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RESPONSE OF TWO SOYBEAN CULTIVARS AND THE ASSOCIATED WEEDS TO SOME AGRONOMIC FACTORS UNDER NEWLY RECLAIMED SOIL

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ABSTRACT

Individual and integrated effects of three weed control treatments H [weedy control (H_1); Butralin (H_2) and manual twice hoeing (H_3)] , three hill spacing , D [10 (D_1), 15 (D_2) and 20 cm (D_3)] and two soybean varieties, V [Giza 111 (V_1) and Giza 21 (V_2)] on dry matter (DM) of associated weeds, growth traits and parameters, nutrients uptake and seed yield, were the intended aim of the present study. To achieve this aim, split- split plot arrangement was used, where tested variables; H, D and V were allocated in main-, sub- and sub-sub plot, respectively, at newly reclaimed soil of the experimental farm "Demo" of Fac. Agric., Fayoum Univ., during 2006 and 2007 summer seasons. The obtained results could be summarized as follows:

Dry weight of weeds were deppressed by twice manual hoeing, dense planting, chemical control and the interaction of H2D2V2 in the first sample and H3 V1 in the second sample.Maximum values of soybean height, number of branches, LA and LAI were obtained by H2 or H3 depending on the sample as well as the studied variety.

Soybean density had a significant effect on plant growth (height, DM and LA). In addition CGR and NAR as well as N, P, and K were affected by H3 and H2. Several dual and triointeractions significantly affected the growth traits.

Manual hoeing, H_3 (1490 kg/fed) out yielded Butralin treatment, H_2 (1000kg/fed) and both surpassed the weedy control one, H_1 (530 kg/fed). Closest spacing, D_1 (1080 kg) followed by intermediate one, D_2 (1060 kg) produced markedly by higher seed yield/fed that of the widest spacing (890 kg). V_2 (1080kg) out yielded V_1 (940 kg/fed). H_3 D_1 (1840), D_2 V_2 (1500) and H_3D_2 (1260) as well as $H_3D_1V_2$ (1890 kg/fed) were the most effective interactions on soybean yield.

The obtained results revealed that, in such newly reclaimed land, the maximum yield with improved quality of soybean could be obtained from Giza 21 planted in closed spacing (10cm) and treated with manual hoeing twice.

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INTRODUCTION

Soybean [*Glycine max* (L.) Merril] as a leguminous and oleifrous plant, is one among the main and important commercial crops cultivated in many world countries, particularly Brazil, China, Argentina and USA which contribute with most of its total production (**Röbbelen *et al* 1989**). Wideworld cultivation of soybean is owing to its numerous nutritional advantages either as processed food or defatted meal as feed, where its seeds contain about 40% protein and 20% oil. In Egypt, though it was incorporated into the local crop rotation since more than three decades, its acreage declined from 100,000 feddan in 1991 up to only 10,000 feddan in 2000 and continued decline to reach limited area in the few last years (**Hassan *et al* 2001**) because of several constraints encountered it. So, cultivation of soybean in newly reclaimed land outside the Valley may be an adequate solution to dilate its area, increase its production and consequently improve our food and feed as well as enhancing the fertility of such soil. Quit a few workers like **Hassan *et al* (2001)** suggested that soybean could be successfully grown in newly reclaimed soil. However, plantation of the new land needs some cautions to avoid its production hazards that can prevent a crop from expressing its yield potential.

Minimizing weed competition for soybean plant is an intended aim of several investigators, where the crop is very sensitive for weeds which cause great yield losses. Many investigators recorded sizeable yield losses of soybean caused by weeds (**Hassan *et al* 1988; Abdalla *et al* 1993 and Shafshak *et al* 1997). Dubey (1998)** reported that manual weeding was more effective weed control than any herbicide and increased seed yield. Whereas, **Yadav *et al* (1999)** and **Hassanein *et al* (2000)** showed that some herbicides used by them 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. **Manijusha *et al* (2004)** and **Umale *et al* (2005)** reported that the favorable 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.

Indeed, 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 but 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 ; Andrade *et al* 2002; Veeramani *et al* 2001; Galal, 2003 and Saitoh *et al* 2007)**. 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.

Soybean varieties investigated by various authors showed significant differences in physiological traits, chemical composition and /or yielding ability as well as their responses to weed control and other cultural practices **(Gaweesh, 1987; Shaban *et al* 1991; Board, 2000; Hassanein *et al* 2000; Hassan *et al* 2001 and Rigsby and Board, 2003)**. Soybean growth traits and parameter as well as nutrient uptake were frequently used as physiological indicators for biomass formation and dry matter accumulation, which oftenly influenced by genetical and environmental factors. These traits and parameters as affected by the variables under study were determined by several authors **(Wells, 1991; Mishra and Bhan, 1996; Dubey, 1998; Board, 2000; Panneerselvam and Lourduraj, 2000; Galal, 2003; Yin and Vyn, 2004 and Saitoh *et al* 2007)**.

Therefore, the present study was undertaken to workout the effect of varieties, plant densities and weed control treatments on dry matter of associated weed, crop growth traits and parameters, nutrient uptake and seed yield of soybean grown in newly reclaimed soil.

MATERIALS AND METHODS

Two field experiments were carried out during the two consecutive seasons of 2006 and 2007 at the experimental "Demo" farm of the Fac. Agric., Fayoum Univ. to study the effects of weed control treatments, hill spacing and cultivars on growth and yield of soybean as well as dry matter of associated weeds. The experimental site (newly reclaimed soil) was loamy sand in both seasons, with ECe 4.56 and 4.2 dS/m, pH 8.07 and 8.2, $CaCO_3$ 15.04 and 14.88% and organic matter of 0.89 and 0.74% in the first and second seasons, respectively. The weed control treatments were (1) unweeded 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) twice manual hoeing treatment (H_3), 30 and 60 days after sowing (DAS). Three hill spacing 10 (D_1), 15 (D_2) and 20 cm (D_3) with two plants per hill after complete emergence. Two soybean cultivars, i.e. Giza 111 (V_1) and Giza 21 (V_2) were used. Random complete block design (RCBD) in split-split plot design with three replications was used. The weed control, hill spacing and cultivars were arranged in main-, sub- and sub-sub plots, respectively. The plot area was 10.5m^2 (3x3.5 m) each plot consisted of 5 rows, 60 cm apart and 3.5m long.

Seeds were sown on May 14 and 13 in 2006 and 2007, respectively after inoculated with *Rizobium japonicum*. 150 kg/Fed. of calcium superphosfate before sowing, 60kg/fed ammonium nitrate in three equal doses (at planting, before the first and second irrigations) were added. After 45 and 90 days from sowing, total weeds of m^2 classified into narrow (NLW) and broad (BLW) leaves were determined and then dry matter was calculated.

Two soybean leaf samples were chosen randomly at 40 and 60 days from sowing to determine N% according to micro Kjeldahle as outlined by **A.O.A.C. (1995)** Phosphorus content was detected photo-metrically according to the method described by **A.O.A.C. (1995)** and Potassium% as indicated by **Page *et al* (1982).**

Random Soybean three samples were chosen from every treatment at 40 (sample 1), 61(sample 2) and 82 days (sample 3) from sowing to measure plant height (Pl.H, cm), number of branches/plant (No. Brs.), leaf area per plant (LA) in dm^2 by using Digital Planimeter Planix 7 and leaf area index (LAI) and then dried to determined dry matter per plant. Growth analysis criteria were calculated **(Radford, 1967).**

Crop growth rate (CGR; g dm^{-2} land area per day): $\frac{(W_2 - W_1)}{(t_2 - t_1)}$,

Relative growth rate (RGR) :

$\frac{(Log_e W_2 - Log_e W_1)}{(t_2 - t_1)}$ **and**

Net assimilation rate (NAR; g dm^{-2} leaf area per day): $\frac{(W_2 - W_1)}{(A_2 - A_1)} \times \frac{(Log_e A_2 - Log_e A_1)}{(t_2 - t_1)}$

Where: W_1, A_1 and W_2, A_2 refer to plant dry weight and leaf area at the first time (t_1) and the second time (t_2) of sampling, respectively.

Seed yield/fed (S.y/fed, Kg), was calculated on seed yield/plot basis. Combined analysis of the obtained data was performed for the two seasons, after testing homogeneity of variance **(Gomez and Gomez, 1984)**. Comparisons of means were done using LSD at 5% level.

RESULTS AND DISCUSSION

a. Associated weeds

The common weeds presented in our experimental fields were : *Chenopodium album, common Lambsquarters, Cyperus, longus* L., *Echinochloa colonum, Portulaca olerace* L., *Amarnathus ascendes* and *Cypnodon dactylon* L.

Effect on dry weight

The effect of the agronomic factors on the dry weight of soybean associated weeds are shown in **Table (1).** The results indicate that hand hoeing exhibited significant reduction comparing to both and chemical control treatments. The pattern of changes in the first sample was similar to those obtained by the second one. These results were similar to those obtained by (**Tewari, *et al* 1994; Thakare, *et al* 1998; Panneerselvam and Lourdurj, 2000; Ahmed *et al* 2001; El-Quessni *et al* 2002 and Pandya *et al* 2005).** However, **Yadav *et al* (1999) and Hassanein *et al* (2000)** reported that both mechanical and chemical (applied by them) were equally effective in reducing weed population and DM weight.

In the first sample significant lowest DW of both broad leaves weight (BLW) and total weight (TW) were obtained by narrowing hill space to 10cm **(Abdalla, 1993; Dubey, 1998; Hassan *et al* 2001; Galal, 2003 and Saitoh *et al* 2007)** reported that closed sown soybean recorded significantly minimum dry weight biomass of weeds.

Varietal differences have no significant effects on DM of weeds in both samples. On the contrary, **Hassanein *et al* (2000) Jannink *et al* (2001) and Pandya *et al* (2005)** found varietal differences on DM of associated weeds. These differences may be attributed to varied germination dates, growth rates, and late maturing variety allows weed occurrence excessively.

Effect of interaction

Dual interaction HxD had significant effect on DM of BLW and TW in the first sample. Minimum DM resulted from manual hoeing (H_3) combined with plant spacing 15 cm (D_2). **Galal (2003)** recorded minimum DM of weeds from hand hoeing twice for soybean plant spaced by 5 cm.

HxV significantly influenced DM of BLW weeds in the two samples and TW in the second sample. The lowest DM of weeds was recorded by V_2 (Giza 21) and manual hoeing (H_3) in the first sample. Triointeraction (HxDxV) exerted significant effects on DM of narrow leaves weight (NLW) in the first sample and both BLW and NLW in the second one. $H_2D_2V_2$ (3.57 g/m^2) for NLW in the first sample, as well as $H_3D_1V_2$ interaction (5.59 g/m^2) for NLW in the second sample were the promising treatments recorded the lowest DM weight of weeds.

b. Soybean growth traits

Weed control treatments significantly affected all growth traits in the three samples with gradual increases from the first to third sample **(Table 2).** Chemical treatment (H_2) gave the tallest plants of

Table 1. Effect of the agronomic factors on the dry matter of weeds in soybean field at 45 and 90 days from planting (calculated as combined data over 2006 and 2007 seasons)

Fac. (H)	Fac. (D)	Sample (1)								
		Broad leaves weight		Mean	Narrow leaves weight		Mean	Total weight		Mean
		V_1	V_2		V_1	V_2		V_1	V_2	
	D_1	91.50	85.17	88.33	85.55	28.70	57.13	177.05	113.87	145.46
H_1	D_2	126.65	175.30	150.98	14.95	31.35	23.15	141.60	206.65	174.13
	D_3	129.80	188.33	159.07	27.80	39.38	33.59	157.60	227.72	192.66
Mean		**115.98**	**149.60**	**132.79**	**42.77**	**33.14**	**37.96**	**158.75**	**182.74**	**170.75**
	D_1	53.35	58.15	55.75	5.61	26.70	16.16	58.96	84.85	71.91
H_2	D_2	64.67	116.22	90.44	10.08	3.57	6.82	**74.75**	**119.78**	97.27
	D_3	73.60	106.85	90.23	23.20	4.30	13.75	96.80	111.15	103.98
Mean		**63.87**	**93.74**	**78.81**	**12.96**	**11.52**	**12.24**	**76.84**	**105.26**	**91.05**
	D_1	53.60	36.93	45.27	7.00	4.10	5.55	**60.60**	41.03	50.82
H_3	D_2	36.80	24.18	30.49	11.70	13.65	12.68	48.50	**37.83**	43.17
	D_3	50.10	27.58	38.84	15.43	12.62	14.03	65.53	40.20	52.87
Mean		**46.83**	**29.57**	**38.20**	**11.38**	**10.12**	**10.75**	**58.21**	**39.69**	**48.95**
	D_1	66.15	60.08	**63.12**	32.72	19.83	**26.28**	98.87	79.92	**89.39**
	D_2	76.04	105.23	**90.64**	12.24	16.19	**14.22**	88.28	121.42	**104.85**
	D_3	84.50	107.59	**96.04**	22.14	18.77	**20.46**	106.64	126.36	**116.50**
Mean of V		**75.56**	**90.97**	**83.27**	**22.37**	**18.26**	**20.32**	**97.93**	**109.23**	**103.58**

LSD for:	Broad leaves	Narrow leaves	Total weight
Weed control (H)	17.94	12.67	24.21
Plant density (D)	12.24	n.s	16.97
Varieties (V)	n.s	n.s	n.s
HxD	21.2	n.s	29.39
HxV	27.63	n.s	n.s
DxV	n.s	n.s	n.s
HxDxV	n.s	39.22	n.s

Table 1. Cont.

Fac. (H)	Fac. (D)	Sample (2)								
		Broad leaves weight		Mean	Narrow leaves weight		Mean	Total weight		Mean
		V_1	V_2		V_1	V_2		V_1	V_2	
	D_1	343.03	162.32	252.68	97.65	31.96	64.81	440.68	194.28	317.48
H_1	D_2	372.78	228.38	300.58	31.02	38.56	34.79	403.80	266.94	335.37
	D_3	188.35	150.83	169.59	34.98	56.03	45.51	223.33	206.86	215.10
Mean		**301.39**	**180.51**	**240.95**	**54.55**	**42.18**	**48.37**	**355.94**	**222.69**	**289.32**
	D_1	87.65	157.77	122.71	80.93	30.98	55.96	168.58	188.75	178.66
H_2	D_2	59.15	148.18	103.67	18.33	34.15	26.24	77.48	182.33	129.91
	D_3	122.38	130.75	126.57	25.57	52.06	38.82	147.96	182.81	165.38
Mean		**89.73**	**145.57**	**117.65**	**41.61**	**39.06**	**40.34**	**131.34**	**184.63**	**157.98**
	D_1	49.08	45.87	47.48	8.41	5.59	7.00	57.49	51.45	54.47
H_3	D_2	26.33	43.00	34.67	17.15	15.13	16.14	43.48	58.13	50.81
	D_3	39.42	44.09	41.75	18.83	16.51	17.67	58.25	60.60	59.42
Mean		**38.28**	**44.32**	**41.30**	**14.80**	**12.41**	**13.60**	**53.07**	**56.73**	**54.90**
	D_1	159.92	121.98	**140.95**	62.33	22.84	**42.59**	222.25	144.83	**183.54**
	D_2	152.76	139.86	**146.31**	22.17	29.28	**25.72**	174.92	169.13	**172.03**
	D_3	116.72	108.56	**112.64**	26.46	41.53	**34.00**	143.18	150.09	**146.63**
Mean of V		**143.13**	**123.47**	**133.30**	**36.99**	**31.22**	**34.10**	**180.12**	**154.68**	**167.40**

LSD for:	Broad leaves weight	Narrow leaves weight	Total weight
Weed control (H)	80.63	12.53	80.70
Plant density (D)	n.s	n.s	n.s
Varieties (V)	n.s	n.s	n.s
HxD	n.s	n.s	n.s
HxV	95.78	n.s	96.62
DxV	n.s	n.s	n.s
HxDxV	165.90	40.17	n.s

Table 2. Effect of the agronomic factors on the growth of three soybean samples (calculated as combined data over 2006 and 2007 seasons)

Treatments.	Sample (1)					Sample (2)					Sample (3)				
	Plant height (cm)	No of Branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI	Plant height (cm)	No of branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI	Plant height (cm)	No of branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI
Mean of weed control (H)															
H_1	22.44	0.10	1.95	5.27	136.68	40.43	0.63	6.40	14.76	361.44	55.25	1.25	11.91	16.49	411.28
H_2	26.51	0.52	3.30	9.40	228.48	41.33	1.57	8.66	24.94	584.81	68.59	2.28	30.98	40.01	973.83
H_3	22.67	0.25	2.51	7.61	188.05	42.26	1.76	10.32	27.97	688.97	67.18	2.42	27.62	43.11	1109.44
LSD 5%	0.55	0.07	0.11	0.29	8.81	1.22	0.25	0.31	1.05	30.03	1.11	0.15	0.76	1.22	33.08
Mean of plant density (D)															
D_1	24.24	0.28	2.47	7.18	247.56	40.59	0.93	7.39	18.93	653.64	66.25	2.01	25.82	33.21	1145.83
D_2	24.77	0.29	2.72	7.63	177.30	40.22	1.42	8.52	23.37	544.17	63.04	1.97	22.43	33.72	784.97
D_3	22.60	0.29	2.58	7.45	128.35	43.21	1.61	9.47	25.36	437.42	61.73	1.97	22.26	32.68	563.75
LSD 5%	0.84	n.s	0.10	0.25	7.33	0.94	0.12	.26	1.19	32.99	1.03	n.s	0.67	n.s	29.17
Mean of varieties(V)															
V1	23.93	0.28	2.65	7.39	181.48	41.72	1.59	8.78	24.03	584.57	65.40	2.07	23.00	33.70	844.54
V2	23.81	0.30	2.53	7.46	187.32	40.96	1.05	8.13	21.08	505.57	61.94	1.90	24.14	32.70	818.50
LSD 5%	n.s	n.s	n.s	n.s	n.s	n.s	.24	0.64	2.82	60.51	2.59	n.s	n.s	n.s	n.s

the first (40 DAS) and the third sample (82 DAS), whereas manual hoeing (H_3) produced the tallest plants in the second sample (61 DAS) that insignificantly different from that of (H_2). The greatest number of branches due to chemical treatment (0.52 br.) in the first sample as well as to manual hoeing in the second sample (1.76 br.) and the third one (2.42 br.) were recorded. Consequently, plant dry matter followed similar trends of those of plant height and number of branches. Both mechanical and chemical control treatments surpassed the weedy control for the three traits. Similar results were detected by **Mishra and Bhan (1996), Thakare *et al* (1998) and Panneerselvam and Lourduraj (2000),** while **Galal (2003)** obtained the tallest plants from chemical herbicide and the greatest number of branches from twice manual hoeing. LA and LAI showed similar trend exhibited by plant height, number of branches and dry matter. The highest values 9.40 and 228.48 due to H_2 in the first sample, 27.97 and 688.97 in the second sample and 43.11 and 1109.44 in the third sample due to H_3 manual treatment were observed for LA and LAI, respectively **(Table 2)**. The different trend of the first sample might be attributed to greater weed competition to plants. In this concern, **Chaichi and Ehteshami (2001)** suggested that the peak competition period between weeds and crop plants occurred between the formation of 3^{rd} and 7^{th} nodes. These results indicated that manual hoeing had positive effect for longer time than Butralin treatment on growth traits.

Plant density exerted significant effects on all growth traits except for number of branches in the first sample and LA in the third one **(Table 2)**. Intermediate spacing (D_2 of 15 cm) gave the tallest plants (24.77 cm) without significant difference for that of D_1 (10 cm) in the first sample, while D_1 gave tallest plants (66.25 cm) in the third sample. This may be due to greater plant competition on edaphic and climatic factors, under narrow than wide spacing, in addition to ouxcin effect that influenced by light intensity which depending on plant density. Ouxin may be broken under high light intensity (i.e. wider planting) while it activated under low light intensity (i.e. denser planting). Thereby, plant height of closest spacing (D_1) was taller at the late age of the third sample than those of young ages. Number of branches were of similar values in each of the first and third sample and insignificantly differed from those of corresponding D_1 values in both samples. Consequently, D_2 in the first sample (2.72g) and D_1 in the third one (25.82g) produced the heaviest weight of plant dry matter. The high LA values were obtained from intermediate plant density (D_2) in both youngest (41DAS) and oldest (82 DAS) samples. These results are in harmony with several authors who stated that dense spacing increased the plant competition on light and other environmental factors and lead to stem elongation and more biomass accumulation depending on LA expansion and index (**Wells, 1991; Jain *et al* 1996; Dubey, 1998; Galal, 2003 and Saitoh *et al* 2007).**

Contradicted results were recorded in the second sample, where the widest spacing (D_3) led to highest values of plant height, number of branches, plant dry matter and LA whereas, the largest LAI was obtained by narrowing spacing (D_1). This may be attributed to the change in plant-to- plant competition during this age. However, the narrow planting gave largest LAI values in the first (247.56), second (633.64) and third (1145.85) samples. In this concern **Saitoh *et al* (2007)** suggested that in narrow plant spacing, the upper layer of canopy had large LA and LAI but it had low light extinction coefficients and the canopy exhibited good light interception due to increase vegetation source and uniform.

Significant varietal effects on growth traits were observed for number of branches, dry matter, LA and LAI in the second sample (61DAS) and only plant height in the eldest plant sample (82DAS), in favorable to Giza 111(V_1). These results revealed relative similarity of the two tested varieties for vegetative growth traits and parameters, particularly at youngest and oldest ages. However, the difference between them at the intermediate age (61DAS) of the second sample reflected its different response to plant density. Varietal differences for growth traits were previously detected by **Abdalla *et al* (1993), Hassan *et al* (2001) and Rigsby and Board (2003).**

Interaction effects

As shown in **Table (3)** all growth traits were significantly affected by all second order interactions HxD, HxV and DxV, except number of branches by HxV and DxV interactions, as well as plant height by HxV interaction in the 2^{nd} sample. The most effective (HxD) dual interactions were H_2D_1, H_2D_3, and H_3D_3. H_2D_1 on LAI (285.50) in the first sample, DM weight (36.42g) in the third one and plant height (28.82 and 71.20cm, erderly). H_2D_3 interaction significantly influenced number of branches (0.73), DM weight (3.46g) and LA (10.33 dm^2) in the first sample. H_3D_3 interaction markedly affected all growth traits except LA and LAI, in the intermediate plant age of the second sample, indicating its relative importance during this age (61 DAS) of plant development. These results were supported those reported by **Chaich and Ehteshami (2001) and Saitoh *et al* (2007).** Regarding the (HxV) interaction effects on growth traits, the results showed that H_3V_1 was the most effective one, where it significantly produced the highest values of all growth traits in the second and the third samples, except plant height in the former and DM weight in the later. Concerning (DxV) interaction, D_1V_1 was the most effective interaction where it significantly increased plant height (67.18 cm), number of branches (2.44 br.) and DM weight (27.61g) on the late stage of the third sample as well as LAI in the second (699.94) and third (1204.66) samples, indicating the high response of V_1 to dense planting, and confirming the above mentioned results. Significant (VxD) interaction was previously reported by **Abdalla *et al* (1993), Shafshak *et al* (1997) and Hassan *et al* (2001).**

Triointeraction (HxDxV) significantly affected all growth traits at the three ages, except number of branches in the youngest one **(Table 4).** The most effective second order interactions on growth traits were $H_2D_1V_1$, $H_3D_1V_1$ and $H_3D_2V_1$. The first one ($H_2D_1V_1$) markedly affected plant height (74.08 cm) number of branches (3.10 bt.) and DM weight (40.70 g) as well as $H_3D_1V_1$ influenced DM weight (30.83 g), LA (54.82) and LAI (1891.67) at the late stage of the third sample. $H_3D_2V_1$ interaction had considerable effect on DM weight (12.98g), LA (41.13) and LAI (957.33) in the second sample. These results indicating the high response of V_1 to dense planting, particularly if combined with manual weed control.

Table 3. Weed control and hill space interaction effect on the growth of soybean calculated as combined data over 2006 and 2007 seasons

Treatments.	Sample (1)					Sample (2)					Sample (3)				
	Plant height (cm)	No of Branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI	Plant height (cm)	No of branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI	Plant height (cm)	No of branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI
Mean of weed control and plant density (H&D)															
H_1D_1	23.11	0.31	2.15	6.36	219.42	39.88	0.49	6.15	12.97	447.67	58.86	1.24	12.44	16.48	568.08
H_1D_2	23.31	0.00	1.93	4.75	110.13	38.63	0.80	6.69	16.01	373.08	53.62	1.19	12.03	15.98	372.42
H_1D_3	20.89	0.00	1.78	4.69	80.49	42.80	0.59	6.34	15.28	263.58	53.28	1.33	11.26	17.00	293.33
H_2D_1	28.82	0.33	3.08	8.29	285.50	40.73	1.06	6.98	19.20	663.17	71.20	2.35	36.42	34.53	1191.83
H_2D_2	28.27	0.49	3.36	9.56	222.08	39.92	1.58	8.19	21.87	509.17	67.47	2.08	29.83	42.24	983.17
H_2D_3	22.44	0.73	3.46	10.33	177.85	43.33	2.08	10.81	33.75	582.08	67.09	2.41	26.70	43.27	746.50
H_3D_1	20.81	0.22	2.16	6.90	237.75	41.17	1.23	9.02	24.63	850.08	68.69	2.46	28.60	48.62	1677.58
H_3D_2	22.73	0.38	2.86	8.59	199.69	42.11	1.90	10.66	32.24	750.25	68.03	2.65	25.43	42.94	999.33
H_3D_3	24.46	0.15	2.49	7.34	126.71	43.49	2.16	11.26	27.04	466.58	64.83	2.16	28.83	37.77	651.42
LSD 5%	**1.46**	**0.13**	**0.17**	**0.44**	**12.7**	**1.63**	**0.20**	**0.45**	**4.88**	**57.15**	**1.79**	**0.28**	**1.16**	**1.74**	**50.53**
Mean of weed control and varieties (H&V)															
H_1V_1	22.07	0.12	1.97	5.42	219.42	40.33	0.73	6.19	14.94	375.61	57.82	1.17	11.04	18.04	442.78
H_1V_2	22.81	0.08	1.94	5.12	110.13	40.54	0.53	6.60	14.58	347.28	52.68	1.33	12.79	14.93	379.78
H_2V_1	25.99	0.52	3.57	9.66	80.49	41.77	1.73	8.71	25.41	608.78	69.12	2.43	28.29	37.32	905.50
H_2V_2	27.03	0.51	3.03	9.13	285.50	40.89	1.42	8.61	24.47	560.83	68.06	2.13	33.67	42.71	1042.17
H_3V_1	23.73	0.20	2.40	7.10	222.08	43.05	2.32	11.45	31.75	769.33	69.27	2.60	29.26	45.74	1185.33
H_3V_2	21.61	0.29	2.61	8.12	177.85	41.46	1.21	9.19	24.19	608.61	65.10	2.25	25.98	40.47	1033.56
LSD 5%	**2.35**	**n.s**	**0.54**	**1.81**	**41.79**	**n.s**	**0.41**	**1.12**	**2.88**	**104.8**	**4.48**	**0.35**	**4.52**	**4.02**	**115.99**
Mean of plant density and varieties (D&V)															
D_1V_1	24.64	0.24	2.52	7.08	244.00	41.52	1.37	8.13	20.26	699.94	67.18	2.44	27.61	34.91	1204.61
D_1V_2	23.84	0.33	2.42	7.29	251.11	39.66	0.49	6.64	17.60	607.33	65.32	1.59	24.03	31.51	1087.06
D_2V_1	24.74	0.29	2.49	6.76	156.79	42.25	1.55	8.98	26.54	617.67	64.53	1.81	20.06	30.99	721.72
D_2V_2	24.80	0.29	2.94	8.51	197.81	38.18	1.30	8.05	20.21	470.67	61.55	2.14	24.79	36.45	848.22
D_3V_1	22.40	0.31	2.94	8.34	143.65	41.37	1.85	9.24	25.29	436.11	64.49	1.95	20.92	35.21	607.28
D_3V_2	22.79	0.27	2.22	6.56	113.05	45.04	1.37	9.71	25.43	438.72	58.79	1.98	23.61	30.15	520.22
LSD 5%	**2.35**	**n.s**	**0.54**	**1.81**	**41.79**	**4.11**	**0.41**	**1.12**	**4.88**	**104.8**	**4.48**	**0.35**	**4.52**	**4.02**	**115.99**

Table 4. Weed control (H), plant density (D) and varieties (V) interactions effects on some growth traits of three soybean samples, calculated as combined data over 2006 and 2007 seasons

Treatments	Sample (1)					Sample (2)					Sample (3)				
	Plant height (cm)	No of Branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI	Plant height (cm)	No of branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI	Plant height (cm)	No of branches	Dry matter, DM (g)	Leaf area, LA (dm^2)	Leaf area Index, LAI
Mean of weed control, plant density and varieties (H&D&V)															
$H_1D_1V_1$	22.68	0.36	2.29	6.77	233.67	39.98	0.99	6.71	15.82	546.50	56.52	1.14	11.28	16.37	564.33
$H_1D_1V_2$	23.53	0.25	2.01	5.96	205.17	39.77	0.00	5.59	10.13	348.83	61.20	1.33	13.60	16.59	571.83
$H_1D_2V_1$	22.82	0.00	1.79	4.90	113.55	39.85	0.42	5.36	13.32	310.17	58.93	1.15	11.70	18.55	432.50
$H_1D_2V_2$	23.80	0.00	2.07	4.60	106.72	37.40	1.18	8.02	18.70	436.00	48.30	1.24	12.37	13.42	312.33
$H_1D_3V_1$	20.70	0.00	1.83	4.59	78.77	41.15	0.78	6.51	15.67	270.17	58.02	1.22	10.12	19.22	331.50
$H_1D_3V_2$	21.08	0.00	1.72	4.78	82.22	44.45	0.40	6.18	14.90	257.00	48.53	1.43	12.40	14.78	255.17
$H_2D_1V_1$	27.52	0.36	3.20	7.78	267.83	44.10	1.51	8.40	20.83	720.00	74.08	3.10	40.70	33.53	1157.83
$H_2D_1V_2$	30.12	0.31	2.96	8.80	303.17	37.37	0.61	5.56	17.57	606.33	68.32	1.60	32.13	35.52	1225.83
$H_2D_2V_1$	27.97	0.50	3.36	7.92	183.50	42.93	1.67	8.61	25.17	585.50	65.53	2.00	24.90	34.13	794.67
$H_2D_2V_2$	28.57	0.49	3.36	11.21	260.67	36.90	1.49	7.78	18.57	432.83	69.40	2.17	34.75	50.35	1171.67
$H_2D_3V_1$	22.48	0.71	4.16	13.27	228.53	38.27	2.00	9.13	30.22	520.83	67.73	2.20	19.28	44.28	764.00
$H_2D_3V_2$	22.40	0.75	2.77	7.40	127.17	48.40	2.15	12.48	37.28	643.33	66.45	2.63	34.12	42.25	729.00
$H_3D_1V_1$	23.73	0.00	2.05	6.68	230.50	40.48	1.60	9.28	24.13	833.33	70.95	3.07	30.83	54.82	1891.67
$H_3D_1V_2$	17.88	0.43	2.28	7.12	245.00	41.85	0.86	8.77	25.12	866.83	66.43	1.85	26.37	42.42	1463.50
$H_3D_2V_1$	23.43	0.38	2.33	7.45	173.33	43.97	2.57	12.98	41.13	957.33	69.12	2.28	23.58	40.30	938.00
$H_3D_2V_2$	22.03	0.39	3.40	9.73	226.05	40.25	1.22	8.34	23.35	543.17	66.95	3.01	27.27	45.58	1060.67
$H_3D_3V_1$	24.02	0.24	2.83	7.18	123.65	44.70	2.78	12.07	29.98	517.33	67.73	2.45	33.37	42.12	726.33
$H_3D_3V_2$	24.90	0.06	2.16	7.50	129.77	42.28	1.54	10.46	24.10	415.83	61.92	1.88	24.30	33.42	576.50
LSD 5%	**4.06**	**n.s**	**0.94**	**3.13**	**72.39**	**7.11**	**0.72**	**1.93**	**8.46**	**181.52**	**7.77**	**0.60**	**7.03**	**6.96**	**200.9**

C. Growth parameters and nutrient uptake

Often, improving seed yield and quality of soybean is associated with improved growth traits and biomass as well as greater photosynthesis and proper partitioning of them to reproductive organs as a sink. Several physiological parameters such as CGR, RGR and NAR as well as nutrient uptake of N, P and K are measured as indicators for yield and quality. These three parameters (during two growth periods i.e. 40-61 and 61-82 DAS) and the three nutrients (in two leaf samples, i.e. at 40 and 65 DAS) were estimated **(Tables 5, 6 and 7).**

Main effects

All physiological parameters measured during the two periods and all nutrients estimated in the two samples exerted marked differences due to weed control treatments **(Table 5).** The data showed that CGR as well as N, P and K percentages were increased with increasing plant age. The manual hoeing (H_3) resulted in greatest values of CGR (0.373g/day), RGR (0.068 g/g/day) and NAR (0.024 g/dm^2/day, in the first period (40-61 DAS). Whereas, the corresponding values of 1.063g/day, 0.061 g/g/day and 0.036 g/dm^2/day for the three parameters, respectively were due to Butralin treatment (H_2). By using chemical treatment (H_2), the three parameters were increased with increasing age. These results are in line with those of **Mishra and Bhan (1996).** Also, Butralin treatment (H_2) gave the highest estimates of N, P and K percentages in the two samples. Similar results were reported by **Ahmed *et al* (2001).**

Table 5. Growth parameters (crop growth rate "CGR", relative growth rate "RGR" and net assimilation rate "NAR") and nutrients of soybean as affected by weed control (H), hill spacing (D) and varieties (V) as combined data over 2006 and 2007 seasons

Treatments	Growth parameters						Nutrients					
	Period from 40-61 day			Period from 61-82 day			Sample (1)			Sample (2)		
	CGR g/day	RGR g/g/day	NAR g/dm/day	CGR g/day	RGR g/g/day	NAR g/dm/day	N%	P%	K%	N%	P%	K%
Mean of weed control (H)												
H_1	0.212	0.056	0.023	0.264	0.030	0.018	2.68	0.21	2.21	2.94	0.23	2.32
H_2	0.256	0.045	0.016	1.063	0.061	0.036	3.25	0.23	2.29	3.33	0.26	2.39
H_3	0.373	0.068	0.024	0.824	0.047	0.024	2.86	0.22	2.28	3.05	0.25	2.38
LSD 5%	**0.02**	**0.002**	**0.001**	**0.029**	**0.0013**	**0.002**	**0.14**	**0.01**	**0.02**	**0.06**	**0.01**	**0.02**
Mean of plant density (D)												
D_1	0.234	0.052	0.019	0.878	0.059	0.035	2.98	0.22	2.26	3.11	0.24	2.37
D_2	0.277	0.054	0.020	0.663	0.044	0.023	2.92	0.22	2.26	3.12	0.25	2.37
D_3	0.329	0.063	0.023	0.609	0.040	0.021	2.89	0.22	2.26	3.09	0.24	2.35
LSD 5%	**0.02**	**0.002**	**0.001**	**0.027**	**0.0006**	**0.0006**	**0.08**	**n.s**	**n.s**	**n.s**	**0.001**	**0.02**
Mean of varieties(V)												
V1	0.292	0.057	0.021	0.677	0.047	0.025	2.84	0.22	2.26	3.09	0.24	2.36
V2	0.268	0.055	0.021	0.763	0.050	0.028	3.02	0.22	2.27	3.13	0.25	2.37
LSD 5%	**0.03**	**n.s**	**n.s**	**0.122**	**0.002**	**n.s**	**0.13**	**n.s**	**n.s**	**n.s**	**0.01**	**n.s**

Hill spacing showed marked effect on all growth parameters during the two periods, as well as N% in the first sample and P and K % in the second one **(Table 5).** The highest growth parameters during the early period were due to widest spacing, whereas they were due to the closest spacing in the second period. This may be ascribed to greater vegetation accompanied with increasing plant age. Each of growth parameters under dense planting (D_1) was increased by increasing age. D_1 and/or D_2 gave the highest estimates of nitrogen and potassium percentages.

CGR at the first period (40-61), CGR and RGR at the second period (61-82), N% in the first sample and Phosphorus % in the second sample showed significant differences due to varieties (Table 5). During the first period, though V_1 surpassed V_2 in CGR, both varieties had the same NAR (0.021 g/dm/day). Whereas during the second period, V_2 markedly surpassed V_1 for CGR and RGR, in addition to its superiority in N and P percentages. Varietal differences for growth parameters and leaf uptake nutrient were early detected by **Wells *et al* (1982), Board (2000) and Rigsby and Board (2003).**

Table 6. Growth parameters (crop growth rate "CGR", relative growth rate "RGR" and net assimilation rate "NAR") and nutrients of soybean as affected by dual-interactions between weed control (H), hill spacing (D) and varieties (V) as combined data over 2006 and 2007 seasons

Treatments	Growth paramotors						Nutrients					
	Period from 40-61 day			Period from 61-82 day			Sample (1)			Sample (2)		
	CGR g/day	RGR g/g/day	NAR g/dm/day	CGR g/day	RGR g/g/day	NAR g/dm/day	N%	P%	K%	N%	P%	K%
Mean of wood control and plant density (H&D)												
H_1D_1	0.190	0.050	0.021	0.302	0.034	0.021	2.85	0.22	2.23	3.09	0.24	2.35
H_1D_2	0.227	0.059	0.024	0.255	0.029	0.016	2.62	0.21	2.21	2.88	0.23	2.32
H_1D_3	0.217	0.061	0.024	0.234	0.027	0.015	2.58	0.20	2.20	2.84	0.22	2.30
H_2D_1	0.186	0.038	0.014	1.406	0.079	0.055	3.12	0.22	2.27	3.13	0.24	2.37
H_2D_2	0.231	0.042	0.016	1.031	0.061	0.033	3.31	0.23	2.29	3.46	0.26	2.40
H_2D_3	0.351	0.055	0.018	0.758	0.042	0.020	3.31	0.23	2.30	3.42	0.26	2.39
H_3D_1	0.327	0.068	0.024	0.933	0.055	0.026	2.95	0.22	2.29	3.11	0.24	2.38
H_3D_2	0.373	0.062	0.020	0.703	0.042	0.020	2.83	0.22	2.28	3.04	0.26	2.39
H_3D_3	0.419	0.072	0.028	0.837	0.045	0.026	2.78	0.22	2.28	3.00	0.25	2.37
LSD 5%	**0.03**	**0.003**	**0.001**	**0.047**	**0.001**	**0.001**	**0.14**	**0.02**	**0.03**	**0.15**	**0.01**	**0.04**
Mean of weed control and varieties (H&V)												
H_1V_1	0.201	0.055	0.022	0.232	0.028	0.014	2.64	0.21	2.20	2.90	0.22	2.31
H_1V_2	0.222	0.058	0.025	0.296	0.032	0.021	2.72	0.21	2.22	2.97	0.24	2.33
H_2V_1	0.245	0.043	0.016	0.952	0.056	0.035	3.12	0.22	2.29	3.32	0.25	2.39
H_2V_2	0.266	0.047	0.016	1.194	0.068	0.039	3.38	0.23	2.29	3.34	0.26	2.38
H_3V_1	0.432	0.074	0.026	0.848	0.045	0.023	2.76	0.22	2.28	3.03	0.25	2.38
H_3V_2	0.314	0.061	0.022	0.800	0.050	0.025	2.95	0.22	2.28	3.07	0.25	2.38
LSD 5%	**0.05**	**0.005**	**0.003**	**0.212**	**0.003**	**0.005**	**0.22**	**0.01**	**0.03**	**0.21**	**0.02**	**0.04**
Mean of plant density and varieties (D&V)												
D_1V_1	0.267	0.056	0.021	0.948	0.058	0.037	2.87	0.22	2.25	3.04	0.24	2.36
D_1V_2	0.201	0.048	0.018	0.830	0.059	0.035	3.08	0.22	2.27	3.18	0.25	2.38
D_2V_1	0.310	0.060	0.021	0.528	0.039	0.019	2.99	0.22	2.27	3.29	0.25	2.38
D_2V_2	0.244	0.049	0.019	0.798	0.049	0.027	2.85	0.22	2.26	2.96	0.25	2.36
D_3V_1	0.300	0.056	0.021	0.556	0.038	0.019	2.66	0.21	2.25	2.93	0.24	2.35
D_3V_2	0.358	0.069	0.026	0.662	0.040	0.023	3.12	0.22	2.27	3.25	0.25	2.36
LSD 5%	**0.05**	**0.005**	**0.003**	**0.212**	**0.003**	**0.005**	**0.22**	**0.01**	**n.s**	**0.21**	**n.s**	**n.s**

Table 7. Weed control (H), plant density (D) and varieties (V) interactions effects on growth parameters and nutrients of soybean, calculated as combined data over 2006 and 2007 seasons

Treatments	Growth parameters						Nutrients					
	Period from 40-61 day			Period from 61-82 day			Sample (1)			Sample (2)		
	CGR g/day	RGR g/g/day	NAR g/dm/day	CGR g/day	RGR g/g/day	NAR g/dm/day	N%	P%	K%	N%	P%	K%
$H_1D_1V_1$	0.210	0.051	0.020	0.219	0.025	0.014	2.85	0.21	2.20	3.02	0.23	2.32
$H_1D_1V_2$	0.170	0.049	0.022	0.384	0.042	0.029	2.86	0.23	2.26	3.17	0.26	2.38
$H_1D_2V_1$	0.170	0.052	0.020	0.303	0.037	0.019	2.55	0.20	2.20	2.86	0.21	2.30
$H_1D_2V_2$	0.284	0.065	0.028	0.208	0.021	0.013	2.69	0.21	2.23	2.90	0.24	2.34
$H_1D_3V_1$	0.222	0.060	0.025	0.172	0.021	0.010	2.52	0.21	2.21	2.84	0.23	2.32
$H_1D_3V_2$	0.212	0.061	0.024	0.296	0.032	0.020	2.63	0.20	2.18	2.85	0.21	2.28
$H_2D_1V_1$	0.248	0.046	0.019	1.541	0.080	0.060	2.83	0.22	2.26	2.98	0.24	2.35
$H_2D_1V_2$	0.124	0.030	0.010	1.267	0.084	0.050	3.42	0.23	2.28	3.27	0.25	2.38
$H_2D_2V_1$	0.250	0.045	0.017	0.777	0.051	0.026	3.63	0.24	2.32	3.91	0.27	2.44
$H_2D_2V_2$	0.211	0.040	0.014	1.285	0.071	0.040	2.99	0.23	2.25	3.00	0.25	2.36
$H_2D_3V_1$	0.237	0.037	0.012	0.485	0.036	0.013	2.90	0.22	2.27	3.08	0.25	2.37
$H_2D_3V_2$	0.464	0.072	0.025	1.030	0.048	0.026	3.72	0.24	2.33	3.77	0.28	2.41
$H_3D_1V_1$	0.344	0.072	0.025	1.028	0.057	0.027	2.93	0.22	2.30	3.12	0.25	2.40
$H_3D_1V_2$	0.310	0.064	0.022	0.838	0.052	0.026	2.98	0.22	2.27	3.10	0.24	2.37
$H_3D_2V_1$	0.509	0.082	0.026	0.504	0.028	0.012	2.79	0.22	2.29	3.10	0.26	2.40
$H_3D_2V_2$	0.236	0.043	0.015	0.902	0.056	0.027	2.87	0.23	2.28	2.98	0.26	2.38
$H_3D_3V_1$	0.442	0.069	0.028	1.014	0.048	0.029	2.55	0.21	2.25	2.87	0.24	2.34
$H_3D_3V_2$	0.397	0.075	0.028	0.660	0.040	0.023	3.01	0.22	2.30	3.14	0.25	2.40
LSD 5%	**0.09**	**0.008**	**0.005**	**0.367**	**0.006**	**0.008**	**0.38**	**0.02**	**0.05**	**0.37**	**0.04**	**0.07**

Interaction effects

All growth parameters assessed during the two periods were significantly affected by all second interactions HxD, HxV and DxV. Nutrients (N, P and K) estimated in the two samples were markedly influenced by HxD and HxV interactions while DxV one affected only N and P **(Table 6).** For growth parameters, the most influenced dual-interactions affecting all parameters were H_3D_3, H_3V_1 and D_3V_2 in the first period (40-61 day). Whereas, during the second period (61-82 day) the effective interactions were H_2D_1, H_2V_2 which resulted in the highest estimates of all growth parameters and D_1V_1 that produced the highest CGR and NAR values. These results reflected the efficiency of manual hoeing (H_3) as a weed control treatment during the early stage of crop plants, especially under wide hill spacing (D_3) either with V_1 or V_2. While during the second period (61-82 day), where the crop vegetation increased and consequently encountered more solar radiation which in turn enhanced photosynthesis translated into high growth parameter, Butralin (H_2) and dense planting become more important. The data showed that the highest N, P and K percentages in the two samples produced by H_2D_2 , H_2D_3, H_2V_2 and D_3V_2, indicating again the relative important effect of Butralin (H_2) on nutrient uptaked by the young plants, where the two samples were taken at 40 and 65 day age.

Concerning triointeractions, the highest values of CGR (0.509 g/day), RGR (0.082 g/g/day) were produced by $H_3D_2V_1$ in the first period (40-61 day). Whereas during the second period, the highest values of CGR (1.541 g/day) and NAR (0.060 g/dm^2/day) due to $H_2D_1V_1$ and RGR (0.084 g/g/day) due to $H_2D_1V_2$ interaction were recorded **(Table 7).** In regard to nutrients uptake, the highest percentages of N (3.72), P (0.24) and K (2.33) in the first sample were due to $H_2D_3V_2$. While in the second sample, the highest percentages of N (3.91) and K (2.44) due to $H_2D_2V_1$ and P (0.28) due to $H_2D_3V_2$ interaction were detected.

d. Soybean seed yield

Seed yield (kg/faddan) was significantly affected by all the main variables under study (H,D and V). In regard to weed control treatment effect, H (Table 8), manual hoeing, H_3 (1490 kg) surpassed Butralin treatment, H_2 (1000 kg) and both overyielded the weedy control, H_1 (530 kg). This result reflected the necessity of weed control for increasing soybean yield. Superiority of manual hoeing, detected herein, due to its efficient effect on weeds where it resulted in the lowest DM weight in the two samples examined at 45 and 90 DAS. **Thakare *et al* (1998), Yadav *et al* (1999), Ahmed *et al* (2001); Galal (2003) and Pandya *et al* (2005)** who obtained maximum seed yield from mechainal weed control treatments. It worth to note that manual hoeing had advantages over the chemical treatment for plant height , number of branches, LA and LAI, specially at late growth stage, which all increased photosynthesis rate and assimilates resulted in greater biomass and higher dry matter. Greater values of CGR and NAR concomited manual hoeing, especially during the first period of 61 days age, contributed also for increasing seed yield. In this concern, positive correlation coefficients between seed yield and each of NAR **(Buttery and Buzzell, 1972 and (Wells *et al* 1982)** were reported.

Concerning plant density (hill spacing), the data in **Table (8)** showed that the close spacing of 10 cm, D_1 (1080kg) followed by the intermediate one of 15 cm, D_2 (1060kg/fed) produced considerably increased yield compared to that of the wide spacing of 20 cm, D_3 (890 kg/fed). This may be due to the superiority of D_1 in plant height and DM weight at 82 days age (sample 3) as a result of its greater biomass formed later by the aid of its high LA and LAI values. These results are in agreement with that of **Saitoh *et al* (2007)** who stated that highest seed yield of dense planting was due to the reduction of competition with neighbor plants resulting in tallest plants and larger leaf area at top of plant canopy which more efficient encounter for solar radiation and produced greater dry matter. **Andrade *et al* (2002)** reported that seed yield increased in response to narrow rows was closely related to the improvement in light interception during the critical period of seed set. Also during the late growth stage, the dense planting (D_1 and D_2) gave the highest percentage, of N , P and K which encouraged growth and activities, whereas the wide planting, (D_3) had the highest N% only during the early growth stage, contributing in raising seed yield of D_1 and D_2 compared with that of D_3 .**Yin and Vyn (2004)** concluded that K concentration in plants is very important to high quality and value added soybean production because K is widely involved in plant metabolism.

Regarding soybean varieties, Giza 21, V_2 (1080 kg/fed) outyieded Giza 111, V_1 (940 kg/fed) due to its superiority in CGR and RGR particularly during the late period (61-82 DAS). V_2 also had higher N, P and K percentage than V_1 and both had equal estimates of NAR. Although the two varieties had no effect on DM weight of associated weeds and V_1 showed higher growth treatments in the young (first) sample, the above factors led to increase yield of V_2 more than that of V_1, indicating the different response of the two varieties to the tested variables. Varietal yield differences were reported by **Abdalla *et al* (1993), Board (2000), Hassan *et al* (2003) and Rigsby and Board (2003).**

Interaction effects

The highest seed yield of 1840, 1260 and 1500 kg/fed, due to the first order interactions H_3D_1, D_2V_2 and H_3D_2 as well as 1890 kg/fed due to $H_3D_1V_2$ second order interaction were recorded **(Table 8).** Therefore, at such newly reclaimed soil, soybean could be successfully grown and produced maximum yield with improved quality by using Giza 21 (V_2) planted in close spacing (D_1) and treated with manual hoeing (twice) weed control.

Table 8. Soybean seed yield (kg/ faddan) as affected by weed control(H), plant density (D), varieties (V) and their interactions calculated as combined data over 2006 and 2007 seasons

H	H_1			Mean	H_2			Mean	H_3			Mean				
D	D_1	D_2	D_3		D_1	D_2	D_3		D_1	D_2	D_3		D_1	D_2	D_3	Mean
V_1	280	400	600	430	960	710	1090	920	1790	1470	1160	1470	1010	860	950	940
V_2	410	1060	440	640	1170	1190	920	1090	1890	1520	1140	1520	1160	1260	830	1080
Mean	**340**	**730**	**520**	**530**	**1060**	**950**	**1000**	**1000**	**1840**	**1500**	**1150**	**1490**	**1080**	**1060**	**890**	

LSD for :							
Weed control (H)	68.0	H x V	94.0	Plant density (D)	72.0	D x V	94.0
Varieties (V)	54.0	H x D x V	162.0	H x D	124.0.		

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استجابة صنفين من فول الصويا والحشائش المصاحبة لبعض المعاملات الزراعية تحت ظروف اراضى حديثة الاستصلاح

[٦]

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الملخــص العربــــي

التأثيرات الفردية والمتكاملة لثلاثة معاملات لمقاومة الحشائش (بدون معاملة "الكنترول"، والبيوترالين، العزيق مرتين) مع ثلاثة مسافات بين الجور (١٠،١٥،٢٠) وصنفي فول الصويا (جيزة ١١١، جيزة ٢١)- على وزن المادة الجافة للحشائش المصاحبة، وصفات وقياسات النمو، والعناصر الممتصة بالنبات، والمحصول البذري، كانت هي الهدف المقصود من هذه الدراسة. لتحقيق هذا الهدف استخدمت القطع المنشقة مرتين حيث وزعت معاملات الحشائش، والكثافة النباتية والأصناف في القطع الرئيسية، والفرعية وتحت الفرعية مرتين علي الترتيب، وذلك باراضى حديثة الاستصلاح في مزرعة التجارب "دمو" بكلية الزراعة جامعة الفيوم في عامي ٢٠٠٦/٢٠٠٧.

ويمكن تلخيص اهم النتائج فيما يلى

- اتضح ان العزيق اليدوى مرتين قد تفوق على كل من الكثافة النباتية الأعلى والمقاومة الكيميائية فى خفض الوزن الجاف للحشائش المصاحبة ولم يظهر الصنفين تحت الدراسة اختلافات معنوية من حيث التأثير على الوزن الجاف للحشائش فى حين كان تاثير التفاعل الثلاثى H2D2V2 فى العينة الاولى والثنائى H3V1 فى العينة الثانية معنويا على هذه الصفة.
- تم الحصول على أعلى قيم لطول النبات ، عدد الافرع ، مساحة الورقة ودليل مساحة الأوراق بواسطة H2 او H3 بناء على ميعاد أخذ العينة والصنف.
- اعطت الكثافة النباتية تاثيرا معنويا على صفات النمو (ارتفاع النبات ، الوزن الجاف ومساحة الورقة) بالاضافة الى نمو المحصول وصافى التمثيل الضوئى وكذلك نسبة النيتروجين والفوسفور والبوتاسيوم التى تاثرت معنويا كإستجابة لكل من H2 و H3 وعموما فقد اعطى العديد من التفاعلات الثنائية والثلاثية تأثيرات معنوية على صفات نمو نبات فول الصويا.
- بالنسبة للمحصول البذري للفدان فقد انتجت معاملة العزيق محصولا أعلى (١٤٩٠كجم) مما نتج عن معاملة البيوترالين (١٠٠٠كجم) وكلاهما فاق محصول الكنترول (٥٣٠كجم). كما نتج عن الكثافة النباتية الأعلى (١٠٨٠كجم) متبوعة بالمتوسطة (١٠٦٠كجم) محصولا أعلى من ذلك الناتج من أضيق المسافات بين الجور (٨٩٠كجم). وتفوق الصنف جيزة٢١ (١٠٨٠كجم) على جيزة١١١ (٩٤٠كجم) في غلة الفدان. وكانت التفاعلات ذات الأثر المعنوي على كمية المحصول هي: معاملة العزيق مع الكثافة الأعلى (١٨٤٠كجم) والكثافة المتوسطة مع الصنف جيزة٢١ (١٢٦٠كجم) ومعاملة العزيق مع الكثافة المتوسطة (١٥٠٠كجم) بينما نتج أعلى محصول (١٨٩٠كجم/فدان) من التفاعل بين معاملة العزيق مع الكثافة العالية مع الصنف جيزة٢١.

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