gave by H_2 L_{12} line. Similar conclusions were reported by Abd-Alla and Omran (2002), Pedersen and Lauer (2004), Mehasen and Saeed (2005), De Bruin and Pedersen (2009) and Shairef *et al.* (2010).

Table 2 clearly showed aaveraged across planting date, highest seed yield/ha and oil yield/ha was obtained from planting on the first May only (5059.88, 5331.2, 1003.99 and 1055.16 t ha^{-1}) in both seasons, respectively. Weight of 100-seed was obtained from 20th planting (15.87, 16.19 g, respectively) and sown on 20th May produced highest protein yields (1640.00 and 1811.74 kg ha^{-1}). Results in Table 2 clearly showed that Giza 21 cultivar recorded highest 100-seed weight, seed yield (t ha^{-1}) and oil yield (kg ha^{-1}) which were, 17.28, 17.28 and 4936, 5164.6 and 952.29, 987.91 in both seasons, respectively. In addition, H2L21 genotype produced highest protein yield/ha which were 1710.61 and 1566.13 t ha^{-1} in both seasons, respectively. Whereas, H32 line recorded the lowest values, except H30 line and Giza 22 cultivar with protein yield (kg ha^{-1}), in the first and second seasons, respectively. Such increases in seed yield may be attributed to the considerable increases in leaf area index and 100-seed weight. Consequently, increases in oil and protein yields/ha may be due to increases in seed yield/ha or oil and protein percentages. Similar conclusions were reported by Bastidas *et al.* (2008), El-Borai *et al.* (2008), Egli and Cornelius (2009), De Bruin and Pedersen (2009) and Shairef *et al.* (2010).

There were a significant effects due to the interaction between genotypes and planting dates, results in Table 3 clearly showed that H30 line recorded highest growth values with the latest planting date (5th June) on crop growth rate and net assimilation rate, whereas, highest values recorded with the second planting date (5th May) with respect to relative growth rate and leaf area index. However, lowest values of crop growth rate, relative growth rate and net assimilation rate were obtained from planting H_2 L_{12} line on 5th June. H32 line recorded the

Table 3: Means of vegetative growth parameters as affected by the interaction between soybean genotypes and planting dates in 2010 and 2011 seasons

	CGR		RGR		NAR		Leaf area index	
Genotypes	2010	2011	2010	2011	2010	2011	2010	2011
20th April								
Giza 21	150.93^{h-j}	166.95^{f-h}	0.24^{de}	0.25^{cd}	30.16^{f-i}	43.78^{ef}	2.44^{i}	2.44^{fg}
Giza 22	100.77^{mn}	99.12^{jk}	0.22^{ef}	0.20^{ef}	26.12^{h-j}	26.10^{hi}	2.25^{j}	2.27^{gh}
Giza 111	127.11^{kl}	147.97^{g-i}	0.20^{f-h}	0.20^{ef}	34.68^{e-g}	40.28^{fg}	2.79^{efg}	2.92^{de}
H2L 12	161.99^{g-j}	160.89^{f-h}	0.24^{de}	0.22^{de}	43.74^{cd}	42.80^{f}	2.63^{gh}	2.51^{fg}
H 30	165.09^{g-i}	181.46^{ef}	0.28^{bc}	0.28^{bc}	45.97^{cd}	51.61^{de}	2.83^{ef}	2.89^{e}
H 32	200.67^{de}	225.13^{c-d}	0.30^{b}	0.30^{b}	56.96^{b}	63.16^{a-c}	3.10^{d}	3.25^{cd}
5th May								
Giza 21	157.74^{g-j}	175.85^{f-g}	0.29^{bc}	0.30^{b}	41.85^{c-e}	44.89^{ef}	3.31^{c}	3.44^{c}
Giza 22	100.15^{n}	90.75^{k}	0.20^{fg}	0.17^{fg}	23.55^{ij}	20.79^{i}	2.68^{fg}	2.69^{ef}
Giza 111	117.63^{l-n}	110.62^{jk}	0.23^{ef}	0.19^{e-g}	30.72^{f-i}	27.44^{hi}	3.54^{b}	3.50^{c}
H2L 12	121.45^{lm}	123.01^{ij}	0.22^{ef}	0.22^{de}	29.16^{e-j}	27.85^{hi}	2.82^{ef}	2.85^{e}
H 30	170.33^{f-h}	211.29^{de}	0.35^{a}	0.39^{a}	47.17^{c}	56.16^{cd}	5.11^{a}	5.61^{a}
H 32	99.03^{n}	85.38^{k}	0.19^{g-i}	0.15^{g}	24.75^{ij}	20.75^{i}	3.60^{b}	3.92^{b}
20th May								
Giza 21	188.01^{ef}	208.28^{de}	0.20^{f-h}	0.22^{de}	43.57^{cd}	51.35^{de}	2.33^{ij}	2.50^{fg}
Giza 22	97.66^{n}	102.57^{jk}	0.11^{j}	0.10^{h}	20.88j	22.89i	1.70^{l}	1.69^{jk}
Giza 111	177.42^{fg}	187.61^{ef}	0.17^{hi}	0.16^{fg}	37.72^{d-f}	39.29^{fg}	1.75^{l}	1.78^{ij}
H2L 12	129.46^{kl}	145.06^{g-i}	0.16i	0.16^{fg}	29.07^{e-j}	33.26^{gh}	2.04^{k}	2.09^{hi}
H 30	241.03^{ab}	251.53^{a-c}	0.27^{b-d}	0.28^{bc}	55.68^{b}	59.40^{b-d}	2.18^{jk}	2.21^{gh}
H 32	143.54^{jk}	164.87^{f-h}	0.20^{fg}	0.23^{de}	31.46^{f-i}	40.03^{fg}	1.44m	1.44^{k}
5th June								
Giza 21	231.63^{bc}	235.40^{b-d}	0.25^{de}	0.25^{cd}	57.14^{b}	64.39^{ab}	2.64^{gh}	2.88^{e}
Giza 22	219.29^{c-d}	259.25^{ab}	0.27^{b-d}	0.28^{bc}	56.83^{b}	66.12^{ab}	2.33^{ij}	2.89^{e}
Giza 111	144.08^{j-k}	143.93^{hi}	0.17^{g-i}	0.16^{fg}	34.17^{e-h}	32.61^{gh}	2.02^{k}	2.23^{gh}
H2L 12	37.57^{o}	38.57^{l}	0.07^{k}	0.07^{h}	10.01^{k}	9.86^{j}	2.49^{hi}	2.69^{ef}
H 30	260.42^{a}	276.34^{a}	0.29^{bc}	0.28^{bc}	68.04^{a}	70.78^{a}	2.92^{e}	3.37^{c}
H 32	229.26^{bc}	231.15^{b-d}	0.26^{cd}	0.24^{cd}	63.90^{ab}	55.27^{cd}	3.54^{b}	4.03^{b}
F. Test	**	**	**	**	**	**	**	**
LSD 5%	0.25	0.38	0.03	0.04	8.31	8.38	0.17	0.33

**and NS indicate p<0.01 and not significant, respectively, Means designated by the same letter within columns are not significantly different at the 5% level according to Duncan's multiple range test

Table 4: Means of 100-seed weight, seed, protein and oil yields/ha as affected by the interaction between soybean genotypes and planting dates in 2010 and 2011 seasons

	100-Seed weigh (g)		Seed yield (t ha^{-1})		Protein yield (kg ha^{-1})		Oil yield (kg ha^{-1})	
Genotypes	2010	2011	2010	2011	2010	2011	2010	2011
20th April								
Giza 21	17.57^{bc}	17.57^{b}	1920^{b-g}	2096^{c-f}	1589.5f^{j}	1768.40^{d-i}	632.04^{c-d}	1007.55^{c-d}
Giza 22	15.04^{hij}	14.48^{e}	1775^{fgh}	1916^{d-h}	1841.4^{jkl}	1514.44^{j-m}	855.07^{d-h}	919.97^{cde}
Giza 111	16.45^{ef}	16.55^{c}	1563^{ij}	1670^{hij}	1263.88^{kl}	1393.17^{lmn}	764.74^{jkl}	820.57^{fg}
H2L 12	14.59^{ijk}	15.62^{d}	2065^{bc}	2132^{cde}	1749.06^{c-f}	1847.07^{b-f}	1028.78^{b}	1051.57^{ab}
H 30	16.43^{ef}	17.42^{b}	1729^{hi}	1944^{d-h}	1459.89^{ijk}	1614.49^{e-l}	845.59^{e-h}	958.01^{bc}
H 32	15.13^{hi}	15.47^{d}	1303^{k}	1303^{k}	1229.20^{lm}	1241.52^{no}	638.39^{lm}	636.96^{h}
5th May								
Giza 21	18.87^{a}	18.69^{a}	2619^{a}	2602^{a}	20.9096^{a}	2107.16^{ab}	1252.04^{a}	1239.32^{a}
Giza 22	17.26^{c-d}	17.35^{b}	2090^{b}	2182^{cd}	1891.16^{e-d}	1911.03^{b-e}	991.93^{bc}	1911.36^{ef}
Giza 111	17.95^{b}	18.49^{a}	2488^{a}	2462^{ab}	1963.91^{ab}	1982.3^{bc-d}	11874^{a}	1172.64^{de}
H2L 12	15.91^{f-g}	18.32^{a}	2021^{b-d}	1925^{d-h}	1828.72^{b-e}	1723.21^{e-j}	948^{bc}	891.46^{gh}
H 30	16.94^{de}	17.34^{b}	1810^{e-h}	2281^{bc}	1533.07^{g-j}	2019.82^{a-bc}	860.24^{d-ef}	1082.18^{ef}
H 32	15.67^{gh}	17.35^{b}	1731^{ghi}	1989^{d-g}	1466.16^{ijk}	1684.69^{e-k}	706.68^{hij}	921.97^{gh}
20th May								
Giza 21	18.64^{a}	17.49^{b}	1904^{b-h}	1960^{d-g}	1502.95^{ij}	1578.19^{j-l}	856.61^{d-g}	870.16^{gh}
Giza 22	16.91^{de}	16.20^{c}	1843^{d-h}	1954^{d-g}	1738.16^{c-g}	1824.41^{c-g}	835.93^{d-j}	885.54^{gh}
Giza 111	17.65^{bc}	16.68^{c}	2013^{b-d}	2275^{bc}	1938.11^{abc}	2219.22^{a}	893.83^{c-d}	1011.25^{gh}
H2L 12	16.50^{ef}	16.46^{c}	1954^{b-f}	2088^{c-f}	1730.37^{d-h}	1889.33^{b-e}	864.77^{c-de}	923^{gh}
H 30	15.93^{f-g}	16.41^{c}	1803^{e-h}	1849^{fgh}	1527.15^{hij}	1579.53^{j-l}	781.15^{ijk}	809.09^{i}
H 32	17.72^{bc}	15.55^{d}	1896^{c-h}	1960^{d-g}	1751.90^{c-f}	1811.04^{c-h}	831^{hij}	859^{gh}
5th June								
Giza 21	14.06^{k-m}	15.56^{d}	1983^{b-e}	2023^{c-f}	1643.4^{e-i}	1700.5^{e-k}	839.21^{f-i}	849^{gh}
Giza 22	14.46^{jkl}	15.48^{d}	1432^{jk}	1453^{jk}	1047.50^{m}	1109.5^{o}	600.88^{m}	611.18
Giza 111	13.78^{mn}	14.32^{e}	1733^{ghi}	1739^{ghi}	1434.68^{jkl}	1467.20^{k-n}	731.89^{k-m}	734.93^{i}
H2L 12	14.67^{ijk}	14.77^{e}	1814^{e-h}	1898^{e-h}	1536.45^{g-j}	1607.60^{f-l}	777.67^{ijk}	813.20^{gh}
H 30	13.32^{n}	13.32^{f}	1514^{j}	1564^{ijk}	1253.38^{lm}	1319.53^{mno}	633.15^{lm}	654.104^{i}
H 32	13.89^{lmn}	14.67^{e}	1972^{b-e}	2002^{c-g}	1516.261^{ij}	1576^{h-l}	839.34^{f-i}	860.39^{gh}
F. Test	**	**	**	**	**	**	**	**
LSD 5%	0.64	0.49	189.7	279.6	207.02	240.57	83.55	102.38

**and NS indicate p<0.01 and not significant, respectively, Means designated by the same letter within columns are not significantly different at the 5% level according to Duncan's multiple range test

lowest values of leaf area index. The results in Table 4 clearly showed that planting Giza 21 cultivar on 5th May recorded highest of 100-seed weight, seed yield (t ha^{-1}) and oil yield (kg ha^{-1}).Whereas, planting Giza 21 cultivar on 5th May gave the highest protein yield/ha. Planting Giza 111 cultivar on 20th May gave highest protein yield/ha. Planting H30 line on 5th June produced the lowest 100-seed weight. Planting H32 line on 20th April gave the lowest seed yield/ha and planting Giza 22 cultivar on 5th June gave the lowest protein and oil yields/ha. High temperature during reproductive stages of R5 and R6 enhanced oil content and generally reductions of protein content (Dornbos and Mullen, 1992) Similar results were reported by Hassan *et al.* (2002), Hamed (2003), Mehasen and Saeed (2005) and De Bruin and Pedersen (2009).

CONCLUSION

It could be summarized that planting Giza 21 cultivar early on 5th May maximized seed, oil and protein yields/ha of soybean under the environmental condition of Kafr El-Sheikh District, Egypt.

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