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THE EFFECT OF SEEDBED PREPARATION, INTERCROPPING AND WEED CONTROL TREATMENTS ON SUNFLOWER PRODUCTIVITY AND ASSOCIATED WEEDS

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ABSTRACT

Two field experiments were carried out at Sids Agricultural Research Station, Agricultural Research Center, Egypt during 2004 and 2005 summer seasons to study the effect of three possible integration between seedbed preparation by mechanical tillage i.e. mouldboard plow + rotary plow, chisel plow three passes + rotary plow, chisel plow two passes (farmer treatment), intercropping sunflower with soybean, sole sunflower and weed control treatments (pendimethalin at 875 g/fed., fluazifop butyl at 62.5 g/fed., hand-hoeing twice and unweeded check) on fresh weight of weeds, yield and its components of primary crop (sunflower) and second crop soybean which intercropped with sunflower in natural infested soil by weeds.

In both seasons, the main findings mentioned seedbed preparation by mouldboard plow + rotary plow and chisel plow + rotary; sunflower and soybean intercropping and weed control treatments (Pendimethalin hand-hoeing twice and fluazifop butyl) reduced weed biomass ranged from (17 - 52), (34 - 76) and (20 – 96%), respectively. The previous three factors increased seed yield ranged from (2 – 18), (6 – 8) and (29 – 63%), as well as, they gave the highest profitability ranged from (16 – 56), (36 – 60) and (25 – 76%), respectively.

Different possible interactions between the three studied factors referred that the use of two or three combination of them increased the potential of reducing weed biomass and increasing sunflower productivity and consequently increased the profitability as compared with any single. Thus tillage systems, intercropping and weed control treatments can be used as compatible tactics for weed management with improving sunflower production.

INTRODUCTION

Weed management in sunflower fields is a big challenge to its producers which come from limited herbicide options are available in this situation. Cultural systems to manage weeds in this crop improve sunflower's competitiveness with weeds and make it can tolerate weed interference. Tillage systems exert effects on weeds through distribution of weed seeds in the soil tillage layer which had been mentioned by many researchers as Yenish *et al* (1992) and Ball and Miller (1993) they found that inversion tillage such as mouldboard plowing results in burial of a large proportion of weed seeds in tillage layer than in non inversion tillage methods such as chisel plowing which leave a greater proportion of weed seeds in soil surface to produce a greater potential for weed germination and establishment; beside improving soil porosity and crop productivity. Hamad *et al* (1992), Abd El Maksoud *et al* (1994), Abdou (1996), El-Naggar and Tageldin (1997), Abd Alla *et al* (1999), Helmy *et al* (2001) and Mosad and Foudy (2003) found that all systems; i.e., chisel, chisel + disk, mouldboard + disk, mouldboard + chisel, subsoil + chisel, subsoil + chisel + disk, subsoil + mouldboard + disk

and subsoil + mouldboard + chisel, especially those including mouldboard, gave the best soil physical preparation and best seedbed properties. Another cultural methods for increasing crop competitive ability against weeds is intercropping with live cover crops for increase the ecological diversity in field, and it can be grown with the main crop, usually in alternative rows. In this respect, growth of the living mulch should be controlled to avoid over competing with main crop (Labrada, 2005). Liebman and Dyck, 1993 and Baumann *et al*, 2000) reported that total weed density increased after 1 yr of no- tillage and after 2 yr of conventional tillage in a 4-yr experiment with repeated assignment of the same plots. Within the no- tillage treatment, rye or hairy vetch residue reduced total weed density by 78% compared to the treatment without cover crop when cover crop biomass exceeded 300 g/m^2 and when residue covered more than 90% of the soil where goosegrass, stinkgrass, and carpetweed densities were reduced by cover crop residue and weed biomass was equivalent in all. Like cover crops, intercrops increase the ecological diversity in a field, use of natural resources by the canopy and compete better with weeds for light, water and nutrients, compared to sole crops. Intercrop sown in arrow-by-row layout decreased relative soil cover of weeds by 41%, reduced the density and biomass of S*enecio vulgaris* by 58% and 98%, respectively and increased total crop yield by 10%. Increased weed suppression and crop yield has also been demonstrated in many environments for cereal-legume intercrops. Summer cover crops are used for weed control. Li,1998 reported that cover crops are important to improve soil physical properties, increase soil organic carbon, conserve soil water, reduce surface runoff and recycle nutrients during the heavy summer rains. Hubbell and Sartain, 1980; Reeves, 1994; Mansoer *et al*., 1997 reported that cover crops used to continue to increase as farmers seek to improve soil quality, reduce chemical input. Stansly *et al*., 1999 showed that legumes contribute more nitrogen by N fixation compared to non legumes. Ammon *et al* (1995) reported that weed development and the ground cover by live mulch were different in the four cropping systems; in the conventional ploughed system, using chemical weed control. The system using mechanical weed control and with grass/trifolium under seed offered a good weed control, rotary band-tilled in a flail-chopped rye using row crop spraying and with single mulching between the rows resulted in too high weed infestation but allowed full nitrate retention before maize sowing and erosion control. Rotary band-tillage a trifolium/grass sward with two to three mulching procedures between the maize reduced weed production. Curran *et al* (1994) compared between cover crop management systems with no cover treatments and residual herbicides including atrazine plus metolachlor applied pre – emergence at three cover crop management systems effectively controlled weeds. Residual herbicide performance was similar a cross cover crop management systems. Ulandy and Pava (1995) reported that growing soybean intercropping with corn gave more return when compared to the monoculture soybean. Mekky (1998) and Sarhan *et al* (2003) reported that weed control treatments (hand – hoeing twice, guar as a cover crop and Gesaprim) herbicide reduced significantly fresh weight of total weeds and increased grain yield of maize. The objective of this research is to

compare intercropping as living mulch and tillage systems and herbicides on weed management and sunflower productivity.

MATERIALS AND METHODS

Two field experiments were conducted during 2004 and 2005 summer seasons at Sids Agricultural Research Station, Agriculture Research Center, to study the effect of tillage systems, the ground cover by soybean intercrop and weed control treatments on fresh weight of weeds, yield and its components of sunflower and soybean in soil naturally infested with weeds.

Table (A) particle size distribution and soil textural class of.

Clay %	Silt %	Clay + Silt %	Fine sand %	Coarse Sand %	Real density (g/cm^3)	Soil textural class
51.22	28.73	79.95	18.25	1.70	2.65	Clay

The experimental field included twenty four treatments. The treatments were arranged in a split – split plots design where tillage system laid in main plots, intercropping sunflower and soybean in sub plots and weed control treatments in sub – sub plots as follows:-

A: Main plots (tillage system): -

A1 – Mouldboard plow followed by rotary plow .
A2 – Chisel plow three time followed by rotary plow .
A3 –Chisel plow two only .

B: Sub plots (intercropping system): -

B1 – Soybean intercropped with sunflower.
B2 – Sole sunflower.

C: Sub – sub plots (weed control treatments)

C1 – Pendimethalin (N–(1–ethylpropyl) –3,4– dimethyl–2,6–dinitrobenzenamine), known commercially as Stomp 50 % EC sprayed as pre – emergence at the rate of 1.75 L. / fed. for control broad – leaved and grassy weeds.

C2 – Fluazifop (+)-2-[4-(5-trifluoromethyl-2-pyridyloxy) phenoxy] propionic acid, known commercially as Fusilade Super sprayed as post-emergence at stage 2 - 4 leaves for grassy weeds at 500 cm^3/fed.

C3 – Hand – hoeing (twice) the first added before the first irrigation and the second added before the second irrigation.

C4 – Untreated (weedy check).

Sunflower (main crop) seeds variety (Eroflowers) was planted in hill of one side of the ridge in double seeds per hill spaced 20 cm. apart at seeding rate of 40 kg and the other side of the ridge was sowing soybean in drilling at seeding rate 20 kg/fed. in 9 st June and 29th June in 2004 and 2005 seasons, respectively. The plot consists of 5 row with 3.5 m long and 60 cm apart. Super phosphate 15.5 % P_2O_5 at the rate of 150 kg / fed. was applied to all plots before seeding, 60 Kg N/fed. of nitrogen fertilizer / fed. were added

as ammonium nitrate (31.5 % N) in two split doses before the first and second irrigations in both seasons.

Concerning the plowing, the average depth of plowing was 15 – 20 cm for chisel plow, 20 cm for mouldboard plow and 10 cm for rotary plow. The forward speed was 3.6 km/h. for chisel plow , 4.4 km/h. for mouldboard plow and 5.2 km/h. for rotary plow. The specifications of the different machinery used for seed bed preparation were as follows:

1 – Tractor: - Belarus type, four cylinders, diesel engine, four stroke, hydraulic system, water cooled and four wheels, had 54.68 kW engine power.

2 – Plows:-

a – A mounted chisel plowing consisted of seven shanks in two rows with 1.75 m width.

b – A mouldboard plowing; two blades with 1.00 m width.

c – A rotory plowing; total width 1.80 m.

All cultural practices were carried out according to the local recommendations. The used herbicides were applied with a knapsack sprayer equipped with one nozzle boom with 200 L of water /fed. Weed species in the experimental site were Common purslane (*Portulaca oleracea* L.), Cocklebur (*Xanthium strumarium* Vellozo) as annual broad – leaved weeds and Jungle Rice (*Echinochloa colonum* (L.) Link) as annual grassy weed.

Data recorded: -

a – Weeds : -

Weeds were hand pulled from one square -meter taken randomly from each plot after 75 days from sowing . Weeds were classified into species and determining the fresh weight of broad – leaved, grassy and total weeds were calculated as g / m^2.

B – Yield and its components: -

At harvest, (last weeks in September) the following characters from each plots were recorded : -

1 - Stem diameters of sunflower (cm).

2 –Head diameters of sunflower (cm).

3 - Weight of 1000 seeds of sunflower (g).

4 – Seed yield of sunflower crop (ton / fed.)

5 – Seed yield of soybean crop (ton / fed.)

6 – Economic analysis: -

Economic evaluation for the results by estimating the average of seed yield of sunflower and soybean (ton/fed.), total variable cost, Gross Income (GI), Gross Margin (GM), Benefit/Cost ratio (B/C) and profitability according to Heady and Dillon (1961), where:

Gross Income (GI)=1700L.E.Xsunflower yield (ton/fed) +1500L.E.Xsoybean yield (ton/fed)

Gross Margin = Gross Income – Total cost

Benefit/Cost ratio = Gross Income / Total cost.

Profitability = 100 X Gross Margin / Total cost

Statistical analysis: -

All data were statistically analyzed according to the procedures outlined by Steel and Torrie, 1981 and the treatments means were compared by least significant differences (L.S.D) at 5% level.

RESULTS AND DISCUSSION

A- Effect of tillage systems on weeds, sunflower and soybean productivity: -

Data in Table (1) show that the differences between the three tillage systems gave significant effect on reducing the annual broad leaved, grassy and total weeds in the first season, and on broadleaved weeds only in the second season. Mouldboard plow followed by rotary plow, chisel plow three passes followed by rotary plow decreased the fresh weight of annual broad leaved, grassy and total weeds by 50.1, 56.8 and 51.6%, respectively; and 42.7, 32.2 and 40.3%, respectively, compared to chisel plow two passes (farmer treatment) in the first season. Mouldboard followed by rotary plow reduced the broadleaved weeds significantly by 19.3% compared to farmer treatment in the second season. These results agreed with those obtained by Ball and Miller (1993) they reported that weed density decreased in mouldboard plow than chisel plow . Yenish *et al* (1992) found that chisel plowing concentrated weeds seeds over 30 percent in 1 cm top meanwhile mouldboard plowing exerted uniform distribution of weeds seeds in upper 19 cm from soil surface.

Concerning the effect on seed yield and yield components of sunflower, mouldboard plow followed by rotary plow and chisel plow three passes, followed by rotary plow treatment increased significantly stem diameter, head diameter, 1000 seed weight and seed yield (ton/fed.) by 3.4, 7.4, 8.5, 17.8 % and 5.5, 12.0, 1.4, 13.6 % respectively compared to the farmer treatment in the first season. While they increased significantly 1000 seed weight and seed yield (ton/fed.) by 1.9, 2.3 and 2.8, 3.4 %, respectively compared to farmer treatment with second season. These increments in yield may be attributed to either the reduction of weed competition or improving soil porosity. These results agreed with those obtained by Abd-Alla *et al* (1999).

With regard to economic analysis, data in table (1) illustrate that the total cost was calculated by 1450 L.E /fed. for fixed cost (Land preparation, sowing post sowing activities, fertilization, irrigation, insect control, harvesting and rental per feddan), random cost mechanical tillage systems about 40 L.E / fed., r mouldboard plow 45 L.E / fed., for rotary plowing 80 L.E. /fed., for chisel plow three passes 60 L.E / fed., for chisel plow two passes only and intercropping 40 L. E / fed., Stomp 60 L. E. / fed, Fusilade Super 90 L. E. / fed. And hand hoeing 120 L. E. / fed.. The highest values for gross income of seed yield reached about 2538 and 1884 L. E. / fed. with mouldboard pl. + rotary pl., while the lowest values with farmer treatment 2126 and 1779 L. E. / fed. The highest values of profitability were 55.6 and 15.5 %, while the lowest values were 32.6 and 10.9 in the first and second season.

Table (1) Effect of tillage systems on fresh weight of grassy, broad – leaved, total weeds, yield and its components of sunflower in 2004 and 2005 seasons.

Tillage system	Fresh weight of weeds (g/m²)			Yield and its components of sunflower				Economic analysis		
	Broad – leaved weeds	Grassy weeds	Total weeds	Stem diam. (cm)	Head diam (cm)	Weight of 1000 seed (g)	Seed yield (ton/fed.)	Total cost (L.E./fed)	Total gross income (L.E./fed)	Profitability %
2004 season										
Mouldboard PL +rotary PL.	139.3	35.7	175.0	2.43	18.84	61.56	1.39	1622	2538	55.57
Chisel PL. three passes + rotary PL.	159.9	56.1	216.0	2.48	19.64	57.53	1.34	1662	2488	48.94
Farmer treatment	279.0	82.7	361.7	2.35	17.54	56.72	1.18	1597	2126	32.61
LSD at 5%	56.96	19.70	61.86	0.082	0.355	0.797	0.03		58.2	
2005 season										
Mouldboard PL. + rotary PL	139.7	77.3	217.0	1.82	15.85	52.58	0.91	1622	1884	15.52
Chisel PL. three passes + rotary PL	150.2	77.5	227.7	1.77	15.71	53.02	0.92	1662	1948	16.50
Farmer treatment	173.2	101.7	274.9	2.13	15.23	51.58	0.89	1597	1779	10.87
LSD at 5%	30.36	N.S	N.S	N.S	N.S	1.40	0.03		34.2	

- **Farmer treatment: chisel plow two passes only.**

B - Effect of intercropping on fresh weight of weeds, yield and yield components of sunflower and soybean

Data in table (2) show that intercropping soybean caused significant reduction in fresh weigh of broad-leaved, grassy and total weeds by 32.4, 40.7 and 34.4 % in first season and 67.6, 89.5 and 76.3 % in the second season, respectively compared to sole sunflower. These decreases are attributed to the increases in number of intercropping plants / unit area in the first days of growing sunflower compared with sole crop that plants were not cover all surface of soil field. These results are in harmony with those obtained by Li (1998), Mekky (1998) and Sarhan *et al* (2003).

Intercrop soybean with sunflower caused increasing head diameter, weight of 1000 seeds, seed yield, total cost, gross income and profitability and decreased stem diameter compared to sole sunflower in the first season. While it increased head diameter, seed yield, gross income and profitability and decreased stem diameter, weight of 1000 seeds and total cost in the

second season. The increasing in seed yield ton/fed was 6.0 and 5.7 % compared to sole sunflower in the first and second season, respectively.

This improvement in sunflower yield and its components by intercropping with soybean may be due to decreasing weed biomass accompanied with improving soil physical properties and legumes contribute more to nitrogen by N fixation. These results are in agreement with those obtained by (Stansly *et al*, (1999) they reported that cover crops are important to improve soil physical properties and increase soil organic carbon, conserve soil water, reduce surface runoff and recycle nutrients.

Table (2) Effect of intercropping on fresh weight of weeds, yield and its components of sunflower and soybean crops in 2004 and 2005 seasons.

Intercropping system	Fresh weight of weeds (g/m^2)			Yield and its components of sunflower and secondary crop (soybean)					Economic analysis		
	Broad – leaved weeds	Grassy weeds	Total weeds	Stem diamet. (cm)	Head diamet. (cm)	Weight of 1000 seeds(g)	Seed yield (ton/fed.) of sunflower	Seed yield (ton/fed) of soybean	Total cost (L.E./fed.)	Total gross income (L.E./fed.)	Profitability %
2004 season											
Sunflower + soybean	155.5	43.3	198.8	2.4	18.8	60.9	1.35	0.23	1647	2651	60.37
Sole sunflower	229.9	73.0	302.9	2.5	18.5	56.3	1.25	-	1607	2118	31.05
LSD at 5%	16.04	18.80	23.76	0.058	0.33	0.41	0.05			84.7	
2005 season											
Sunflower + soybean	75.6	16.3	91.9	1.80	16.1	51.9	0.93	0.45	1647	2240	35.47
Sole sunflower	233.1	154.7	387.8	2.02	15.1	53.0	0.88	-	6707	1502	-6.88
LSD at 5%	31.60	33.94	53.62	N.S	0.40	N.S	0.03			51.4	

C- Effect of weed control treatments on the fresh weight of weeds (g/m^2) and sunflower productivity: -

Data in Table (3) showed the significant effect on reducing broad-leaved weeds was obtained by Stomp (84.1 & 88.8 %), and hand hoeing (70.9 & 96.5 %) in the first and second seasons, respectively compared with weedy check.. The significant effect on reducing grassy weeds was obtained by Stomp (89.7 & 95.3 %), Fusilade Super (77.4 & 98.0 %) and hand hoeing (64.5 & 95.4 %) in the first and second season, respectively. The final significant effect on reducing total weeds was obtained by Stomp (85.8 & 92.1 %) and hand hoeing (69.0 & 96.0 %) in both seasons, respectively. There are significant differences between weed control treatments and weedy check in regard to head diameters, 1000 seed weight and seed yield of

sunflower in both seasons, and stem diameter in first season only. The highest increasing percentage for head diameter, 1000 seed weight and seed yield was obtained from hand hoeing twice by 16.2, 13.1 and 62.6 %, respectively, in the first season and 23.2, 13.3 and 36.0 %, respectively, in the second season.

Table (3) Effect of weed control treatments on fresh weight of grassy, broad – leaved, total weeds, yield and its components of sunflower in 2004 and 2005 seasons.

Weed control treatments	Fresh weight of weeds (g/m²)			Yield and its components of sunflower				Economic analysis		
	Broad – leaved weeds	Grassy weeds	Total weeds	Stem diameter (cm)	Head diameter (cm)	Weight of 1000 seeds (g)	Seed yield (ton/fed.)	Total cost (L.E./fed)	Total gross income (L.E./fed)	Profitability %
2004 season										
Stomp	49.1	14.2	63.3	2.7	19.3	60.5	1.38	1620	2600	60.13
Fusilade S	323.1	31.2	354.3	2.5	17.9	58.8	1.22	1650	2210	33.82
Hand hoeing –	89.8	49.0	138.8	2.7	20.1	61.1	1.61	1680	2966	76.35
Weedy check	308.9	138.2	447.1	2.1	17.3	54.0	0.99	1560	1762	12.53
LSD at 5%	16.0	18.8	23.76	0.05	0.33	0.41	0.05		84.2	
2005 season										
Stomp	32.7	14.4	47.1	1.88	15.9	54.6	0.97	1620	2231	37.22
Fusilade S	282.5	6.1	288.6	1.82	15.6	50.5	0.88	1650	1840	11.24
Hand hoeing –	10.1	14.2	24.2	1.96	17.0	55.5	1.02	1680	2100	24.74
Weedy check	292.2	307.4	599.5	1.96	13.8	49.0	0.75	1560	1312	-16.01
LSD at 5%	31.7	33.9	53.6	N.S	0.4	1.4	0.03		71.4	

For profitability, it was increased significantly by hand hoeing (76.4 %), Stomp (60.1 %) and Fusillade Super (33.8 %) compared to weedy check (12.5 %) in the first season, and by Stomp (37.2 %), hand hoeing (24.7 %) and Fusillade S. (11.2 %), compared to weedy check (-16.0 %) in the second season.

D – Effect of the interaction between mechanical tillage, intercropping and weed control treatments, on weeds, sunflower productivity: -

Table (4) showed that the highest reduction on the fresh weight of broad-leaved, grassy and their total weeds were obtained from the interactions: mouldbroad plow + rotary plow, chisel plow three passes + rotary plow and chisel plow two passes each with Stomp by 91.1, 90.9 and 82.4%& 94.4, 92.1 and 91.9 % & 92.2, 91.3 and 85.5 %, respectively, in the first season, and with hand hoeing twice for fresh weight of broadleaved and total weeds by 96.7, 96.3 and 98.2 % & 96.5, 96.8 and 96.4% and with Fusilade S. for fresh weight of grassy weeds by 98.9, 97.8 and 98.3%, respectively in the second season compared with farmer treatment and unweeded check.

Table (4) Effect of interaction between tillage system and weed control treatments on fresh weight of grassy, broad – leaved, total weeds, yield and its components of sunflower in 2004 and 2005 seasons.

Tillage system	Weed control Treatments	Fresh weight of weeds (g/m2)			Yield and its components		Economic analysis		
		Broad – leaved weeds	Grassy weeds	Total weeds	Head diameter (cm)	Seed yield (ton/fed.)	Total cost (L.E./fed)	Total gross income (L.E./fed)	Profitability %
2004 season									
Mould Board pl. + rotary pl.	Stomp	36.7	11.0	47.7	19.7	1.48	1615	2776	71.44
	Fusilade S	219.5	26.8	246.3	17.4	1.34	1645	2419	46.81
	Hand hoeing twice	119.5	20.4	139.9	20.4	1.73	1675	3180	89.85
	Unweeded	181.4	84.6	266.0	17.8	0.99	1555	1778	14.17
Chisel pl. three pass + rotary pl.	Stomp	37.6	15.6	53.2	19.9	1.38	1655	2670	60.85
	Fusilade S	201.3	20.9	222.2	19.4	1.19	1685	2160	27.93
	Hand hoeing twice	69.9	55.6	125.5	21.2	1.72	1715	3188	85.86
	Unweeded	330.8	132.1	462.9	18.1	1.09	1595	1937	21.12
Chisel pl. two pass only (farmer treatment)	Stomp	72.8	16.1	88.9	18.3	1.29	1590	2355	48.09
	Fusilade S	548.6	45.8	594.4	17.0	1.14	1620	2053	26.73
	Hand hoeing twice	80.1	70.9	151.0	18.88	1.38	1650	2529	53.34
	Unweeded	414.5	198.0	612.5	16.1	0.88	1530	1569	2.29
LSD at 5%		119.2	37.34	124.8	0.75	0.08		145.8	8.43
2005 season									
Mouldboard pl + / rotary pl.	Stomp	38.0	9.0	47.0	15.81	1.0	1615	2342	44.50
	Fusilade S	232.9	4.1	237.0	15.8	0.86	1645	1807	9.60
	Hand hoeing twice	11.3	13.5	24.8	17.7	1.02	1675	2094	24.81
	Unweeded	276.5	282.7	559.2	14.1	0.74	1555	1295	-16.82
Chisel pl. three pass + rotary pl.	Stomp	17.1	13.1	30.2	16.2	1.00	1655	2332	40.50
	Fusilade Super	316.7	8.0	324.7	15.2	0.89	1685	1944	15.02
	Hand hoeing twice	12.9	9.8	22.6	17.3	1.04	1715	2206	28.41
	Unweeded	254.2	279.0	533.2	14.2	0.74	1595	1311	-17.94
farmer treatment	Stomp	43.0	21.0	64.0	15.7	0.92	1590	2019	26.65
	Fusilade S	297.8	6.2	304.0	15.9	0.88	1620	1770	9.08
	Hand hoeing twice	6.1	19.3	25.3	16.1	0.99	1650	2000	21.01
	Unweeded	345.9	360.4	706.3	13.2	0.77	1530	1329	-13.28
LSD at 5%		55.9	71.1	90.1	1.1	0.07		123.7	7.11

For head diameter, seed yield of sunflower and profitability the highest significant increasing was obtained from the interactions between mouldbroad plow + rotary plow, chisel plow three passes + rotary plow and chisel plow two passes each with hand hoeing twice by 26.1, 31.6 and 17.3 % & 96.6, 95.5 and 56.8 & 89.9, 85.9 and 53.3%, and 34.1, 31.1 and 22% &

32.5, 35.1 and128.6% & 24.8, 28.4 and 21.0% in the first and second season, respectively.

E –Effect of the interaction between intercropping and weed control treatments on fresh weight of weeds, sunflower and soybean productivity: -

Table (5) indicated that the most interaction between intercropping and weed control treatments had significant effect on reducing the fresh weight of weed species and increasing the yields of sunflower and soybean crops. The highest significant reduction on the fresh weight of broad-leaved, grassy weeds and their total was achieved by the following interactions in a descending order, soybean with sunflower intercropping and Stomp (93.4, 94.0 and 93.6 %), respectively; sole sunflower and Stomp (84.1, 89.6 and 85.7 %), respectively, and sole sunflower and hand hoeing twice (78.9, 72.1 and 77.0 %) respectively, soybean with sunflower intercropping and hand hoeing twice (80.0, 71.4 and 77.5 %) , respectively; in first season. While, in the second season soybean with sunflower intercropping and hand hoeing twice gave 97.7, 97.6 and 97.6 %, respectively, soybean with sunflower intercropping and Stomp gave 95.4, 98.0 and 97.5 %, respectively, sol sunflower and hand hoeing twice gave 97.7, 97.6 and 97.5 %, respectively, and sol sunflower and Stomp gave 89.5, 96.0 and 93.2 %, respectively.

The previous interactions gave also the highest increasing percent in yield and its components of sunflower and seed yield of soybean in both seasons. The interactions between soybean with sunflower intercropping and Stomp; soybean with sunflower intercropping and hand hoeing twice, sole sunflower and hand hoeing twice, and sole sunflower and Stomp increased head diameter, 1000 seed weight and seed yield of sunflower compared to sole sunflower and unwed check by 28.8, 29.58, 25.2 and 23.3 %, & 80.7, 795, 107.2 and 53.0 % respectively, in the first season and 29.3, 36.6, 40.7 and 29.3 respectively, in the second season.

Regard to profitability, the highest value resulted for intercropping soybean with sunflower and Stomp (85.0 and 71.4 %) followed by intercropping soybean with sunflower and hand hoeing twice (76.49 and 7.09)in the first and second season. The lowest value was obtained from sloe sunflower and unweeded check (- 8.2 and -27.1 %) in the first and second season.

Table (6) show that the interaction between tillage system, intercropping weed control treatments had significant effect on reducing the fresh weight of total weeds and reflected the increasing yields both of sunflower and soybean in the both seasons.

The effective on reducing the fresh weight of total weeds can arranged in a descending order as follows: mouldboard plow + rotary plow, intercropping and Stomp (96.0 and99.6%), chisel plow two passes only, intercropping and Stomp (94.7 and 95.1) chisel plow three passes/ rotary plow, intercropping and Stomp (94.3 and 98.8 %), chisel plow three passes/ rotary plow; sole sunflower and Stomp (92.2 and 96.1%), mouldboard plow/ rotary plow, sole sunflower and Stomp (91.9 and 92.6 %) compared to sole sunflower and unweeded check in the first and second seasons, respectively.

Table (5) Effect of interaction between intercropping and weed control treatments on fresh weight of grassy, broad – leaved, total weeds, yield and its components of sunflower and soybean in 2004 and 2005 seasons

Intercropping system	Weed control Treatments	Fresh weight of weeds (g/m2)			Yield and its components of sunflower				Economic analysis	
		Broad – leaved weeds	Grassy weeds	Total weeds	Head diameter (cm)	Weight of 1000 seeds (g)	Seed yield (ton/fed.)	Seed yield of soybean (ton/fed)	Total cost (L.E./fed)	Profitability %
2004 season										
Sunflower + soybean	Stomp	28.9	10.4	39.3	19.6	61.8	1.50	0.33	1640.0	85.03
	Fusilade S	323.8	10.3	334.1	18.1	59.7	1.29	0.18	1670.0	46.82
	Hand hoeing	87.7	49.6	137.3	19.6	62.2	1.49	0.31	1700.0	76.38
	Unweeded	181.7	102.8	284.5	18.1	60.0	1.14	0.12	1580.0	33.24
Sole sunflower	Stomp	69.2	18.0	87.2	19.1	59.2	1.27		1600.0	35.22
	Fusilade S	322.4	52.0	374.4	17.7	58.0	1.16	-	1630.0	20.83
	Hand hoeing	92.0	48.4	140.4	20.7	60.1	1.72	-	1660.0	76.32
	Unweeded	436.1	173.6	609.7	16.5	48.0	0.83	-	1540.0	-8.19
LSD at 5%		97.4	30.5	101.9	0.62	1.24	0.68	0.03		6.88
2005 season										
Sunflower + soybean	Stomp	19.9	6.0	25.9	15.9	53.6	0.98	0.77	1640.0	71.40
	Fusilade S	122.3	3.1	125.3	16.4	50.7	0.90	0.47	1670.0	32.99
	Hand hoeing	10.1	13.7	23.8	16.8	53.3	0.98	0.50	1700.0	42.39
	Unweeded	150.0	42.5	192.5	15.4	49.9	0.84	0.05	1580.0	-4.92
Sole sunflower	Stomp	45.5	22.8	68.3	15.9	55.6	0.97	-	1600.0	3.03
	Fusilade S	442.7	9.1	451.8	14.8	50.3	0.86	-	1630.0	-10.52
	Hand hoeing	10.0	14.7	24.7	17.3	57.7	1.05	-	1660.0	7.09
	Unweeded	434.3	572.2	1006.5	12.3	48.1	0.66	-	1540.0	-27.11
LSD at 5%		45.7	58.1	73.6	0.93	2.5	0.06	0.04		5.81

F:- Effect of interaction between tillage system, intercropping and weed control treatments on fresh weight of weeds, sunflower and soybean productivity: -

The previus interactions gave the highest significant effect on yields both of sunflower and soybean by (131.5 and 37.7%), (64.4 and 36.4%), (117.8 and 47.0%), (60.3 and 54.5%) and (74.0 and 43.9%) in the first and second season, respectively.

Table (6): The interaction effect between tillage systemintercropping and weed control treatments on fresh weight of total weeds and yield of sunflower and soybean in 2004 and 2005 seasons.

Tillage system	Coverage crop treatments	Weed control Treatments	2004 season				2005 season			
			Fresh weight of total weeds (g/m^3)	Yield of sunflower (ton/fed.	Yield of soybean (ton/fed.)	Profitability	Fresh weight of total weeds (g/m^3)	Yield of sunflower (ton/fed.)	Yield of soybean (ton/fed	Profitability
Mouldboard pl. + rotary pl.	intercropping	Stomp	31.5	1.69	0.35	107.52	5.4	1.06	0.85	87.74
		Fusilade Super	314.4	1.48	0.18	67.29	69.3	0.87	0.46	30.02
		Hand hoeing twice	89.5	1.62	0.33	91.42	34.8	0.98	0.49	40.84
		unweeded	69.3	1.09	0.12	29.55	224.5	0.82	0.04	-8.13
	Sole sunflower	Stomp	63.9	1.27	-	35.36	88.6	0.95	-	1.25
		Fusilade Super	178.3	1.21	-	26.32	404.8	0.85	-	-10.82
		Hand hoeing twice	190.4	1.83	-	88.28	14.8	1.06	-	8.78
		unweeded	462.6	0.89	-	-1.21	893.9	0.67	-	-25.52
Chisel pl. three pass + rotary pl.	intercropping	Stomp	45.0	1.59	0.43	99.73	14.3	0.97	0.85	74.69
		Fusilade Super	138.1	1.31	0.19	48.04	154.5	0.94	0.58	43.77
		Hand hoeing twice	154.0	1.61	0.36	88.93	23.8	1.01	0.58	48.95
		unweeded	348.1	1.29	0.12	47.23	130.4	0.84	0.06	-5.77
	Sole sunflower	Stomp	61.4	1.17	-	21.96	46.1	1.02	-	6.32
		Fusilade Super	306.3	1.06	-	7.82	494.9	0.85	-	-13.72
		Hand hoeing twice	97.1	1.82	-	82.79	21.5	1.08	-	7.87
		unweeded	577.8	0.88	-	-4.99	936.0	0.65	-	-30.11
Chisel pl. two pass only (farmer treatment)	intercropping	Stomp	41.5	1.21	0.21	47.85	58.0	0.90	0.61	51.79
		Fusilade Super	550.0	1.07	0.15	25.11	152.3	0.89	0.36	25.20
		Hand hoeing twice	168.5	1.24	0.26	48.78	12.8	0.97	0.43	37.38
		unweeded	436.3	1.03	0.10	22.96	222.8	0.87	0.04	-0.86
	Sole sunflower	Stomp	136.3	1.37	-	48.34	70.0	0.94	-	1.51
		Fusilade Super	638.8	1.21	-	28.35	455.8	0.88	-	-7.03
		Hand hoeing twice	133.6	1.51	-	57.90	37.9	1.00	-	4.63
		unweeded	788.8	0.73	-	-1838	1189.8	0.66	-	-25.70
LSD at level 5%			176.5	0.12	0.01	11.92	127.4	0.10	0.05	10.10

Concerning the profitability %, the highest obtained values were mouldboard plow/ rotary plow, intercropping and Stomp (107.5 %), chisel plow three passes/ rotary plow, intercropping and Stomp (99.7 %),

mouldboard plow/ rotary plow, intercropping and hoeing (91.4 %), chisel plow three passes/ rotary plow, intercropping and hand hoeing (88.9 %), and chisel plow three passes/ rotary plow, sole sunflower and hand hoeing (82.8 %) in the first season. While the interactions mouldboard plow/ rotary plow, intercropping and Stomp gave (87.7 %), chisel plow three passes/ rotary plow, intercropping and Stomp (74.7 %) chisel plow two passes, intercropping and Stomp (51.8 %), chisel plow three passes/ rotary plow, intercropping and Fusilade Super (43.8 %) in the second season.

The intercropping decreased competitiveness of weeds by covering soil surface between sunflower plants and stomp had good efficacy in controlling annual weeds, it could be summarized from the results and recommended that the application of tillage systems i.e mouldboard / rotary plow or chisel plow three passes/ rotary plow live mulch or chemical or mechanical weed control can be used as compatible tactics for weed control management in improving sunflower production.

The contribution of mouldboard/rotary and chisel plow/rotary tillage system, intercropping and weed control treatments reduced weed biomass by percentages ranged from 17 - 52, 34 - 76 and 20 – 96 percent accompanied with increasing in profitability which ranged from 15.5 – 55.6, 35.5 – 60.4 and 24.7 – 76.4 percent, respectively, as compared with chisel plow two passes only, sole sunflower and unweeded control treatments in both seasons. The interaction effect between tillage systems (mouldboard/rotry and chisel/rotary plow) intercropping and weed control treatments by Pendimethalin or hand hoeing twice reduced fresh weight of weeds ranged from 80.5 – 99.5 percent and increased profitability by percentage ranged from 40.84 – 107.52 than the normal farmer treatment, under sole sunflower crop and unweeded check. The role of these tillage systems which include mouldboard/rotary plow or chisel plow three passes + rotary plow reduced the available weed seeds germination due to seed weeds plow in burying it in lower soil layer. Meanwhile, intercropping decreased competitiveness of weeds by covering soil surface between sunflower plants. On the other hand Stomp had good efficacy in controlling annual weeds and consequently make soil resources available for sunflower productivity. Integration by the three measures were compatible with each other Concerning weed management. Thus we can recommend that the application tillage systems (mouldboard/rotary plow or chisel plow three passes + rotary plow , live mulching and chemical and mechanical weed control can be used as compatible tactics for weed management in improving sunflower production.

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تأثير إعداد مرقد البذرة والتحميل ومقاومة الحشائش علي إنتاجية محصول عباد الشمس والحشائش المصاحبة له

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أقيمت تجربتين حقليتين بمحطة البحوث الزراعية بسدس خلال الموسم الصيفي لعامي ٢٠٠٤ و ٢٠٠٥ وذلك لدراسة تأثير التكامل بين أعداد مرقد البذرة باستخدام المحراث القلاب متبوعا بالمحراث الدوراني ، والمحراث الحفار ٣ سكة متبوعا بالدوراني ، والمحراث الحفار ٢ سكة (معاملة المزارع) وتحميل فول صويا علي عباد الشمس ومعاملات مقاومة الحشائش وهي (بندميثالين بمعدل ٨٧٥ جم / ف ، فلوزوفوب بمعدل ٦٢,٥ جم / ف ، والعزيق مرتين ، بدون معاملة علي الوزن الغض للحشائش والمحصول ومكوناته للمحصول الرئيسي (عباد الشمس) والمحصول الثانوي (فول الصويا) .

وتبين أهم النتائج أن نظام الخدمة بالمحراث القلاب + الدوراني ، والمحراث الحفار ٣ سكة + الدوراني مقارنة بمعاملة المزارع (المحراث الحفار ٢ سكة فقط)، وتحميل فول الصويا مع عباد الشمس مقارنة بزراعة عباد الشمس منفردا ومعاملات مقاومة الحشائش بندميثالين ، فلوزوفوب، والعزيق مرتين مقارنة بالكنترول (بدون مقاومة) قد ساهموا في خفض عشائر الحشائش بنسبة تتراوح بين (١٧ - ٥٢%), (٣٤ - ٧٦ %), (٢٠ – ٩٦%) وزيادة في محصول البذور من (٢ – ١٨%), (٦ – ٨%), (٢٩ – ٦٣%) وكذلك زيادة في الربحية تتراوح بين (١٦- ٥٦%)، (٣٦ – ٦٠%), (٢٥ – ٧٦%) علي التوالي . وقد أعطي التفاعل بين تلك العوامل الثلاثة تأثيرا معنويا في إنقاص أوزان الحشائش الحولية وزيادة في إنتاجية محصول عباد الشمس مصحوبا بزيادة الربحية

من ذلك يتضح أن المعاملات الزراعية مثل خدمة التربة وتحميل محصول فول الصويا علي عباد الشمس ومعاملات مقاومة الحشائش يمكن أن تستخدم كنظم متوافقة مع بعضها في إدارة الحشائش وتحسين إنتاجية محصول عباد الشمس.