INTEGRATED EFFECT OF VARIETIES, PLANT DENSITY AND WEED CONTROL TREATMENTS ON CHEMICAL COMPOSITION AND YIELD OF SOYBEAN GROWN IN NEWLY RECLAIMED SOIL

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ABSTRACT

The effects of Butralin herbicide (2.5 L/fed), H_2 and manual hoeing twice, H_3 (at 30 and 60 days age) together with three hill spacing (10 (D_1), 15 (D_2) and 20 (D_3) cm between hills) on vegetative growth, chemical composition, yield and yield components and quality traits of two soybean cvs (Giza 111, V_1 and Giza 21, V_2) and associated weeds, were of interest of the present work. The study was carried out, through split split-plot design at experimental farm of the Fac. of Agric., Fayoum univ., during 2006 and 2007 seasons. The results showed that both Butralin herbicide (H_2) and manual hoeing (H_3) weed treatments surpassed the unweeded one (H_1) in controlling weeds in soybean field. Suppression ratios of weed growth due to manual hoeing (71.3 to76.3%) for broad (BFW), narrow (NFW) leaved and total weeds were higher than that of Butralin (60.19%) for only narrow leaved weeds. Hill spacing significantly affected BFW and total weed weight in the first sample in favor to the closest spacing (D_1) which resulted in 30.3 and 36.2% weed excision, respectively, over the widen spacing (D_3). The results indicated that hill spacing had lower effect than weed control treatment on weed growth. There was no significant effect of soybean varieties on weed growth. H_2 D_2 V_2 and/or H_3 D_1V_2 exhibited the lowest NFW. In respect to chemical constituents of soybean plants, H_2 and H_3 markedly exceeded H_1 treatment, in favour to H_2 for most estimates, with similar values for phenols, carotenoids and anthocyanin with those of H_3. Hill spacing showed overlapping effect on chemical constituents, in favour to the intermediate plant density D_2 (15 cm) and /or D_1 (10 cm). H_2 D_3, H_2 D_2, H_3V_2 as dual interaction as well as H_2 D_3 V_2, H_3 D_1 V_1 and H_2 D_2 V_1 as trio-interactions were of great positive effects on chemical constituents of soybean plants. Regarding yield and its components, H_3 treatment produced highest values for yield and its components, while H_2 increased vegetatively, i.e. plant height. Narrow spacing (D_1) increased numbers of branches and pods and weight of pods, plant seeds and seed yield/fed. Intermediate plant density gave branches and seed yield/fed similar to those of D_1. V_2 outweighed V_1 in yield and its components where is the reverse was true for plant height. Positively effective interactions were H_3 D_1, H_2 V_2 and $H_3D_1V_2$, on weights of pods, number of seeds/plant and seed index. The highest percentages of carbohydrates (23.37), protein(48.10) and oil(22.38%) were recorded by $H_3D_3V_2$, $H_2D_1V_1$ and $H_2D_3V_1$, respectively. The absolutely highest seed yield/fed (1.89) in such newly reclaimed land was obtained by Giza 21 (V_2) planted in closest hill spacing D_1(10cm ,2 plants/hill) and treated by manual hoeing twice.

Key words: Varieties, Plant density, Weed control, Chemical composition, Yield.

INTRODUCTION

Soybean [*Glycine max* (L.) Merril] is a worldwide legume crop grown commercially in over 35 countries located in between 10 and 50̊ latitudes. The wide expansion of the crop is due mainly to its advantages as food and feed. Soybean seeds, contain about 40% protein and 20% oil, provide approximately 60% of the world supply of vegetable protein and 30% of the oil (**Feh, 1990**). It is also used in the formation of various industrial human diets and concentrated animal feed. In addition to its merit in improving soil fertility by fixing atmospheric nitrogen. Despite, the crop acreage and production in Egypt are limited and currently diminished owing to its lower benefit than the other competitive summer crops occupied the old land in Nile Valley and Delta. So, growing soybean in new ameliorate soils is imperative and ineludible for raising its national production, particularly if cultivated under complementary suitable combination of agriculture factors such as varieties, plant density and weed control treatments.

Weeds occurrence in soybean field cause great losses in yield, thereby various mechanical and chemical weed control treatments were investigated. **Muniyabba *et al* (1982) and Joshi and Billore (1998)** suggested that weed control is essential especially during the early development of soybean. **Lakers *et al* (1987) and Dubey (1998)** reported that manual weeding was more effective weed control than any herbicide and increased seed yield. Whereas, **Hassanein *et al* (2000)** showed that some herbicide (i.e, pendimethalin, oxyurlen and linuzon, in combination of betrazone) were effective and comparable to hand weeding from the point of weed control and soybean yield. Both hand weeding and pendimethalin treatments, tested by **Galal (2003)** significantly decreased the dry weight of broad and narrow leaved weeds than unweeded treatment, but hand weeding gave the lowest dry weight of total weeds. **Manjusha *et al* (2004)** and **Umale *et al* (2005)** reported that the favourable effect of weed suppression, fully reflected in improved yield and its components, was obtained with two hoeing and one hand weeding. **Keramati *et al* (2008)** stated that it is possible to optimize the timing of weed control, between second trifoliate and beginning bloom or first flower, which can serve to reduce the costs and side effect of intensive chemical weed control.

Virtually, soybean produces better when it is spaced in adequate geometry resulted in full cover of entire soil surface, encountered solar radiation, during its seed development period **(Taylor, 1980)**. Where the greatest seed yield may be obtained from greater light interception and conversion of solar energy into dry matter production before seed initiation (**Duncan, 1986**). Several soybean investigators suggested that plant spacing greatly affected both vegetative growth and reproductive traits and the closer plant spacing decreased some yield components, whereas, the total seed yield/unit area was increased (**Wells, 1991; Dubey, 1998; Ball *et al*, 2000 Veeramani *et al* 2001 and Galal, 2003)**. However, the favorable plant densities were varied according to spacing between rows (20 to 70 cm) and /or within row (5 to 30 cm), cultural practices, production area, soil fertility and used varieties.

Therefore, the present work was designed to study the integrated effect of plant spacings, weed control treatments and varieties on growth, chemical composition, yield and yield components of soybean and associated weeds under the conditions of newly reclaimed soil of Fayoum Governorate.

MATERIALS AND METHODS

The present investigation was carried out at the experimental Demo Station farm of the faculty of Agriculture, Fayoum University, during 2006 and 2007 summer season. The work objective was to study the individual and integrated effects of weed control treatments, hill spacing and varieties on vegetative chemical composition, seed yield and its components and quality traits of soybean and associated weeds. Field soil was loamy sand texture in both seasons, characterized by ECe of 4.56 and 4.2 dS/m, pH of 8.07 and 8.2, $CaCO_3$ of 15.04 and 14.88% and organic matter of 0.89 and 0.74% in the first and second season, respectively. The weed control treatments were (1) unwed or control (H_1), (2) Butralin [Amex 48% EC, 4-(1,1- dimethylethyl) –N-(1-methylepropyl)-2,6-dinitrobenzenamine] at 2.5 L/feddan (H_2) applied pre-sowing and (3) manual hoeing treatment (H_3) done twice, after 30 and 60 days from sowing. Also, three hill spacing treatments were practiced, i.e. 10 (D_1), 15 (D_2) and 20 cm (D_3) between hills with two plants per hill after complete emergence. Two soybean varieties, i.e. Giza 111 (V_1) and Giza 21 (V_2) were used. A split-split plot design with three replications was used, where the weed control treatments, hill spacing and varieties were arranged in main-, sub- and sub-sub plots, respectively. The plot area was 10.5m^2 (3x3.5 m) each plot consist of 5 rows, 60 cm apart and 3.5m long.

Immediately before sowing, soybean seeds were treated with *Rizobium japonicum*. Sowing dates were on May 14 and 13 in the first and second seasons, respectively. Calcium super phosphate (15.5% P_2O_5) was applied before sowing at a rate of 150 kg/fed. Nitrogen fertilizer in the form of ammonium nitrate (33.5%N) was added at a rate of 60 kg/fed in three equal doses at planting, before the first and second irrigation. Weeds survey done during growth period, were hand pulled from one square meter in each plot after 45 and 90 days from sowing and classified into narrow (NFW), broad-leaved (BFW) and total weeds (Total W.) and then their fresh weights were determined. Also during the growth stage, two leaves samples were randomly taken from each plot after 40 and 65 days from sowing to estimate the chemical composition using either fresh (F.W) or dry weight (D.W). Total indols (mg/g D.W) after **Larson *et al* (1968)** and total free amino acids (mg/g, D.W) according to **Jayarman (1981)** were also determined. Total chlorophyll (g/g, F.W) as well as total carotenoids concentration (mg/g, F.W) were estimated using the method described by **Welburn and lichtenthaler (1984)**. Total sugars (mg/g, D.W.) and free phenols (mg/g, D.W) as well as anthocyanin concentration (mg/100g D.W) were determined according to the methods described by **Hoagland (1980).**

At harvesting time, a random sample of ten soybean plants was taken from each plot to record the individual plant traits, i.e. plant height (Pl.H., cm), number of branches/plant (Brs/pl), number of pods (Pods/pl), weight of pods/plant (Pods Wt./pl, g.), weight of seeds/plant (S. Wt/pl., g) and 100-seed weight (S.I, g). Seed yield/fed (S.y/fed, t), was calculated on seed yield/plot basis. Seed protein content (Prot.%) determined by estimating nitrogen% and multiplying it by a factor of 6.25, total soluble carbohydrates (Carbo.%) in seed oil percentage (Oil%) were determined according to the **A.O.A.C. (1990).**

Combined analysis of the obtained data was performed for the two seasons, according to **Gomez and Gomez (1984)**, where the Bartlet test of homogeneity for errors indicated that the variance of data of both seasons was insignificant. Comparisons of means were done using LSD at 5% level.

RESULTS AND DISCUSSION

The results showed, that soybean could be successfully grown in such new ameliorative soil even it tend to be calcorious, but its productivity differed depending upon empirical cultural factors and their combinations. The following discussion of the obtained results are concerned with weed and chemical composition of soybean plant during the vegetative growth stage as well as final seed yield and its components of the crop.

a) Vegetative growth stage:

1. Effect on weeds:

Weeds presented in the experimental fields were: *Chenopodium album, Common lambsquarters, Cyperus* longus L., *Echinochloa* colonum L., *Portulaca* oleracea L. *Amaranthus ascendens, Cynodon* dactylon L. Weed control practices significantly affected both fresh weight broad (BFW) and narrow (NFW) leaves and their total weeds in the two vegetative samples (Table1). Compared to the unwed treatment, both chemical and mechanical weed control ones were superior. Application of manual hoeing (H_3) resulted in lightest weight of BFW (327.47) and total weeds (372.58 g/m^2) in the first sample as well as BFW (364.07), NFW (60.08) and total weeds (424.15 g/m^2) in the second older sample. Relative to the corresponding weight of unweeded treatment, H_3 caused weed excision ratios of 72.5 and 71.3% in the first sample, and 76.3, 62.3 and 75.0% in the second one, respectively. However, Butralin treatment resulted in lowest weight of NFW (39.46 g/m2) in the first sample causing a weed reduction ratio of 60.19% relative to unweeded treatment. These results indicated that manual hoeing, especially during the two experimental growth stages was more effective in controlling both BFW and NFW than Butralin herbicide. Similar findings were previously obtained by **Laker *et al* (1987), Dubey (1998), Joshi and Billore (1998), Galal (2003), Idapuganti *et al* (2005) and Silva (2008).** However, **Hassanien *et al* (2000)** found that all chemical herbicides, used were effective and comparable to hand hoeing from point of weed control and soybean yield.

Hill spacing, as another main factor, pronounced affected BFW and total weeds in the first sample, whereas the differences did not reach significance level in the second one (Table1). Closed hill spacing (D_1) prevented a considerable proportion of weeds to alive, where it associated with lowest weight of BFW (585.44 g/m^2, with significant difference with that of D_2) and total weeds (654.69 g/m^2) of the first sample. These two finding represented 69.8 and 63.8% of the corresponding weed weight associated with the widest hill spacing (D_3). **Dubey *et al* (1998) and Galal (2003)** revealed that closer plant spacing reduced weed production and its dry matter, whereas, **Pandya *et al* (2005)** reported that crop geometry failed to affect the dry matter of weeds and crop yield. The present findings, in other words, showed that the absolute elimination ratios of BFW and total weeds due to D_1 were 30.3 and 36.2%, respectively. These results indicated that

Table 1

plant density was of lower effect on weed control than chemical or mechanical practices.

Soybean varieties, as the third main factors did not show significant effect on weeds. This result is in full harmony with that of **Hassanein *et al* (2000) and Pandya *et al* (2005).**

H_3D_2 interaction resulted in the lowest weights of BFW (275.58) and (288.53) in the first and second sample respectively, and total weed (372.36 g/m^2) in the older sample. Also, H_3V_2 decreased weed weight to 261.33 for BFW and 311.36 g/m^2 for total weeds in the first sample. H_3V_1 interaction gave total weed weight similar to that of H_3V_2, indicating similar varietals response to this plant density from the point of allowing weed growth. The trio-interaction (HDV) had a significant effect on NFW in both samples. The lowest weights were recorded as the effective influence of $H_2D_2V_2$ interaction (12.0) in the first sample and $H_3D_1V_2$ (25.23 g/m^2) compared with the greatest weights of $H_1D_1V_1$ (183.83) and (228.65 g/m^2) in the first and second sample, respectively.

2. Soybean chemical constituent:

Due to weed control treatments, all chemical constituents studied in the two vegetative growth samples exerted significant differences except total carotenoids and anthocyanin in the second sample (Table 2). Both chemical (H_2) and manual hoeing (H_3) treatments surpassed the unweeded one (H_1). These results showed that the presence of weeds in soybean field had deleterious effect on its vegetative growth which may be reflected in partial physiological inhibition of the crop activity owing to heavy competition of weeds. The mean estimates were in favour to H_3 for total sugars (39.66 mg/g DW) and total phenols (4.96 mg/g DW) in the first and second sample, respectively. However, the other estimates were in favour to H_2 in the two samples, but the differences between the effect of H_2 and H_3 did not reach the significance level for phenols, carotenoids and anthocyanin. Connecting with the above mentioned weed control treatments (Table 1), it seems that clear reduction in weeds associated with manual hoeing, which were mostly lower than those of Butralin, caused slackening in chemical constituents synthesized by soybean plant. While with Butralin, synthesis of these constituents was enhanced as defince against the remained low weeds. However, under H_1 treatment which obviously concomitant with a lot of weeds, soybean plant failed to compete and consequently produced the lowest estimates.

Hill spacing had considerable effect on chemical constituents under the study in both vegetative samples, except total chlorophyll in the first one and total amino acids in bothe samples (Table 2). Closed spacing (D_1) was superior for amino acids (13.46 mg/g Dw) and chlorophyll (1.76 g/g FW) of the second sample as well as carotenoids (152.35 and 145.65 mg/g FW) and anthocyanin 22.6 mg/g)in the young and older sample, respectively. The intermediate plant density (D_2) produced the highest estimates of indols (2.95 mg/g DW, in the first sample, which was insignificantly different from that of D_1 (2.87 mg/g) and 3.88 mg/g in the second sample. D_2 also showed high estimates for total sugars (38.73 and 58.52) , phenols (7.65 and 5.05) , carotenoids (142.85 and 134.38) and anthocyanin (21.3 and 23.08) in the first and second sample, respectively. However, the widest plant spacing (D_3) gave similar, but lower estimates for these characteristics. These results revealed the suitability of D_1 and /or D_2 for growing soybean , which keep an appropriate space for plant growth allowing it to obtain its requirements from its ambient atmosphere such as light, water and nutrients. Respecting to this, **Wells (1991)** stated that plant spacing greatly influenced leaf area, light interception and canopy which in turn affect the photosynthesis in soybean plants.

The two soybean varieties exhibited few significant differences in their chemical constituents, especially in the young age. Where Giza 21 (V_2) gave the highest estimates of sugars (38.73 mg/g) and phenols (7.65 mg/g) in the early sample as well as for carotenoids (143.7 mg/g) in the late one. Whereas, Giza111 (V_1) surpassed V_2 in anthocyanin (22.60 mg/g) in the first sample (Table 2).

Dual interaction (HxD) had conspeceous effect on all chemical constituents estimated in both samples, except total chlorophyll in the first one (Table3). H_1D_3 interaction for phenol (8.69 and 5.47 mg/g) in the first and second sample, respectively, and H_2D_1 for carotenoids (160.42 mg/g) in the first sample were superior. H_2D_2 interaction had the highest values for amino acids (11.44 mg/g) in the young age, and indols (3.32 and 4.23 mg/g) in the two samples. The more obvious interaction was H_2D_3 where it positively several estimates, i.e., chlorophyll (1.72 and 1.84 g/g) and anthocyanin (24.21and 25.93 mg/g) in the first and second sample, respectively, as well as sugars (64.63) and free amino acids (15.07 mg/g) in the second sample. This may be due to the wider space (D_3) together with Butralin (H_2) which gave each plant a full opportunity to obtain all of its environmental requirements and reflected in vigorous growth and consequently enhanced the photosynsis and photosynthates accumulation in soybean plants. H_3D_1 interaction for carotenoids (155.83 in the second sample) and H_3D_2 for sugars (41.76 mg/g in the first sample) gave the greatest values, with insignificant differences from that of H_2D_3 (41.39).

HxV interaction followed the same trend showed by the above mentioned one, where it significantly affected all estimates in the two samples except total chlorophyll in the first sample (Table 3). The highest estimates of phenols (8.40 in the first and 5.27 mg/g in the second sample) due to H_1V_1 interaction effect, indols (3.86 mg/g in the second sample) due to H_1V_2 effect, and total chlorophyll (1.81 g/g in the second sample) due to H_2V_2 were recorded. The more important interaction was H_3V_2 where it produced the highest estimates for sugar (41.19 and 58.54) free amino acids (9.13 and 13.29) carotenoids (151.62 and 146.72) and anthocyanin (22.22 and 23.91) in the first and second sample, respectively, in addition to indols (2.96) in the first sample. These results confirmed the early recorded for H_3V_2 interaction concerning its suppression effect weed weights to the lowest level, acquiring soybean plants some physiological advantages, and may be taken as indicator for improved productively of Giza 21 variety (V_2) treated manual hoeing (H_3).

DxV interaction showed marked effect on all traits, except chlorophyll and anthocyanin in both samples as well as indols and free amino acids in the second one (Table3). The greatest estimate of carotenoids (153.58 in the first sample) due to D_1V_1 effect, as well as free amino acids (9.57) and indols (3.04) due to D_1V_2 in the first sample and carotenoids (146.89 mg/g) in the second one were detected. D_2V_1 interaction seemed to be effectiveness for phenols in young age as well as sugars and phenols (5.16 mg/g) in the older

Table 2

Table 3

Table 4

age. While D_3V_2 interaction showed greatest effect on total sugars (40.68 mg/g) in young age.

The triointeraction (HxDxV) exerted significant effect on all estimated traits of the two vegetative sample, except total chlorophyll in the first one (Table4). The greatest total phenols (9.07) of the first sample and (5.72) of the second one were obtained by $H_1D_3V_2$ and $H_1D_2V_1$ interactions, respectively. The highest total carotenoids estimated in the first sample (168.50 mg/g) and in the second one (163.00 mg/g) were recorded for $H_2D_1V_1$ and $H_3D_1V_1$ interaction, respectively. $H_3D_1V_1$ interaction had positive marked effect on anthocyanin (24.52 mg/g) in the first sample, and total chlorophyll (1.92 g/g) in the second one. In addition to the latter interaction, the other two important triointeraction were $H_2D_2V_1$ and $H_2D_3V_2$. Due to the former, greatest total amino acids (13.45) in the first sample and indols (3.50 and 4.26 mg/g) in the two samples were recorded. Highest estimates of total sugars (43.33 and 67.90 mg/g) in the two samples, as well as free amino acids (16.57) and anthocyanin (25.97) were obtained by $H_2D_3V_2$ interaction. These results supported the above mentioned one of dual interaction (Table3) and revealed the importance of these three triointeractions, allowing the plant to from greatest biomass with active synthesis of oil , protein and carbohydrates, which if combined with quit proper translocation to sink, high productivity become expected.

b. Soybean yield and its components:

The data in Table (5) show sufficient distinct difference, due to weed control treatments, for all studied traits except protein percentages. Both Butralin (H_2) and manual hoeing (H_3) surpassed the unweeded treatment (H_1) for all traits, indicating again the necessity of weed control in soybean field. H_2 was only superior i.e., plant height, whereas manual hoeing (H_3) had pronounced advantage for the productive traits. This may by ascribed to greater effect of H_3 in weed elimination ratios as shown in Table(1) (62.3-76.3%) than that of Butralin (60.2%) and consequently, soybean plants exposed to more weed competition under H_2 pushed it to elongated . Superiority of mechanical weeding over chemical one was previously reported by several outhors (**Ball *et al,* 2000, Galal, 2003; Manjusha *et al,* 2004; Umale *et al,* 2005 and Idaquganti *et al,* 2005**). However, insignificant differences between both on seed yield (**Hassanein *et al,* 2000**) and on seed index (**Silva, 2008**).

Due to hill spacing, significant differences were detected for six out of ten studied traits (Table 5). Narrow hill spacing (D_1) produced perspective advantages for plant height (64.94cm) number of branches (2.87 br.) number of pods (65.95 pod), pods weight (100.09 g), plant seed weight (42.22 g) and seed yield/fed (1.08 t). The intermediate plant density (D_2) gave number of pods and seed yield/fed. insignificantly different from those of D_1. However, the wider hill spacing produced the lowest values for all traits except oil percentage. These advantage effect of D_1 over D_2 may be due to its weed elimination was high (63.79 to 69.67%, Table1), and indicated that seed yield/fed depended mainly on number of plants in both experimental plant density in favour to D_1. These results are in harmony with those of **Purvez *et al* (1989) Pires *et al* (2001) and Andrade *et al* (2002). However, Veeramani *et al* (2001)** found insignificant differences due to plant density effect on seed yield.

Table 5. Yield and quality traits of soybean as affected by the main experimental factors

Treat.	Pl. H. (cm)	Brs/pl	Pods/pl	Pods wt./pl (g)	Seed wt./pl (g)	S.I (g)	S.Y/f (ton)	Carbo. %	Prot. %	Oil %
Mean of weed control (H)										
H_1	54.11	2.18	22.09	30.17	11.16	10.32	0.53	21.59	44.02	19.86
H_2	69.90	2.84	79.41	110.11	41.07	12.76	1.00	21.45	42.77	19.08
H_3	62.75	3.16	88.17	132.25	53.99	12.11	1.49	22.03	42.27	19.44
LSD 5%	**1.18**	**0.13**	**2.93**	**4.54**	**2.13**	**0.73**	**0.13**	**0.44**	**n.s**	**n.s**
Mean of plant density (D)										
D_1	64.94	2.87	65.95	100.09	42.22	12.13	1.08	21.59	44.32	18.85
D_2	60.36	2.78	65.76	91.41	33.59	11.61	1.06	21.81	42.48	18.93
D_3	61.46	2.52	57.97	81.02	30.41	11.45	0.89	21.68	42.26	20.61
LSD 5%	**1.17**	**0.01**	**3.89**	**5.10**	**3.60**	**n.s**	**0.13**	**n.s**	**n.s**	**n.s**
Mean of varieties(V)										
V1	63.40	2.62	60.95	82.68	29.63	10.92	0.94	21.70	43.71	19.54
V2	61.11	2.82	65.50	99.00	41.18	12.54	1.08	21.69	42.33	19.38
LSD 5%	**0.48**	**0.07**	**0.98**	**3.03**	**1.47**	**0.38**	**0.07**	**n.s**	**n.s**	**n.s**

The two tested varieties showed marked differences for all studied traits except carbohydrate, protein and oil percentages (Table 5). Giza 21 (V_2) surpassed Giza111 (V_1) in all traits except plant height. Superiority of V_2 may be attributed to its genetic background which enabled it to form great biomass combined with effective partitioning for synthates to productive organs.

Dual interaction H_2D_3 (71.04) and H_2D_2 (70.31 cm) had the tallest plants Table (6). H_3D_1 interaction produced the heaviest weights of pods (161.42) plant seeds (72.97) seed index (13.21) and consequently seed yield/fed (1.48 t). Also, H_3D_2 interaction was superior for number of pods (101.59). These results revealed that pods and seeds weights were more important than pods number for higher plant and area yields, under the same weed control treatment, and the highest plant density (D_1) encouraged seed set, whereas, the intermediate density (D_2) enhanced biomass formation. In this concern, **Galal (2003)** obtained the highest seed yield (1.15 t) from interaction of manual hoeing and 5cm plant spacing. H_3D_3 interaction gave the highest percentage of carbohydrates (22.37%) which may be attributed to its highest total sugars estimated in the early growth stage as well as oil percentage with 21.33% (Table 3).

HxV interaction significantly affected all traits (Table 6). Tallest plants (70.28 cm) and heaviest seed index (13.13 g) produced by H_2V_2 interaction, as well as greatest number of branches (3.22 Br.) and highest ratio of carbohydrates (22.37%) produced by H_3V_1 interaction were detected. H_3V_2 interaction manifested some advantages, where it produced the highest values of pods number (89.84 pod), pods weight (143.27 g) and plant seed weight (63.31 g) in addition to improved seed yield/fed (1.52 t). Superiority of H_3V_2 interaction for these traits may be due to its advantages of most chemical constituents during growth stage (Table 3). The increase in yield and its components as well as the chemical composition of the seeds may be attributed to the increased photosynthetic rate which consequently increased the photosynthesis and the accumulation of photosynthesis and their translocation to the newly developed seeds.

Table 6. Yield and quality traits of soybean as affected by dual interaction between tested factors, combined overall the two seasons.

Treat.	Pl. H. (cm)	Brs/pl	Pods/pl	Pods wt./pl (g)	Seed wt./pl (g)	S.I (g)	S.Y/f (ton)	Carbo. %	Prot. %	Oil %
Mean of weed control and plant density (H&D)										
H_1D_1	59.00	1.92	18.52	28.53	11.15	9.64	0.34	21.44	44.21	19.13
H_1D_2	51.80	2.33	27.80	35.25	12.94	10.29	0.73	21.83	45.62	19.92
H_1D_3	51.53	2.28	19.95	26.72	9.39	11.03	0.52	21.51	42.23	20.54
H_2D_1	68.36	2.90	81.28	110.33	42.53	13.55	1.06	21.10	46.38	18.92
H_2D_2	70.31	2.67	67.88	92.14	33.72	12.33	0.95	22.10	39.23	18.38
H_2D_3	71.04	2.95	89.09	127.84	46.95	12.40	1.00	21.16	42.71	19.94
H_3D_1	67.46	3.78	98.05	161.42	72.97	13.20	1.84	22.23	42.36	18.50
H_3D_2	58.98	3.35	101.59	146.83	54.12	12.20	1.50	21.50	42.58	18.50
H_3D_3	61.81	2.33	64.88	88.49	34.88	10.92	1.15	22.37	41.86	21.33
LSD 5%	**2.03**	**0.37**	**6.74**	**8.84**	**6.23**	**1.32**	**0.21**	**0.86**	**4.47**	**1.24**
Mean of weed control and varieties (H&V)										
H_1V_1	55.50	2.11	22.06	28.32	10.52	8.79	0.43	21.28	45.65	19.39
H_1V_2	52.72	2.24	22.12	32.02	11.80	11.86	0.64	21.90	42.38	20.33
H_2V_1	69.52	2.53	74.31	98.51	33.69	12.39	0.92	21.44	42.19	19.63
H_2V_2	70.28	3.14	84.52	121.70	48.44	13.13	1.09	21.47	43.35	18.53
H_3V_1	65.18	3.22	86.50	121.22	44.67	11.57	1.47	22.37	43.28	19.61
H_3V_2	60.32	3.09	89.84	143.27	63.31	12.64	1.52	21.69	41.26	19.28
LSD 5%	**0.84**	**0.12**	**1.70**	**5.24**	**2.55**	**0.66**	**0.13**	**0.56**	**2.65**	**0.94**
Mean of plant density and varieties (D&V)										
D_1V_1	63.49	2.78	61.70	84.88	30.86	11.16	1.01	21.77	46.03	17.42
D_1V_2	66.39	2.96	70.19	115.31	53.57	13.10	1.16	21.41	42.61	20.28
D_2V_1	62.85	2.67	66.64	89.81	32.77	10.98	0.86	20.89	41.44	19.78
D_2V_2	57.87	2.90	64.87	93.01	34.41	12.23	1.26	22.72	43.51	18.08
D_3V_1	63.86	2.42	54.52	73.36	25.25	10.61	0.95	22.43	43.66	21.43
D_3V_2	59.06	2.62	61.43	88.68	35.57	12.29	0.83	20.93	40.87	19.78
LSD 5%	**0.84**	**0.12**	**1.70**	**5.24**	**2.55**	**n.s**	**0.13**	**0.56**	**2.65**	**0.94**

Due to the effect of DxV interaction, all traits except seed index were markedly affected the tallest plants (66.39 cm) with greater number of branches (2.96 Br.) and pods (70.19 pod) as well as heavier weights of pods (115.31) seed of plant (53.57) and seed index (13.10 g) were produced by D_1V_2 interaction. Whereas, the highest seed yield/fed (1.26 t) which was similar value of D_1V_2 (1.16 t) and the highest carbohydrate ratio (22.72%) were given by D_2V_2 interaction. These results confirmed again the superiority of Giza 21 (V_2) variety under either high or intermediate plant density in favour to the former one. D_3V_1 interaction gave the improves ratios of protein (43.66) and oil (21.43%).

Triointeraction (HxDxV) was of marked effect on all studied traits (Table7). The highest values of protein (48.10%), seed index (13.78 g) number of branches (4.0 br.) number of pods (114.55 pod) and carbohydrates (23.73%) were exhibited by $H_2D_1V_1$, $H_2D_1V_2$, $H_3D_1V_1$, $H_3D_2V_2$ and $H_3D_3V_1$ interactions, respectively. It is worth to noting that the greatest number of branches produced by $H_3D_1V_1$ interaction was due to its superiority in total chlorophyll, carotenoids and anthocyanin (Table 4) which promote the vegetative growth. Last but not least, $H_3D_1V_2$ interaction which was of similar values for the latter three chemical constituents in addition to its clear suppression effect for NFW (12.5&25.23 g/m2 in 1st, 2nd) and partially for total weeds (Table1), resulted in great biomass combined with good partition of the syntheses of V_2 variety and consequently produced the highest values of pods weight (176.67 g) plant seed weight (91.72 g) and seed yield/fed (1.89 t).

Table 7. Yield and quality traits of soybean as affected by interaction between weed control, plant density and varieties over all two seasons.

Treat.	Pl. H. (cm)	No. Brs	No. Pods/pl	W. Pods/pl (g)	W. seed/pl (g)	S.I (g)	S.Y/f (ton)	Carbo. %	Prot. %	Oil %
Mean of weed control, plant density and varieties interactions(H&D&V)										
$H_1D_1V_1$	54.67	1.73	16.77	22.32	7.23	7.37	0.28	20.90	46.82	17.25
$H_1D_1V_2$	63.33	2.10	20.27	34.75	15.07	11.92	0.41	21.98	41.60	21.00
$H_1D_2V_1$	56.62	2.47	29.85	37.58	15.88	9.44	0.40	21.05	45.88	20.83
$H_1D_2V_2$	46.98	2.20	25.75	32.92	9.99	11.15	1.06	22.60	45.35	19.00
$H_1D_3V_1$	55.22	2.13	19.55	25.05	8.43	9.56	0.60	21.90	44.25	20.08
$H_1D_3V_2$	47.85	2.42	20.35	28.38	10.35	12.50	0.44	21.12	40.20	21.00
$H_2D_1V_1$	63.63	2.60	68.45	86.17	31.13	13.32	0.96	21.02	48.10	17.25
$H_2D_1V_2$	73.08	3.20	94.10	134.50	53.93	13.78	1.17	21.18	44.67	20.58
$H_2D_2V_1$	70.53	2.43	81.45	105.02	37.00	11.97	0.71	21.65	37.75	19.25
$H_2D_2V_2$	70.08	2.90	54.30	79.27	30.43	12.70	1.19	22.55	40.70	17.50
$H_2D_3V_1$	74.40	2.57	73.02	104.35	32.93	11.90	1.09	21.65	40.73	22.38
$H_2D_3V_2$	67.68	3.33	105.17	151.33	60.97	12.90	0.92	20.67	44.68	17.50
$H_3D_1V_1$	72.17	4.00	99.88	146.17	54.22	12.80	1.79	23.40	43.17	17.75
$H_3D_1V_2$	62.75	3.57	96.22	176.67	91.72	13.60	1.89	21.07	41.55	19.25
$H_3D_2V_1$	61.40	3.10	88.63	126.83	45.42	11.55	1.47	19.98	40.68	19.25
$H_3D_2V_2$	56.55	3.60	114.55	166.83	62.82	12.85	1.52	23.02	44.48	17.75
$H_3D_3V_1$	61.97	2.57	70.98	90.67	34.38	10.37	1.16	23.73	45.98	21.83
$H_3D_3V_2$	61.65	2.10	58.77	86.32	35.38	11.47	1.14	21.00	37.73	20.83
LSD 5%	**1.45**	**0.21**	**2.95**	**9.08**	**4.41**	**1.15**	**0.20**	**0.98**	**4.60**	**1.62**

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التأثير المتكامل للأصناف والكثافة النباتية ومكافحة الحشائش علي المكونات الكيمبائية والمحصول لفول الصويا النامي في الأراضي الجديدة

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قسم المحاصيل كلية الزراعة بالفيوم قسم النبات الزراعي – كلية الزراعة بالفيوم

اهتم هذا البحث بدراسة تـأثير مبيد الحشـائش بيوتيرالين (٢.٥ لتر /فدان)، والعزيق عند أعمار ٣٠ ،٦٠ يوم من الزراعة مع ثلاث مسافات بين الجور ١٠، ١٥، ٢٠ سم علي التركيب الكيماوي للنبات أثناء النمو والمحصول ومكوناته وأيضا نسبةاليروتين والكربوهيدرات و الزيت في البذور لصنفي فول الصويا جيزه ١١١ وجيزه٢١ والحشائش المصاحبة لهما. وأقيمت التجربة في مزرعة دمو بكلية الزراعة جامعة الفيوم خلال موسمي الزراعة٢٠٠٦، ٢٠٠٧ في تصميم القطع المنشقة مرتين.

وأظهرت النتائج أن كلا من البيوترالين (H_2) والعزيق (H_3) قد تفوقا علي الكنترول في مقاومة الحشائش في فول الصويا. كانت نسبة تثبيط نمو الحشائش (عريضة وضيقة الأوراق والمجموع الكلي) بتأثير العزيق كان بين (٧١.٣، ٧٦.٣%) وهذا اعلي من الراجع لتأثير البيوترالين (٦١.١٩%) للحشائش ضيقة الأوراق. وكان تأثر الوزن الأخضر للحشائش عريضة الأوراق وأيضا الحشائش الكلية بالكثافة النباتية في العينة الأولي لصالح الكثافة الاعلي (D_1) وكانت النسبة٣٠.٣و ٣٦.٢ % علي الترتيب مقارنة بالمسافة الواسعة بين النباتات (D_3) وأظهرت النتائج إن تأثير المسافات بين النباتات اقل من تأثير مقاومة الحشائش ميكانيكيا أو كيماويا علي نمو الحشائش.و لم تظهر الأصناف تأثيرا معنويا. أما التفاعل الثلاثي بين المبيد والمسافة الثانية والصنف

الثاني أو العزيق والمسافة الضيقة مع الصنف الثاني أعطت انخفاضا معنويا في نمو الحشائش ضيقة الأوراق.

أما بالنسبة للتركيب الكيماوي لنبات الفول فكانت معاملة المبيد والعزيق متفوقين علي معاملة الكنترول لصالح معاملة المبيد في معظم التقديرات. وقد تشابهتا في الفينول والكاروتينات والانثوسيانين. لوحظ تأثيرات متداخلة للمسافة بين الجور علي التركيب الكيماوي وتفوقت المسافة ١٥سم و١٠سم.

أعطت التفاعلات بين المبيد مع المسافة الواسعة والمبيد مع المسافة المتوسطة والعزيق مع الصنف الثاني وأيضا التفاعلات الثلاثية مبيد × المسافة الواسعة × الصنف الثاني و العزيق × المسافة ١٠سم مع الصنف الأول والمبيد مع ١٥سم مع الصنف الأول أعطوا تأثير موجب عالي علي التركيب الكيماوي لنباتات فول الصويا.

وبالسبة للمحصول ومكوناته أعطت معاملة العزيق أعلي قيم للمحصول ومكوناته. بينما معاملة المبيد تفوقت في طول النبات فقط.اما المسافة الضيقة ١٠سم نتج عنها زيادة في عدد الأفرع وعدد القرون ووزن القرون للنبات ووزن بذور النبات ومحصول الفدان وتشابه معها المسافة المتوسطة ١٥سم في كلا من عدد الأفرع ومحصول الفدان. تفوق الصنف الثاني جيزه ٢١ في المحصول ومكوناته ولكن تميز الصنف الأول جيزه ١١١ بنباتات أطول.

التأثيرات المعنوية للتفاعلات: العزيق مع المسافة والمبيد مع الصنف الثاني والعزيق مع المسافة ١٠ سم مع الصنف الثاني كانت متفوقة ايجابيا في وزن القرون ووزن بذور النبات ودليل البذرة. وكانت أعلي نسبة كربوهيدرات (٢٣.٣٧%) وبروتين (٤١.١%) وزيت في البذور(٢٢.٣٨%) نتجت من التفاعلات بين العزيق والمسافة الواسعة ٢٠ سم مع الصنف الثاني، المبيد مع المسافة الضيقة مع الصنف الاول ، المبيد مع والمسافة الواسعة والصنف الأول علي الترتيب.

وعموما دلت النتائج علي إمكانية الحصول علي محصول عالي للفدان حوالي (١.٨٩٠ طن) من فول الصويا عند زراعة الصنف جيزه٢١ في الأراضي الجديدة بالمسافة ١٠سم بين الجور (D_1) ونباتين في الجوره وإجراء العزيق مرتين أثناء نمو المحصول.