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Effect of some weed control treatments and plant density on two soybean varieties and associated weeds

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Abstract

Two field experiments were carried out at the Research and Experimental Station of the Faculty of Agriculture, Moshtohr, Benha University, Kalubia Governorate during the two summer seasons of 2014 and 2015 to study effect of some weed control treatments and plant densities on two soybean varieties productively and associated weeds. Results of the combined analyses of the two seasons showed that: Pods and seed weights/plant (g), seed, straw and biological yields kg/fad were significantly increased by hand hoeing twice after 15 and 45 days from planting compared with Stomp and Amex.Giza111 soybean variety surpassed Giza 21 in growth characters namely (plant height, dry weight of leaves, stems and plant, while Giza 21 gave the highest value of dry weight of pods. Regarding yield and yield component, Giza 111 recorded the highest value of plant height, straw yield and biological yield, while Giza 21 gave the highest weight of seeds/plant and seed yield/ fad. With regard to plant density Decreasing plant density to 116667plants/fad increased weight of pods and seeds/plant, while the highest plant density (175000 plants/fad) led to increasing the straw and biological yield/ fad. Whereas the plant density 140000 plant/fad recorded the highest values of plant height and seed yield/fad. The interaction between Giza111, plant density of 140000 plants/fad and hand hoeing twice recorded minimum value of dry weight of total weeds at 75 days after planting.

Keywords: *Glycine max*, density, hoeing, growth, chemical control, Stomp, Amex.

Introduction

Soybean [*Glycine max, (L.)* Merill] popular as golden bean has become the marvel crop of the present century. It is a dual purpose crop for being grown both as an oilseed and pulse crops as well **(Thakare*et al.*, 2006**). It has outstanding nutritive value containing around 43% protein, 20% oil and it is also an excellent source of vitamins, minerals and salts **(Raghuvanshi and Bisht, 2010).**

Weed competition is the most imperative cause of yield loss in soybean estimated as 22-77% **(Kurchania *et al*., 2001).** Hence, weed control is considered one of the main factors for high soybean production, and several weed management methods have been suggested for that purpose **(Buhler and Hartzler, 2004).**

Dinitroaniline herbicides are used as pre-plant incorporated, pre-emergence and also as a post-emergence herbicide for weed control in many crops **(Adesina *et al*., 1998)**.Hand weeding in soybean has been recommended where herbicides can't be used especially in small scale production **(Hassan, 2013).. Shairef *et al*. (2010)** indicated that Giza 21 variety registered the highest rates of seed yield and its attributes compared with Giza 111.**Mostafa (2011)** and **Kandil *et al*. (2012)** showed that Giza 21 variety recorded highest yield and yield component compared to Giza 22. While, Giza 22 variety gave higher values of plant height than Giza 21.

Plant densities are important practices for determining the soybean productivity. Such that, adjusting planting density is important tool to optimize crop growth and maximize seed yield and quality **(Biabani, 2010)**. **Bing *et al.* (2010)** reported that seed yield declined with increasing density. **Rahman and Hossain (2011**) concluded that the greatest soybean yield could be possible with a density of 80-100 plants/m^2 depending on variety, season and related agronomic management options.

The objectives of this study were: to investigate the effect of some weed control treatments and plant densities on growth, yield and its components as well as associated weeds of two soybean varieties.

Materials and Methods

Variables included in this experiment were as follow:

A- Weed control treatments:

1- Hand hoeing (Twice) after 15 and 45 days from planting.
2- Pendimethalin (stomp) N (1-Ethylpropyl)-2, 6 dinitro-3, 4-xylidine at a rate of 1.7 L/fad used as pre-planting.
3- Butraline(Amex) N-(1-methyle propyle)-2, 6dinitro4(1, 1dimethyleethyle) at rate of 2.5 L/fad used as the pre-planting.
4- Un-weeded treatment as control.

B- Varieties:

1- Giza 21 2- Giza 111

C- Three plant densities were used as follow:

1- Low plant density as 116667 plants/fad (6 cm between plants).2-Medium plant density as140000 plants/fad (5 cm between plants).3-

High plant density as175000 plants/fad (4 cm between plants).

Experimental layout: was in a split plot design. The main plots were occupied by weed control treatments and the sub-plots were devoted to the combination between plant densities and varieties.

Each experimental unit included 5 ridges each of 60 cm width and 3.5 m length (10.5 m^2). The preceding winter crop was sugar beet in both seasons. The experimental field was well prepared and calcium super phosphate (15.5% P_2O_5) was applied during soil preparation at the rate of 150 kg fad. Soybean seeds were thoroughly mixed with nodulating bacteria **(*Bradyrhizobiumjaponicum*)** strain just before sowing on May 8^{th} and 14^{th} in the first and second seasons, respectively. After three weeks, only healthy plants remained in each hill. Nitrogen and potassium fertilizers were applied in the forms of urea (46.5% N) and potassium sulphate (48% K_2O) at the rate of 60 kg N and 48 kg K_2O/fad after thinning and three weeks later in two equal portions. All herbicides were sprayed on soil surface and irrigation was carried out on the same day. The rest of the cultural practices for growing soybean according to Ministry of Agriculture recommendation were followed.

Data recorded:

1. Dry weight of weeds

At 75 days after planting (DAP) Weeds were hand pulled from one square meter of the middle of each plot in four replication overs dry weight of the total weeds was recorded.

2. Soybean growth and yield:

Similarly, five soybean plants were taken at random from each plot of the four replication to record Plant height (cm), dry weight of leaves, stems and total plant (g/plant).

Harvest was done after 120 days and a sample of 5 soybean plants was randomly taken from each plot to determine plant height (cm), weight of pods and seeds/plant (g), while seed, straw and biological yields/fad (kg)were determined on the whole plots basis in the four replication.

Statistical analysis:

Data were statistically analyzed using MSTAT statistical package (MSTAT-C with MGRAPH version 21).The combined analysis was conducted for data of the two seasons Duncan multiple range test was used to compare between means of traits at 5%probability's**Duncan (1955)**.Least significant difference (LSD) method was used to test the difference between treatment means at 5% level of probability as described by **Snedecor and Cochran (1980)**.

Results and Discussion

I- Effect of weed control treatments:

1- Dry weight of weeds:

Results presented in Table (1) indicate that there was significant difference between weed control treatments as to than effect on dry weight of weeds at 75 days from planting. Hand hoeing twice after 15 and 45 days from planting was most effective in controlling weeds followed by Amex and Stomp treatment. The decreases in total dry weight of weeds were 73.75, 57.12 and 40.23% for hoeing twice, Stomp and Amex as compared with un-weeded treatment. These results are similar to those obtained by **singh and Jolly (2004)** who reported that two hand hoeing are recommended for effective weed control in soybean. Also ,**Abd El-Hamid and El-Metwally (2008)** obtained results showing that two hand hoeing's gave the highest weed depression expressed in the lowest dry weight of total weeds which were significantly reduced by weed management practices, compared to the non-weeded treatment .

2- Growth characters of soybean:

Results in Table (1) show that weed control treatments had significant effect on some soybean growth characters at 75 days after planting.

Table 1. Effect of weed control treatments and plant densities on some growth characters of two soybean varieties and associated weeds after 75 days from planting (combined analysis of 2014 and 2015 seasons).

Treatments		Plant height (cm)	Dry weight of leaves (g/plant)	Dry weight of stems (g/plant)	Dry weight of pods (g/plant)	Dry weight of total plant (g/plant)	Dry weight of total weeds (g/m^2)
Weed control	**Stomp (1.7L/fad)**	124.00**ab**	16.29 **a**	14.98 **a**	3.86 **a**	35.13 **a**	23.18 **b**
	Amex (2.5L/fad)	125.00**ab**	15.27 **b**	14.97 **a**	3.63 **b**	33.88 **b**	16.63 **c**
	Hand Hoeing twice	125.00 **a**	15.27 **b**	14.48 **a**	3.41 **b**	33.16 **b**	10.18 **d**
	Un-weeded (control)	123.00 **b**	13.47 **c**	13.51 **b**	2.82 **c**	29.80 **c**	38.78 **a**
Variety	**Giza 21**	123.00 **b**	14.58 **b**	13.98 **b**	3.92 **a**	32.48 **b**	23.40 **a**
	Giza 111	125.00**a**	15.58 **a**	14.99 **a**	2.94 **b**	33.50 **a**	20.98 **b**
Plant density (fad.)	**116667**	125.00**a**	16.01 **a**	15.21 **a**	3.30 **b**	34.52 **a**	23.51 **a**
	140000	124.00**ab**	15.12 **b**	14.68 **b**	3.55 **a**	33.35 **b**	20.52 **c**
	175000	124.00**b**	14.10 **c**	13.57 **c**	3.44 **ab**	31.11 **c**	22.54 **b**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

Hand hoeing twice treatment resulted in the tallest plant (125.00 cm), while un-weeded treatment gave the lowest one (123.00 cm). Stomp treatment gave the greatest values of dry weight of leaves, stems, pods and total plant (16.29, 14.98, 3.86and35.13 g) compared with other treatments.
On the other hand, un-weeded treatments recorded the minimum values of dry weight of leaves, stem, pods and plant. Similar findings were obtained by **Joshi and Billore (1997)** who reported that weed competition increased the plant height of soybean. Also,**Pandey *et al*. (1996)** observed continuous reduction in plant height with the increasing of weeds competition which was attributed to a variety growth habit.

II _ Varietal response:

1- Dry weight of weeds:

Results in Table (1) show that the differences between the two varieties as to their effect on dry weight of total weeds at 75 after planting were significant in the combined analysis. Giza 111 significantly surpassed Giza 21 variety in combating the associated weeds. The dry weight of total weeds associated with Giza 111 was significantly below than that associated with Giza 21. These results may be due to the vigorous growth of Giza 111which increase the competition between plants and weeds. These results are similar to those reported by **Bussan *et al*. (1997)** who revealed that the competitive capability of crop can be cleared in two ways. First is the capability of crop to compete weeds with decreasing biomass production. The second possibility is having crop resist competition from weeds, while preserving high yields

2- Growth characters of soybean:

Results in Table (1) show that the differences between the two soybean varieties for all studied growth characters at 75 days after planting were significant in the combined analysis. The results indicate clearly that Giza 111 gave the highest values of plant height (125.00 cm), dry weight of leaves (15.58 g), stems (14.99 g) and total weight/plant (33.50 g) compared with Giza 21. On the other hand, Giza 21 recorded the highest value of dry weight of pods (3.92 g) .These results are similar to those reported by **Shukla and Kumar (1994)** stated that differences between the two varieties may be attributed to their genetic constitution.

III- Effect of plant densities:

1- Dry weight of weeds:

Results in Table (1) show that plant density had significant influence on dry weight of total weeds. Indicating that the lower plant density (116667 plants/fad) recorded the highest dry weight of weeds (23.51 g/m^2) after 75 days from planting compared with the other two plant densities. These results may be due to that the higher density of soybean plant reduced the light penetration to the weeds and to their increased competition for all nutrients which in turn suppress the growth of weeds. These results are similar to those obtained by **Singh and Singh (2006)** observed that the density of weed and other measures of weed abundance usually show reductions as crop population increases. They added that narrow row spacing reduce the weeds and increases crop yield. Also, **Harder *et al*. (2007)** indicated that weed biomass of the control was higher in low soybean density compared with the highest soybean density.

2- Growth characters of soybean:

The results in Table (1) indicate that there was significantly difference between all plant densities on the studied growth characters of soybean at 75 days from planting. Low plant density recorded the highest dry weight of leaves, stems and total plant. Whereas, the density 140000 plants/fad recorded the highest values of dry weight of pods. The low plant density (116667 plants/fad) indicated higher plant height (125.00 cm) than other plant densities. These results are similar to **Mohamed *et al*. (2004)** stated that high density recorded tallest plant height. Whereas, plant height increased with the increase in density of plant up to 210000 plants/fad.

IV - Effect of the interaction:

A- The interaction between weed control treatments and varieties:

A_1- Dry weight of weeds:

Data presented in Table (2) show that interaction between weed control treatments and varieties was significantly different dry weight of total weeds, that Giza 21 variety with using hand hoeing twice decreased the dry weight of total weeds at 75 DAP. This means that hand hoeing twice with Giza 21 seems to be more effective than other weed control treatments.

A_2- Growth characters:

Results in Table (2) show that all growth characters namely plant height, dry weight of leaves, stems, pods and total plant at 75 days were significantly affected by the interactions between weed control treatments and varieties. The interaction between Amex treatment and Giza 111 variety recorded the highest values of dry weight of leaves, stems and total plant compared to Giza 21 and the other treatments. On other hand, Amex herbicide x Giza 21 variety significantly increased the dry weight of pods compared with other treatments. The obtained results indicate that the interaction between hand hoeing twice and Giza 111 recorded the tallest plant (126.00 cm) compared with other interaction.

Table 2. Effect of interaction between weed control treatments and varieties on growth characters of soybean and associated weeds after 75 days from planting (combined analysis of 2014 and 2015 seasons).

Treatments							
Weed control	Variety	Plant height (cm)	Dry weight of leaves(g/plant)	Dry weight of stems(g/plant	Dry weight of pods(g/plant)	Dry weight of total plant(g/plant)	Dry weight of total weeds (g/m^2)
Stomp	Giza 21	122.00 **d**	16.20 **ab**	15.48 **a**	4.39 **a**	36.08 **a**	26.32 **c**
Amex		125.00**ab**	13.74 **d**	13.87 **bc**	4.65 **a**	32.26 **d**	20.65 **d**
Hoeing		124.00 **bc**	14.76 **c**	13.43 **c**	3.66 **b**	31.84 **d**	8.87 **g**
Un weeded		123.00**cd**	13.62 **d**	13.16 **c**	2.98 **df**	29.76 **a**	37.77 **b**
Stomp	Giza 111	125.00**ab**	16.38 **ab**	14.48 **b**	3.33 **bc**	34.20 **c**	20.05 **d**
Amex		124.00 **bc**	16.81 **a**	16.08 **a**	2.61 **f**	35.49 **ab**	12.60 **e**
Hoeing		126.00 **a**	15.79 **b**	15.53 **a**	3.16 **cd**	34.48 **bc**	11.49 **f**
Un weeded		123.00 **bcd**	13.32 **d**	13.86 **bc**	2.66 **ef**	29.84 **e**	39.78 **a**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

B The interaction between weed control and plant densities:

B_1- Dry weight of weeds:

Results in Table (3) show that the interaction between hand hoeing twice and density 140000 decreased dry weight of total weeds (6.48 g/m^2) compared to the other interaction treatments. This meant that this treatment was more effective weed control. On the other hand, un-weeded and plant density 175000 plants/fad recorded the higher weight of dry weeds (45.94 g/m^2).

B_2- Growth characters:

Results in Table (3) clear that all growth characters were significantly affected by the interactions between weed control treatments and plant densities. The interaction between stomp treatment and plant density 116667 plants/fad recorded the highest values of dry weight of leaves (17.45 g) and total plant (36.33 g) compared to the other treatments, while stomp treatment plant density 175000 plants/fad increased dry weight of pods. The obtained results indicate that the interaction between hand hoeing twice and plant density140000 plants/fad gave the tallest plants (126.00 cm).

Table 3. Effect of the interaction between weed control and plant densities on growth characters of soybean and associated weeds after 75 days from planting (combined analysis of 2014 and 2015 seasons).

Treatments							
Weed control	Plant density	Plant height (cm)	Dry weight of leaves (g/plant)	Dry weight of stems (g/plant)	Dry weight of pods (g/plant)	Dry weight of total plant (g/plant)	Dry weight of total weeds (g/plant)
Stomp	116667	126.00**ab**	17.45 **a**	15.36 **ab**	3.51 **b**	36.33 **a**	33.95 **c**
Amex		124.00 **abcd**	16.41 **b**	15.90 **a**	3.74 **b**	36.05 **a**	8.41 **i**
Hoeing		125.00**abcd**	16.00 **bc**	14.57 **bc**	2.93 **d**	33.50 **c**	10.36 **h**
Un weeded		124.00**bcde**	14.19 **de**	15.01 **abc**	3.03 **cd**	32.22 **d**	41.35 **b**
Stomp	140000	122.00**e**	15.90 **bc**	15.43 **ab**	3.39 **bc**	34.71 **bc**	18.98 **e**
Amex		125.00**abc**	15.77 **bc**	14.84 **bc**	3.63 **b**	34.24 **c**	27.60 **d**
Hoeing		126.00 **a**	15.41 **c**	15.80 **a**	4.46 **a**	35.67 **ab**	6.48 **j**
Un weeded		123.00**cde**	13.40 **ef**	12.64 **d**	2.73 **d**	28.76 **f**	29.05 **cd**
Stomp	175000	123.00**cde**	15.52 **bc**	14.16 **c**	4.69 **a**	34.38 **bc**	16.65 f
Amex		125.00**abc**	13.64 **def**	14.18 **c**	3.53 **b**	31.34 **de**	13.89 **g**
Hoeing		125.00**abc**	14.41 **d**	13.06 **d**	2.84 **d**	30.31 **e**	13.73 **g**
Un weeded		122.00 **de**	12.82 **f**	12.89 **d**	2.71 **d**	28.42 **f**	45.94 **a**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

C- The interaction between varieties and plant densities:

C_1- Dry weight of weeds:

Data presented in Table (4) indicate that the effect of the interaction between varieties and plant densities on dry weight of total weeds was significant. Giza 111 variety and plant density (140000 plants/fad) significantly decreased the dry

weight of total weeds to 18.69 g/m^{2}as while plant density of 116667 plants/fad and Giza 21 giving the highest dry weight of total weeds (27.10 g/m^2).

C_2- Growth characters of soybean:

Data in Table (4) show that plant height, dry weight of leaves, stems, pods and total plant at 75 DAP were significantly affected by the interaction between varieties and plant densities. Variety Giza 111 gave the best values of plant height as well as dry weight of leaves, stems and total plant at 75 DAP under low plant density (116667 plants/fad), comparing with high plant density 175000 plants/fad Giza111. While, the interaction between Giza21 plant density 140000 plants/fad recorded the highest values of dry weight of pods. These results are similar to those reported by **Worku and Astatkie (2011)** who revealed that the interaction effect of variety and plant spacing was significant on plant height.

Table 4. Effect of interaction between varieties and plant densities on some growth characters of soybean and associated weeds after 75 days from planting (combined analysis of 2014 and 2015 seasons).

Treatments		Plant height (cm)	Dry weight of leaves (g/plant)	Dry weight of stems (g/plant)	Dry weight of pods (g/plant)	Dry weight of total plant (g/plant)	Dry weight of total weeds (g/plant)
Variety	Plant density						
Giza 21	**116667**	122.00**c**	15.59 **b**	14.53 **bc**	3.88 **b**	34.00 **b**	27.10 **a**
	140000	124.00**b**	14.08 **c**	14.29 **c**	4.22 **a**	32.59 **c**	22.34 **c**
	175000	124.00**b**	14.06 **c**	13.14 **d**	3.66 **b**	30.86 **d**	20.77 **d**
Giza 111	**116667**	128.00**a**	16.43 **a**	15.89 **a**	2.72 **d**	35.04 **a**	19.93 **d**
	140000	124.00**b**	16.16 **ab**	15.06 **b**	2.88 **d**	34.11 **b**	18.69 **e**
	175000	123.00**bc**	14.14 **c**	14.01 **c**	3.22 **c**	31.36 **d**	24.32 **b**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

D- Effect of interaction between weed control treatments, varieties and plant densities:

D_1- Dry weight of weeds:

With regard to weed control results in Table (5) show in general, that hand hoeing twice with variety Giza 111 decreased dry weight of total weeds(3.699 g/m^2) under density of 140000 plants/fad, meaning that two hand hoeing's were effective to control weeds. On other hand, the un-weeded plots grown with Giza 111 variety led to the least control under the high density 175000 plant/fad (58.75 g/m^2).

D_2- Growth characters of soybean:

In general, it is clear from the presented results in Table (5) that the second order interaction between weed control treatments, varieties and plant densities caused a significant effect on soybean growth characters.

Application of Amex x Giza 21 x low density (116667 plants/fad) gave the highest dry weight of pods. Stomp, Giza 111 and density of 116667 plants/fad gave the highest value of plant height and dry weight of leaves/plant. Also, the results indicate that the highest dry weight of stems/plant and total plant were produced by the interaction between hand hoeing twice x Giza 111 x 140000 plants/fad.

3. **Yield and yield components**

I- Effect of weed control treatments:

Results in Table (6) indicate that hand hoeing twice recorded highest values of pods and seeds weights/plant as well as seeds, straw, biological yields/fad. The superiority of hand hoeing twice on the other treatments may be due to the improvement of plant growth and its effect on weed control compared with other treatments especially the un-weeded control. These results are similar to those reported by **Abd El-Hamid and El-Metwally (2008)** indicating that two hand hoeing gave the highest value of weight of pods/plant compared to the non-weeded treatment. **Mekki *et al.* (2010)** found that the greatest yield obtained by hoeing twice maybe attributed to lower dry matter accumulation by weeds and decrease in their population that helped to increase the yield attributes of soybean which ultimately led to higher yield. Also**, Shaikh *et al.* (2010)** stated that un-weeded control recorded the lowest grain yield because of heavy infestation by weeds hindering the uptake of nutrients and reducing photosynthesis by shading of the main crop. Elimination of weeds during early cycles of crop growth would thereby enable the plant to grow better and consequently yield better.

II- Varietal response:

Results in Table (6) reveal that the difference between two varieties were significant for plant height, weight of seeds/plant, straw and biological yields/fad except weight of pods/plant were significantly variable between the varieties clearly Giza 21 variety recorded the highest values of seeds weight /plant (13.00 g) and seed yield/fad (1106.00 kg). Whereas, Giza 111 produced the plant height as well as the highest values of straw and biological yields. These results might be attributed to their genetic constitution **(Shukla and Kumar, 1994)**. Also**, Shairef *et al.* (2010)** stated that Giza 21 produced the highest yield and its components compared with Giza 111variety.

Table 5. Effect of the interaction between weed control, varieties and plant densities on growth of soybean and associated weeds at 75 days after planting (combined analysis of 2014 and 2015 seasons).

Treatments			Plant height (cm)	Dry weight of leaves (g/plant)	Dry weight of stems (g/plant)	Dry weight of pods (g/plant)	Dry weight of total plant	Dry weight of total weeds (g/m2)
Weed control	Variety	Plant density						
Stomp	Giza 21	116667	122.00	16.60	15.70	4.15	36.45	38.39
		140000	122.00	16.33	16.93	4.40	37.65	15.75
		175000	123.00	15.68	13.82	4.63	34.13	24.81
	Giza 111	116667	130.00	18.30	15.20	2.88	36.20	29.50
		140000	122.00	15.48	13.93	2.38	31.77	22.19
		175000	123.00	15.38	14.50	4.75	34.63	8.48
Amex	Giza 21	116667	122.00	15.38	14.30	4.90	34.58	7.63
		140000	127.00	13.75	13.98	4.70	32.42	37.25
		175000	126.00	12.10	13.32	4.35	29.78	17.06
	Giza 111	116667	127.00	17.45	17.50	2.58	37.53	9.19
		140000	123.00	17.80	15.70	2.55	36.05	17.94
		175000	124.00	15.18	15.02	2.70	32.90	10.69
Hoeing	Giza 21	116667	123.00	16.73	14.50	3.20	34.42	9.31
		140000	124.00	13.45	14.43	4.45	32.33	9.25
		175000	126.00	14.10	11.35	3.33	28.77	8.06
	Giza 111	116667	126.00	15.27	14.65	2.65	32.58	11.40
		140000	129.00	17.38	17.17	4.48	39.03	3.69
		175000	124.00	14.73	14.77	2.35	31.85	19.38
Un-weeded	Giza 21	116667	120.00	13.68	13.61	3.28	30.56	53.06
		140000	125.00	12.80	11.82	3.33	27.95	27.13
		175000	123.00	14.38	14.05	2.35	30.78	33.13
	Giza 111	116667	128.00	13.70	16.40	2.78	33.88	29.63
		140000	121.00	14.00	13.45	2.13	29.58	30.96
		175000	121.00	11.27	11.73	3.08	26.80	58.75
LSD at 0.05			2.89	1.21	1.15	0.57	1.77	1.83

Table 6. Effect of weed control treatments, varieties and plant densities on yield and component of soybean (combined analysis of 2014 and 2015 seasons).

Treatments		Plant height (cm)	Weight of pods/ plant (g)	Weight of seeds/ plant (g)	Seed yield (kg/fad)	Straw yield (kg/fad)	Biological yield (kg/fad)
Weed control	Stomp	107.00 **b**	23.35 **c**	11.88 **bc**	1051.00**c**	3618.00**b**	4668.00**b**
	Amex	109.00**a**	24.42 **b**	12.32 **b**	1071.00**b**	3340.00 **c**	4411.00**c**
	Hoeing	108.00**ab**	26.44 **a**	14.64 **a**	1201.00**a**	3828.00**a**	5031.00**a**
	Un weeded	107.00**b**	22.45 **d**	11.15 **c**	777.00**d**	3197.00**d**	3974.00**d**
Variety	Giza 21	107.00 **b**	23.96 **a**	13.00 **a**	1106.00**a**	3236.00**b**	4342.00**b**
	Giza 111	109.00**a**	24.39 **a**	11.99 **b**	944.00**b**	3756.00**a**	4700.00**a**
Plant density	116667	108.00**b**	26.38 **a**	13.30 **a**	1026.00**b**	3384.00**c**	4410.00 **c**
	140000	109.00**a**	22.69 **b**	13.01 **a**	1049.00 **a**	3490.00**b**	4540.00**b**
	175000	107.00 **b**	23.43 **b**	11.18 **b**	999.00**c**	3615.00**a**	4613.00**a**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

III- Effect of plant density:

Results in Table (6) show that the low plant densities (116667 plants/fad) were produced the highest weight of pods (26.38 g) and seeds (13.3 g) per plant whereas, the highest seed yield/fad (1049.00 kg) were produced by planting 140000 plants/fad. On the other hand, the highest weight of straw(3615.00kg) and biological yields/fad (4613.00 kg) resulted from the highest density(175000 plants/fad).These results are similar to those reported by **Larry *et al*. (2002)** who indicated that seed yield declined with decreasing plant density. Also, **Frade and Valenciano (2005)** claimed that the increase of seed yield due to the increase of plant density is resultant of the establishment of more soybean plants thus the increase of produced pods/area.

Obvious, increasing plant density increase competition between plants on moisture, light and nutrients, decreased uptake of nutrients from the soil, photosynthesis and net assimilation rates, but

increase the growth of individual plant in the low plant density. These results are similar to those reported **Kachroo *et al*. (2003)** who obtained results showing that weeds compete with crop for light, moisture and nutrients, with early-season competition being the most critical.

IV- Effect of the interaction:

a-The interaction between weed control treatments and varieties:

Results in Table (7) clear that yield and components were significantly affected by the interaction between the weed control treatments and the soybean varieties.

The interaction between hand hoeing twice and Giza111produced the highest values of weight of pods and seeds/plant as well as straw and biological yields compared to the other weed control treatments and un-weeded treatment. On the other hand, the treatment of Amex with Giza 111 resulted in increasing plant height, while hand hoeing twice x variety Giza 21 produced maximum value of seed yield/fad. Results in table (7) regarding for weight of pods the interaction weed control treatment x variety show that almost all interaction showed no significant .exception are interaction between hoeing x Giza 111 and un-weeded x Giza 111.

Table 7. Effect of the interaction between weed control treatments and varieties on yield and its component of soybean (combined analysis of 2014 and 2015 seasons).

Treatments		Plant height (cm)	Weight of pods/plant (g)	Weight of seeds/plant (g)	Seed yield (kg/fad)	Straw yield (kg/fad)	Biological yield (kg/fad)
Weed control	Variety						
Stomp	Giza21	107.00**c**	23.15 **b**	12.52 **c**	1150.00**b**	3477.00**e**	4627.00**d**
Amex		107.00**c**	24.42 **b**	13.34 **b**	1139.00**c**	3059.00**f**	4198.00**e**
Hoeing		109.00**ab**	24.32 **b**	14.53 **a**	1275.00**a**	3544.00**d**	4819.00**b**
Un weeded		105.00**d**	23.88 **b**	11.62 **d**	862.00**g**	2863.00**g**	3725.00**f**
Stomp	Giza111	108.00**bc**	23.55 **b**	11.24 **de**	951.00**f**	3759.00**b**	4710.00**c**
Amex		110.00**a**	24.43 **b**	11.29 **de**	1004.00**e**	3621.00**c**	4624.00**d**
Hoeing		107.00**c**	28.56 **a**	14.74 **a**	1127.00**d**	4115.00**a**	5242.00 **a**
Un weeded		109.00**a**	21.03 **c**	10.68 **e**	692.00 **h**	3531.00**d**	4223.00**e**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

b- The interaction between weed control treatments and plant densities:

Results in Table (8) show that all yield characters namely plant height, weight of pods and seeds were significantly affected by the interactions between weed control treatments and plant densities. The combination of hand hoeing twice and the low plant density (116667 plants/fad) recorded the highest values of weight of pods (31.20 g/plant), whereas the interaction between Amex and density 140000 plant/fad produced the highest values of seed, straw and biological yields (1201.00, 3830.00 and 5031.00 kg/fad, respectively), while the tallest soybean plants were produced by Amex treatment plant density 175000 plants/fad (110.00 cm).within the lower density (116667 plants/fad) no significant trend could be observed among weed control treatment.

Table 8. Effect of the interaction between weed control treatments and plant densities on yield and component of soybean (combined analysis of 2014 and 2015 seasons).

Treatments		**Plant height (cm)**	**Weight of pods/ plant (g)**	**Weight of seeds/ plant (g)**	**Seed yield (kg/fad)**	**Straw (kg/fad)**	**Biological yield (kg/fad)**
Weed control	**Plant density**						
Stomp	**116667**	107.00**cd**	23.29 **d**	12.52 **cd**	1106.00**a**	3236.00**b**	4342.00**b**
Amex		108.00**bc**	27.99 **b**	13.05 **c**	1071.00**b**	3340.00**c**	4411.00**c**
Hoeing		108.00**abc**	31.20 **a**	14.26 **b**	1026.00**b**	3384.00**c**	4410.10 **c**
Un weeded		108.00**bc**	23.02**d**	13.35 **bc**	1106.00**a**	3236.00**b**	4342.00**b**
Stomp	**140000**	110.00 **a**	23.86 **cd**	11.52 **de**	944.00**b**	3756.00 **a**	4700.00**a**
Amex		108.00**ab**	20.79 **e**	13.27 **bc**	1201.00**a**	3830.00**a**	5031.00**a**
Hoeing		108.00**bc**	23.00 **d**	16.44 **a**	1049.00**b**	3490.00**b**	4540.00**b**
Un weeded		108.00**bc**	23.13 **d**	10.51 **e**	1051.00**b**	3756.00**a**	4700.00**a**
Stomp	**175000**	105.00**d**	22.90 **d**	11.59 **de**	1051.00**c**	3618.00**b**	4668.00**b**
Amex		110.00**a**	24.50 **cd**	10.63 **e**	777.00 **d**	3197.00**d**	3974.00**d**
Hoeing		108.00**bc**	25.11 **c**	13.21 **bc**	999.00**c**	3615.00**a**	4613.00**a**
Un weeded		106.00**d**	21.21 **e**	9.29 **f**	944.00**d**	3618.00**b**	4668.00**b**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

c-The interaction between varieties and plant densities:

Data in Table (9) show that yield and its components were significantly affected by the varieties and plant densities. Giza 21 variety show increased seeds weight / plant (14.49 g/plant) interaction with low plant density (116667 plants/fad).On other hand, Giza111 and density of 116667resulted in increasing weight of pods/plant. Also, Giza 111 recorded the highest value of straw and biological yields under densities of (175000 and 140000 plants/fad, respectively). The interaction between Giza 21 variety and plant density116667 plants/fad. Produced the height seed yield per fad (1134.00 kg/fad). These results are similar to those obtained by **Kang *et al*. (2001)** who found that appropriate plant density and cultivar is necessary for obtaining high yield and quality of soybean.

Table 9. Effect of the interaction between varieties and plant densities on yield and its component of soybean (combined analysis of 2014 and 2015 seasons).

Treatments		Plant height (cm)	Weight of pods/plant (g)	Weight of seeds/plant (g)	Seed yield (kg/fad)	Straw yield (kg/fad)	Biological yield (kg/fad)
Variety	Plant density						
Giza21	116667	107.00**bc**	25.70 **b**	14.49 **a**	1134.00**a**	3182.00**e**	4317.00**d**
	140000	107.00**bc**	23.24 **cd**	13.41 **b**	1102.00**b**	3177.00**e**	4279.00**d**
	175000	106.00**c**	22.88 **cd**	11.11 **d**	1082.00**c**	3349.00**d**	4431.00**c**
Giza111	116667	108.00**b**	27.05 **a**	12.10 **c**	918.00**e**	3585.00**c**	4503.00**b**
	140000	110.00**a**	22.14 **d**	12.62 **c**	998.00 **d**	3803.00**b**	4801.00**a**
	175000	108.00**b**	23.99 **cd**	11.25 **d**	915.00**e**	3880.00 **a**	4795.00**a**

The means followed by the same letter(s) in the same column are not significantly different at the 0.05% probability).

d- The interaction between weed control treatments, varieties and plant densities:

Results in Table (10) indicate that the interaction between weed control treatments, varieties and plant densities on yield and its components were significant. In general, with variety Giza 111 when planted under 140000 and 175000 plants/fad using two-hand hoeing increased weight of pods and seeds/plant, straw and biological yield. Plants grown under hand hoeing twice x variety Giza 21 x density 116667 recorded highest value of seed yield/fad (1398.00kg). The un-weeded plants grown under Giza 111and 116667 plants/fad produced the least seed yield (553.00kg/fad); whereas un-weeded x Giza 111 x 140000 plants/fad gave the tallest plants (113.00 cm).

Table 10. Effect of the interaction between weed control, varieties and plant densities on yield and its component of soybean (combined analysis of 2014 and 2015 seasons).

Treatments			Plant height (cm)	Weight of pods/plant (g)	Weight of seeds/plant (g)	Seed yield (kg/fad)	Straw yield (kg/fad)	Biological yield (kg/fad)
Weed control	Variety	Plant density						
Stomp	Giza 21	116667	106.00	26.05	14.80	1145.00	3335.00	4480.00
		140000	110.00	25.15	13.45	1207.00	3481.00	4688.00
		175000	103.00	18.25	9.33	1097.00	3615.00	4712.00
	Giza 111	116667	107.00	20.52	10.25	1086.00	3733.00	4801.00
		140000	109.00	22.58	9.60	908.00	3677.00	4585.00
		175000	107.00	27.55	13.86	879.00	3865.00	4744.00
Amex	Giza 21	116667	106.00	29.83	14.00	1070.00	3013.00	4083.00
		140000	108.00	18.55	13.80	1241.00	2969.00	4210.00
		175000	108.00	24.88	12.23	1106.00	3194.00	4299.00
	Giza 111	116667	110.00	26.15	12.10	884.00	3253.00	4137.00
		140000	109.00	23.03	12.75	1112.00	3753.00	4865.00
		175000	111.00	24.13	9.03	1015.00	3856.00	4872.00
Hoeing	Giza 21	116667	110.00	25.65	14.93	1398.00	3556.00	4954.00
		140000	109.00	23.65	15.18	1215.00	3423.00	4638.00
		175000	107.00	23.65	13.50	1211.00	3654.00	4865.00
	Giza 111	116667	106.00	36.75	13.60	1168.00	3908.00	5076.00
		140000	107.00	22.35	17.70	1195.00	4146.00	5340.00
		175000	109.00	26.58	12.93	1019.00	4292.00	5311.00
Un-weeded	Giza 21	116667	106.00	21.27	14.25	925.00	2825.00	3750.00
		140000	103.00	25.63	11.20	745.00	2832.00	3577.00
		175000	107.00	24.73	9.40	916.00	2932.00	3848.00
	Giza 111	116667	109.00	24.77	12.45	553.00	3448.00	4000.00
		140000	113.00	20.63	10.43	776.00	3637.00	4413.00
		175000	105.00	17.70	9.18	748.00	3507.00	4255.00
LSD at 0.05			2.00	2.14	1.38	7.37	80.84	82.48

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تأثير بعض معاملات مقاومه الحشائش والكثافه النباتيه على صنفى فول الصويا والحشائش المصاحبه له.

أسماء محمد حموده

أجريت تجربتان حقليتان بمحطة التجارب والبحوث الزراعية التابعة لكلية الزراعه بمشتهر جامعة بنها خلال موسمى الزراعة ٢٠١٤ م ، ٢٠١٥م لدراسة تأثير أربع معاملات لمقاومة الحشائش (بدون مقاومه (كنترول)،عزقتين، مبيد ستومب ١.٧لتر/ف، مبيد اميكس ٢.٥ لتر/ف) و صنفين من فول الصويا (جيزه ٢١،جيزه ١١١) وثلاث كثافات نباتية (١١٦٦٦٧،١٤٠٠٠٠،١٧٥٠٠٠نبات/فدان) وتأثير ذلك على محصول فول الصويا ومكوناته والحشائش المصاحبة. وقد استخدم تصميم القطع المنشقة مرة واحدة .

أهم النتائج المتحصل عليها كما يلى:

- اظهرت معاملة العزيق مرتين تفوقا معنويا فى مقاومة الحشائش الكليه عند عمر ٧٥ يوم من الزراعه فى وزن كلا من القرون والبذور للنبات ومحصول الفدان من البذور والقش والمحصول البيولوجى مقارنة ببقية معاملات المقاومة الأخرى.
- اوضحت النتائج تفوق صنف جيزه ١١١على صنف جيزه ٢١ فى صفات طول النبات والوزن الجاف لكل من الاوراق والسيقان والنبات الكلى عند عمر ٧٥يوم من الزراعة والوزن الجاف للحشائش وارتفاع النبات ووزن قرون النبات ومحصول القش والمحصول البيولوجى للفدان.
- أدت الكثافة النباتية المنخفضة١١٦٦٦٧ نبات/فدان الى نقص وزن الحشائش الكلية بالمتر المربع بعد ٧٥ يوم من الزراعة وزيادة وزن قرون وبذور النبات فى حين سجلت الكثافة النباتية العالية (١٧٥٠٠٠ نبات/فدان) زياده فى محصول الفدان من القش والمحصول البيولوجى ، بينما أدت الكثافة النباتية ١٤٠٠٠٠نبات/فدان الى زيادة طول النبات ومحصول الفدان من البذور.
- التفاعل بين معاملة العزيق مرتين والكثافة النباتية ١٤٠٠٠٠نبات/فدان للصنف جيزه ١١١ادى الى انخفاض الوزن الجاف للحشائش الكلية عند ٧٥ يوم من الزراعة فى حين تفوق الصنف جيزه ٢١ والرش بمبيد اميكس بمعدل ٢.٥لتر/فدان والكثافة النباتية ١٤٠٠٠٠نبات/فدان فى محصول الفدان من البذور .