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THE OPTIMAL USE OF LAND AND WATER AT TOSHKY FOR CROP PRODUCTION SOYBEAN CULTIVARS AND SOWING DATES UNDER ENVIRONMENTAL STRESS CONDITIONS

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Abstract

Toshky as a new virgin area in the south valley is interesting for clean agriculture production free from pollution, increase Egyptian national income and decrease imports. This investigation was conducted at Toshky (22º 25 N latitude and 31º 50 E longitude) during the two successive summer seasons 2001 and 2002 to study the performance of Giza 111, Giza 22, Giza 35 and Crawford soybean cultivars under five sowing dates viz. May 1, May 11, May 21, May 31 and June 10. The water requirements are 3647 m^3/fed. This amount was distributed by sprinkler irrigation system during different growing stages. It included 20 % from the calculated water requirements for leaching. The soil analysis indicated that many fragments of various rock and small gravels differing in shape, size and colour dominate on the soil surface. The soil taxonomy classified as Typic xerofluvants, sandy loam, mixed and hyperthermic. The soil salinity, organic matter as well as soil fertility including macro and micronutrients are very low. The recorded data showed that Giza 22 was the best cultivar from the all studied characters. A reduction in the yield of soybean happened due to the late of planting after May 21. The greatest seed yield (1283 kg/fed.) was obtained by Giza 22 at May 21 date of planting. From this study it can be recommended that cultivars Giza 22, Giza 35 and Giza 111 were the suitable cultivars to be planted from the first of May to May 21 under Toshky conditions. Seed yield/plant was correlated positively with each of plant height, number of pods/plant, number of seeds/plant, 100-seed weight and harvest index.

INTRODUCTION

Agriculture intensification and reclamation of new areas are considered important ways of solving or decreasing the large gap between the production and consumption of food products. The new virgin area in south valley of Egypt (Toshky project) is very important to get clean agricultural crops free from pollution and also to increase the Egyptian income through increasing exports.

A Toshky project soil is a good chance for of this match includes aim. A drastic decline in soybean cultivation occurred in Egypt during the last ten years (from about 100.000 feddan in 1991 to about 13.000 feddan in 2001), due to competition with other summer crops, increased production cost, reduced net return per unit area and difficulties in marketing process. Accordingly, the total production became far below the country requirements. Therefore, it is absolutely necessary to introduce the crop to new land areas for reducing cost and increasing productivity per unit area in order to improve soybean total production at a national level. This can be achieved through better management such as growing high yielding cultivars at proper sowing dates.

In this connection, Whigham *et al.* (1978) stated that environmental variables (altitude, longitude, day length, maximum and minimum temperatures) were found to be less important than management variabls (amount of fertilizers applied and nodulation) as determinants of yield. Several investigators (Board and Hall, 1984; Sarmah *et al.* 1984; Boquet *et al.* 1985; Mohamed 1988; Ali 1993 and Shafshak *et al.* 1997) reported that sowing date plays an important role in crop productivity. Seed yield of soybean cultivars decreased with delayed sowing. They added that higher yields were associated with more pods and higher seed weight per plant as well as heavier weight of 100-seeds. Therefore, this investigation was designed to study the response of some soybean cultivars to various sowing dates aiming at evaluating the potentiality of each cultivar under Toshky conditions.

MATERIALS AND METHODS

A field experiment was conducted at the south valley Agriculture Research Station Farm "Toshky", during 2001 and 2002 summer seasons. The Experimental farm is located in Abosimble city at latitude 22º 25 North and longitude 31º 50 East; and 182 m above sea level (a.s.l.). The climatic conditions and data of Toshky meteorological station at the Agricultural Research Station are presented in Table (1).

The water requirements (WR) were calculated + 20 % WR as a leaching fraction and applied during different growing stages of plant. The total amount is 3647 m^3 for total growing period using sprinkler system. The WR is calculated from meteorological data station at Toshky using Penman Monteith methods (Smith, 1991 and Ainer *et al.*

1999). The water quality analysis used in irrigation (EC_{iw} = 140 ppm) represents that of lake Nasser.The treatment combinations in this investigation are as follows: (i) Sowing date: Five sowing dates were used (May 1, May 11, May 21 May 31 and June 10) and (ii) Soybean cultivars: Four soybean cultivars were used (G. 111, G. 22, G. 35 and Crawford).

Table 1. Mean meteorological data, in south valley Agricultural Research Station (Toshky, ARC), and reference evapotranspiration (2001-2002).

Month	Air temp.			R.H.			Soil temp.			ETo	ETo
	Avg.	Max	Min	Avg	Max	Min	Avg	Max	Min	mm/ day	m^3/fed. day
April	31.0	37.0	22.1	29.6	42.0	9.0	37.3	41.6	28.4	7.50	31.5
May	33.5	40.5	26.5	19.0	38.0	9.0	37.8	45.0	32.0	7.50	31.5
June	35.5	43.2	27.5	19.0	36.1	8.6	38.0	46.0	32.1	7.50	31.5
July	37.4	45.4	27.6	16.8	34.5	8.4	39.0	45.0	33.0	8.60	36.1
August	37.7	45.0	29.0	19.5	36.5	9.7	39.4	46.0	32.5	8.60	36.1

A split plot design with four replications was used. Main plots were devoted to sowing date and sub-plots to soybean cultivars. Each plot consisted of seven rows 60 cm apart and six meters long (4.2 m x 6 m = 25.2 m^2). Six m^3/fed of chicken manure (as a source of organic matter) was added at land preparation. Experimental plots were fertilized with phosphorous at a rate of 30 kg P_2O_5/fed (super phosphate) during seedbed preparation and 24 K_2O/fed (potassium sulfate) three weeks after sowing. Seeds were inoculated with the specific rhizobia, and then hand-planted in soil. Nitrogen fertilizer was added as a starter dose two weeks after sowing at a rate of 20 kg N/fed (Ammonium sulfate) Hand weeding was practiced twice to control weeds during the first six weeks of the growing season. At harvest, ten plants were randomly taken from the five central rows of each sub-plot to measure plant height, number of pods and seeds as well as seed weight per plant. Seed yield per fed and 100 seeds weight were determined on plot basis from a central area of 15 m^2 (3 x 5 m).

Soil samples (at initial state, and at end of each season of 2001 and 2002) were taken and analyzed for particle soil distribution as well as chemical analyses including salinity (electrical conductivity), pH, calcium carbonate, cation exchange capacity and

available macro and micro nutrients using international methods reported by Page (1982). Data obtained were tabulated in combined analysis according to Snedecor and Cochran (1981).

RESULTS AND DISCUSSION

Soil characteristics

In general, many fragments of various rocks and gravels dominate on the soil surface. The fragments are different in shape, size and colour. The soil texture of the soybean experiment is mainly sand loam. The soils are virgin soils and the bedrock is shallow (40 cm depth). The main soil characteristics and soil fertility are presented in Tables 2 and 3. In general, the soil salinity is low. At initial state, soil EC is not more than 1.2 dS/m. Also, at the end of the seasons 2001/2002 the soil EC is 1.3 dS/m; exception was, however, obtained in the second layer of profile 5 in the second season where the EC increased slightly to 1.6 dS/m. The control of salinity is due to the addition of a leaching fraction added with irrigation water in the summer season. Therefore, the salinity is not affected in the soybean treatments during growing stages.

The total calcium carbonate percentage varied between 10 and 15 % in the different profiles. The soil behaviour under this rate of calcium carbonate needs good irrigation management to control the physical effect of calcium carbonate and to protect the roots of the crops under these conditions. The organic matter is very low at initial state but increased slightly after soybean in 2001 and 2002. The organic matter increased slightly on the surface soil layer 0-30 cm. The soil pH varies between 8.8 and 9.2 indicating that the soil pH tends to be alkali due to the arid conditions. The cation exchange capacity is low and varied between 13 and 15 meq/100 gm soil.

As a result of the soil physical and chemical properties as well as the morphological features, the soil taxonomy could be classified as typic-xerofluvants, sand loam mixed, hyper thermic (Soil Survey Staff, 1994)

The macro and micro nutrients status

The available nitrogen in the virgin soil was low and also phosphorous, but potassium was medium at the initial stage of the experiment (Table 3). The value of available nitrogen increased in season 2001 and 2002 to 26 mg/Kg soil in surface layer could be due to nitrogen fixation of soybean; also availability of phosphorous increased. Therefore, it could be stated that soybean helps build up fertility of newly reclaimed soil under Toshky conditions. The value of potassium increased in 2001 and 2002 under all treatments in surface layer due to addition of potassium fertilizer, and varied between 180 and 280 mg/kg soil. The micronutrients data indicated that the soil is relatively rich in iron, but the other elements (manganese, copper and zinc) are low according to Lindsay and Norvell (1978).

Agronomic aspects

Sowing date effect

Data presented in Table 4 show clearly that sowing date had a significant effect on yield and yield components of soybean. Seed yield was remarkably reduced when sowing took place after May 21. The yield obtained at the sowing date May 21 surpassed that of May 1 and June 10 by 16.6% and 127%, respectively while that of May 1 surpassed May 31 and June 10 by 40.7% and 94.7%, respectively. The increase in seed yield may be attributed to the considerable increase in plant height, number of pods and seeds/plant and seeds weight per plant. These results suggest that maximum seed yield of soybean could be obtained from planting during a period extending from May 1 to May 21 due to more favourable weather during this period under the conditions of this location. In this connection the major factors contributing to soybean yield reduction at late sowing dates could be the high temperature and short day length that induce early flowering and termination of the main axis, reduce pod development and in turn seed yield (Ali, 1993 and Moor *et al.*, 1991).

Soybean cultivars effect

Results in Table 5 show that the cultivars differed significantly in all characters studied. Plants of Giza 22 were the tallest, whereas those of Crawford were the shortest. Giza 22 surpassed all cultivars in pods and seeds number as well as harvest index

Table 2. The soil physical and chemical characteristics at initial state and after crop harvest (2001 and 2002 seasons).

Date of sowing treatments	Soil depth (cm)	Sp	pH 1:2.5	EC dS/m	CEC meq/100g	$CaCO^3$ %	O.M %	Sp	EC dS/m	O.M %	Sp	EC dS/m	O.M %
		Initial state						End season of 2001			End season of 2002		
1 May	0-30	28	9.0	0.75	15.0	12	0.05	30	0.80	0.30	30	0.95	0.30
	30-60	30	8.8	0.80	13.0	13	0.05	30	0.80	0.10	28	0.90	0.15
	60-90	30	8.8	0.80	13.0	13	0.05	30	0.95	0.10	30	1.10	0.10
	Mean	29	8.9	0.78	13.7	12.7	0.05	30	0.85	0.17	29	0.98	0.18
11 May	0-30	32	8.9	0.90	13.5	15	0.10	32	1.00	0.30	30	1.20	0.30
	30-60	28	9.1	1.10	14.0	14	0.05	30	1.30	0.10	31	1.10	0.10
	60-90	30	9.1	0.90	13.0	14	0.05	30	0.90	0.05	32	1.00	0.05
	Mean	30	9.0	0.97	13.5	14.3	0.07	31	1.07	0.15	31	1.10	0.15
21 May	0-30	31	9.2	0.80	14.5	12	0.10	32	0.90	0.30	30	1.20	0.30
	30-60	28	9.1	0.90	15.0	12	0.10	30	1.20	0.10	32	1.20	0.10
	60-90	28	9.1	0.90	15.0	12	0.10	30	1.10	0.10	30	1.10	0.10
	Mean	29	9.1	0.87	14.8	12	0.10	31	1.07	0.17	31	1.17	0.17
31 May	0-30	30	8.9	0.90	13.0	10	0.15	32	1.30	0.20	32	1.35	0.25
	30-60	28	8.8	0.80	13.5	11	0.10	30	1.00	0.10	30	1.20	0.15
	60-90	30	9.1	0.80	14.0	16	0.05	30	1.00	0.05	30	1.20	0.10
	Mean	29	8.9	0.83	13.5	10.3	0.10	31	1.10	0.12	31	1.25	0.17
10 June	0-30	32	9.0	1.20	14.0	10	0.10	32	1.30	0.20	30	1.20	0.25
	30-60	30	9.1	1.10	13.0	11	0.05	30	1.20	0.10	30	1.60	0.10
	60-90	28	8.9	1.00	13.0	11	0.05	28	1.20	0.05	30	1.30	0.05
	Mean	30	9.0	1.10	13.3	10.7	0.07	30	1.23	0.12	30	1.37	0.13

Table 3. The macro and micro nutrients during 2001 and 2002 seasons.

Date of sowing treatments	Soil depth	N	P	K	Fe	Mn	Cu	Zn	End season of 2001			End season of 2002		
		Mg/kg soil (Initial state)							N	P	K	N	P	K
1 May	0-30	20	6.5	200	12.0	4.0	0.40	0.2	26	7.0	230	24	6.0	240
	30-60	16	6.0	210	12.0	4.0	0.30	0.2	20	7.0	210	22	6.5	200
	60-90	16	5.8	180	10.0	3.0	0.30	0.3	16	6.5	180	18	6.0	180
	Mean	17.3	6.0	197	11.3	3.7	3.30	0.23	21	6.8	207	21	6.2	207
11 May	0-30	16	8.0	230	10.0	4.5	0.20	0.3	26	8.5	235	24	8.0	240
	30-60	15	6.5	200	8.0	3.5	0.30	0.2	18	6.5	200	16	7.0	200
	60-90	13	6.5	180	8.0	3.0	0.20	0.3	18	6.5	190	16	6.0	180
	Mean	14.7	7.0	203	8.7	3.7	0.23	0.27	20	7.2	142	18	7.0	207
21 May	0-30	21	6.6	280	16.0	2.5	0.30	0.4	24	7.0	300	26	7.5	280
	30-60	18	5.5	320	14.0	4.0	0.30	0.4	18	6.5	300	19	6.5	280
	60-90	16	5.5	300	12.0	2.5	0.25	0.4	18	6.5	290	21	6.0	290
	Mean	18.3	5.8	300	14.0	3.0	0.28	0.4	20	6.7	297	22	6.7	197
31 May	0-30	16	6.5	240	16.0	4.0	0.25	0.3	24	7.5	210	26	6.0	230
	30-60	14	6.5	250	16.0	2.5	0.25	0.4	20	6.0	260	20	6.0	230
	60-90	14	6.0	250	16.0	2.5	0.30	0.4	20	6.0	250	18	6.0	250
	Mean	14.7	6.3	247	16.0	3.0	0.27	0.37	21	6.5	240	21	6.0	237
10 June	0-30	18	7.0	200	12.0	4.0	0.40	0.2	26	7.0	210	22	7.5	230
	30-60	16	6.0	180	12.0	4.0	0.40	0.2	18	6.0	200	19	6.0	200
	60-90	14	6.0	180	8.0	2.5	0.20	0.2	18	6.0	180	19	6.0	200
	Mean	16.0	6.3	187	10.6	3.5	0.33	0.2	21	6.3	197	20	6.5	210

(H.I.) and seed weight per plant followed by Giza 35. However, Giza 35 had the heaviest weight of 100-seeds followed by Giza 111, Giza 22 and Crawford.

Table 4. Effect of sowing date on yield and yield components of soybean grown at south valley Agricultural Research Station (Toshky), combined data of 2001 and 2002 seasons.

Sowing date	Plant height (cm)	No. of pods	No. of seeds	Seed yield /plant (g)	100-seed weight (g)	Seed yield /feddan (kg)	Harvest Index H.I %
May 1	57.75 C	28.24 C	64.86 C	8.69 B	17.32 A	1030 B	39.16 C
May 11	64.03 B	31.90 B	69.19 B	9.03 B	16.50 B	1044 B	44.81 B
May 21	67.38 A	33.67 A	75.40 A	10.50 A	16.28 B	1201 A	48.22 A
May 31	53.48 D	23.59 D	56.38 D	6.38 C	13.74 C	732 C	36.19 D
June 10	49.91 E	18.66 E	42.71 E	4.50 D	13.33 D	529 D	32.22 E

The highest seed yield (977 kg per feddan) was obtained with Giza22 followed by Giza 35, Giza 111 and Crawford (940, 891 and 820 kg per feddan, respectively). Giza 22 exceeded Giza 35, Giza 111 and Crawford by 3.9, 9.6 and 19.4 %, respectively. The superiority of Giza 22 may be due to differences existing in genetically making up. Similar differences among soybean cultivars were reported in plant height, number of pods, number of seeds, seed weight per plant, harvest index and 100-seed weight (Ali, 1993 and Board, 1985).

Table 5. Yield and yield components of four soybean cultivars, combined data of 2001 and 2002 seasons.

Cultivars	Plant height (cm)	No. of pods /plant	No. of seeds /plant	Seed weight /plant (g)	100-seed weight (g)	Seed yield /feddan (kg)	Harvest index %
Giza 111	57.15 C	26.37 C	61.94 C	7.62 C	15.57 B	891 C	38.65 C
Giza 22	61.90 A	30.26 A	69.15 A	8.74 A	15.36 B	977 A	44.03 A
Giza 35	60.45 B	28.14 B	65.13 B	7.98 B	15.90 A	940 B	41.63 B
Crawford	54.38 D	24.07 D	58.61 D	6.95 D	14.90 C	820 D	36.17 D

Sowing date x cultivar:

Results in Table 6 show that the highest response of yield component characters to the cultivar x sowing date interaction was achieved through sowing Giza 22 on May 21, this combination recorded the highest values of all studied characters except 100 seeds weight. The greatest yield of seeds (1283 kg per feddan) was achieved by Giza 22 sowing on May 21. It could be concluded that Giza 22 is considered a very promising cultivar for Toshky area, producing its maximum yield when sowing at an appropriate date.

It is noteworthy that Giza 35 and Giza 111 also proved to be adapted cultivars under Toshky conditions, since they came directly after Giza 22 in all characters studied.

Table 6. Effect of sowing date x cultivar interaction on yield and yield components of soybean, combined data of 2000 and 2001 seasons.

Sowing date	Cultivar	Plant height	No. of pods	No. of seeds	Seed yield g/plant	100-seed weight (g)	Seed yield /feddan (kg)	H.I %
May 1	G. 111	56.75 GH	27.38 GH	64.41 FG	8.54 FG	18.00 AB	1025 BCD	39.38 EFG
	G. 22	60.38 EF	32.83 CD	67.74 EF	9.36 D	16.40 DE	1079 B	40.63 DE
	G. 35	60.00 F	27.66 GH	64.85 FG	9.00 DEF	18.42 A	1062 BC	39.88 DEF
	Crawford	53.88 IJ	25.10 IJ	62.42 GH	7.88 H	16.45 DE	956 E	36.75 FGH
May 11	G. 111	62.75 DE	30.99 DE	72.20 D	8.65 EFG	17.34 C	1035 BCD	42.38 DE
	G. 22	67.38 BC	34.16 BC	80.54 AB	10.04 C	17.41 BC	1078 B	48.88 BC
	G. 35	67.25 BC	33.63 BC	77.45 BC	9.23 DE	15.88 EF	1074 BC	48.00 BC
	Crawford	58.75 FG	28.81 FG	71.43 DE	8.19 GH	15.36 FG	987 DE	40.00 DEF
May 21	G. 111	65.38 CD	32.60 CD	78.13 B	10.70 B	15.88 EF	1232 A	47.25 C
	G. 22	72.38 A	36.69 A	84.22 A	11.68 A	16.91 CD	1283 A	52.75 A
	G. 35	68.63 B	35.06 AB	80.63 AB	10.93 B	15.99 EF	1271 A	50.88 AB
	Crawford	63.13 D	30.31 EF	73.80 CD	8.71 EFG	16.36 DE	1015 CDE	42.00 DE
May 31	G. 111	52.38 JK	23.46 JK	55.19 I	5.81 I	12.85 J	649 H	33.88 HIJ
	G. 22	56.00 HI	25.92 HI	62.21 GH	7.79 H	12.52 JK	889 F	43.13 D
	G. 35	53.63 IJK	24.49 IJ	58.79 HI	6.21 I	15.19 G	750 G	36.13 GHI
	Crawford	51.13 KL	20.48 L	49.31 J	5.70 I	14.41 H	642 H	31.63 JK
June 10	G. 111	48.50 L	17.42 M	39.75 L	4.38 J	13.79 HI	512 I	30.38 K
	G. 22	53.38 IJK	21.73 KL	51.06 J	4.83 J	13.56 I	556 I	34.75 HIJ
	G. 35	52.75 JK	19.85 L	43.95 K	4.54 J	14.04 HI	543 I	33.25 IJK
	Crawford	45.00 M	15.65 M	36.08 L	4.28 J	11.93 K	503 I	30.50 K

Correlation among characters

Coefficient of phenotypic correlation among the studied characters in soybean over 2001 and 2002 seasons are shown in Table 7. The results show that there is a high significantly and positive association between seed yield/plant and number of pods/plant (r = 0.836), number of seeds/plant (r = 0.865). High correlation with pod number is of interest to plant breeder because it is relatively easily identifiable character in the field. It is clear from this study that the number of pods/plant, number of seeds/plant and 100 seeds weight are important to improve seed yield through direct selection.

Table 7. Phenotypic simple correlation for yield and its components.

characters	Plant height	No. of pods /plant	No. of seeds /plant	Seed yield /plant	100-seed weight	Harvest index	Seed yield /fed.
Plant height		0.406**	0.443**	0.440**	0.256**	0.391**	0.462**
No. of pods/plant			0.955**	0.836**	0.649**	0.701**	0.832**
No. of seeds/plant				0.865**	0.632**	0.732**	0.866**
Seed yield/plant					0.663**	0.813**	0.963**
100 seed weight						0.484**	0.697**
Harvest index							0.796**
Seed yield /fed.							

* significant at 5% and ** at 1% probability levels, respectively.

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الإستخدام الأمثل للارض والمياه لإنتاج بعض أصناف فول الصويا تحت مواعيد زراعة مختلفة تحت الظروف البيئية بتوشكى

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١ قسم *البحوث البقولية* – معهد بحوث *المحاصيل الحقلية* – مركز *البحوث الزراعية*.
٢ معهد بحوث *الأراضى والمياه* – مركز *البحوث الزراعية*.

تعتبر توشكى من المناطق الجديدة فى جنوب الوادى وهى تعتبر من المناطق الزراعية النظيفة والخالية من التلوث وتساهم فى زيادة الدخل القومى المصرى وتقليل واردات الزيوت. أقيمت تجربتان حقليتان بمحطة بحوث جنوب الوادى (توشكى) – مركز البحوث الزراعية وهى تقع عند خط عرض ٢٥ ٥٢٢ شرقا و طول ٥٠ ٥٣١ شمالا ، خلال موسمى ٢٠٠١ ، ٢٠٠٢م بهدف دراسة سلوك أربعة أصناف من فول الصويا هى جيزة ١١١ ، جيزة ٢٢ ، جيزة ٣٥، وكراوفورد تحت خمسة مواعيد زراعة وهى الأول والحادى عشر والحادى والعشرون والحادى والثلاثون من مايو والعاشر من يونيو، للوقوف على أفضل ميعاد للزراعة وأفضل الأصناف التى يمكن زراعتها للمنطقة. وقد قدرت الإحتياجات المائية وكانت ٣٦٤٧ م^3 للفدان خلال الموسم وهذه الكمية من المياه تم توزيعها خلال مراحل عمر النبات عن طريق الرى بالرش شاملة ٢٠٪ من الاستهلاك المائى المقدر كإحتياجات غسيل.

أوضحت نتائج دراسة وتحليل التربة انخفاض ملوحتها ومحتواها من المادة العضوية علاوة على ضعف خصوبتها بإنخفاض مستوى العناصر الكبرى والصغرى، كما أن يوجد بعض الحصى والحجارة على سطح التربة مختلفة الشكل والحجم واللون. هذا وقد قسمت طبقا للتقسيم الدولى للأراضى على إنها :

Typic xero fluvants, sandy loam, mixed and hyperthermic

أوضحت النتائج المسجلة أن الزراعة خلال الفترة من أول مايو حتى ٢١ مايو أعطت أعلى القيم لجميع الصفات المدروسة وتفوقت الزراعة فى ٢١ مايو فى صفات عدد قرون ووزن بذور النبات وكذلك محصول البذور / فدان، كما أوضحت أيضاً تفوق الصنف جيزة ٢٢ على الأصناف المختبرة فى صفات طول النبات ، وعدد القرون والبذور ، ووزن بذور النبات ومحصول البذور / فدان. كما أظهرت النتائج كذلك أنه أمكن الحصول علي أفضل محصول من فول الصويا (وزن البذور للفدان ١٢٨٣كم) بزراعة الصنف جيزة ٢٢ في ٢١ مايو، كما تشير النتائج إلي أن الأصناف جيزة ٢٢ ، جيزة ٣٥، جيزة ١١١ تعتبر أفضل الأصناف الواعدة التي يمكن زراعتها بنجاح خلال الموسم الصيفي بمنطقة محطة بحوث جنوب الوادي (توشكي) وأن ميعاد الزراعة الأمثل هو خلال الفترة من أول مايو حتى ٢١مايو للحصول علي أعلي محصول من البذور / فدان.