IMPACT OF WEEDS TO SUNFLOWER UNDER ZERO TILLAGE AND PHOSPHORUS FERTILIZATION

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ABSTRACT

In order to investigate the effect of no tillage compared with the conventional cultivation and phosphorus fertilization (100, 200 and 300 kg ha^{-1}) P_2O_5 to the weeds grown in the sunflower field variety Aqmar, a field trial was conducted at the experimental farm (alternative site of College of Agriculture- University of Baghdad) Abu- Ghraib during the spring and fall seasons of 2015. the experiment was carried –out by using R.C.B.D. with in split-split arrangement. The results revealed that un ploughed and un weedy treatments had the lowest means of the dry weight and seeds yield. The results, also revealed a significant increase in the weed density, weed dry weight, seeds yield and its components with the increasing of phosphorus fertilizer from 100 to 300 kg ha^{-1} in both seasons. It can be concluded, that growing sunflower with was reduced the weed density and its distribution in the field, and this caused to zero weed competition reduction to the crop and consequently increased the seeds yield and its components. However, increased phosphor fertilizer levels raised weeds density, their dry weight and seed yield of sunflower.

Key words: conservation agriculture, oil crop, seeds yield, weed density.

تأثير الادغال على زهرة الشمس تحت الزراعة بدون حراثة والتسميد الفوسفاتي

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المستخلص

بهدف معرفة مدى تأثير الزراعة بدون حراثة مقارنة بالزراعة التقليدية والتسميد الفوسفاتي P_2O_5 (100 و200 و300) كغم هـ$^{-1}$ في الادغال المرافقة لمحصول زهرة الشمس الصنف الزيتي اقمار. نفذت تجربة حقلية في حقل تجارب الموقع البديل (موقع كلية الزراعة – جامعة بغداد) في ابوغريب في الموسمين الربيعي والخريفي لعام 2015 ، اجريت التجربة بتصميم القطاعات الكاملة المعشاة حسب ترتيب الالواح المنشقة المنشقة وبثلاثة مكررات. اشارت النتائج الى ان المعاملات بدون حراثة والمعاملات غير المدغلة حققت ادنى متوسط لكثافة الادغال ووزنها الجاف وحاصل الحبوب ومكوناته في كلا موسمي الزراعة مقارنة بالمعاملات المحروثة التي اعطت ادنى متوسط لتلك الصفات. حصلت زيادة معنوية في كثافة الادغال ووزنها الجاف وحاصل البذور ومكوناته مع زيادة مستويات السماد الفوسفاتي من 100 الى 300 كغم هـ$^{-1}$ لكلا موسمي الزراعة. نستنتج من نتائج هذه الدراسة ان زراعة محصول زهرة الشمس بدون حراثة قد خفضت كثافة الادغال وادى الى زيادة في حاصل البذور ومكوناته، كما ادت زيادة مستويات التسميد الفوسفاتي الى زيادة في كثافة الادغال ووزنها الجاف وكذلك زيادة في حاصل حبوب زهرة الشمس وهذا يبين ان الادغال تستنزف جزء من السماد الفوسفاتي الذي اعطي للمحصول الرئيسي.

الكلمات المفتاحية: الزراعة الحافظة، محصول زيتي، حاصل الحبوب، كثافة الادغال.

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INTRODUCTION

Sunflower is considered it is the fourth best oily crop in the world (15). Oil and protein percentages in the seeds are estimated to be 40-55 %, and 23% respectively (10). Its contain the Linoleic acid, moderate oleic acid and Linoloeic acid (14). Sunflower crop is characterized by its highest adaptability within the wide range of environmental conditions, therefore, it was grown widely around the world (3). Iraqi environment is considered as suitable to produce sunflower seeds, but its productivity still low. This was due to the bad application of the crop management and non-using of modern systems of cultivation which assure soil conservation and increase seed yield per unit area. Zero-tillage could be improved the chemicals, physical, biological characteristics of the soil, more stability of productivity, an economic method to reduce production costs via lessening energy waste and saving manpower as well as saving time required for the soil preparation (7, 11, 19). Also, it increases water harvesting, organic matter and protection soil from rain and wind erosions (11, 12). This method, also prevent weeds seeds germination in the soil during the critical period of crop, hence, weeds density and number will be decreased in the field, while using conventional ploughing of soil will break the seeds dormancy which encourages their germination which might affect the crop growth and yield negatively (4, 9), especially in the first stages of crop growth due to the vigorous of weeds higher than the crop growth. Also, nutritional element of soil determines the agricultural production Iraqi soils is characterized by its high content of calcium carbonate which make soil (pH) near the alkalinity ,therefore ,soil is becoming poor due to the unavailability of essential nutritional elements (11). Phosphor is the second most essential element after nitrogen which effect all growth stages of crop in terms of yield and quality (17). The availability of phosphor in the soil improves the plant root system, and hence increase the efficiency of absorption, transportation of nutrient and water which improve growth characters and help the plants more competitive to the weeds. Many studies referred that sunflower crop responds to highest level of P_2O_2 applied to soil and improves crop growth and yield (1, 16). This study was aimed to investigate the response of sunflower (Aqmar oily variety) to the zero – tillage and phosphorous fertilizer levels and their effects on accompanied weeds and seeds yield of sunflower.

MATERIALS AND METHODS

A field experiment was carried out at the experimental farm (alternative site of College of Agriculture, University of Baghdad) Abu-Ghraib /Iraq, during spring and fall seasons of 2015 to investigate the effect of zero-tillage compared with conventional ploughing and phosphorus fertilization (100, 200 and 300 kg ha^{-1}) P_2O_5 on the weeds grown within sunflower field (Aqmar oily variety). A Randomized Complete Block Design (R.C.B.D) within split-split plot arrangement with three replicates. Cultivation method occupied the main plots and weed control treatments were in the sub-plots while phosphorus fertilizer levels were in sub-sub plots. A field previously grown with sunflower in the spring season prepared to be used in the fall season. Field was divided in to six stripes, three of them was ploughed three times after removal of the residual plants randomly and the other stripes left without ploughing with removing all plants residual. Each stripe was divided into experiential units with 3×4 m dimensions i.e. 12 m^2 in area with the same dimensions of the plots left unploughed to ensure the homogeneity of the area of experimental units. Cultivation was done by using rows 75 cm apart and 25 cm between plants .A distance of 75cm was left between the experimental units .Three to four seeds was sown in each hill, and thinning was performed once after the full emergence of seedling and formation of the first true leaves .This trial was conduced by using Strip –Block Design with two factors .The main factor was cultivation without ploughing (zero-tillage) compared with conventional ploughing and the second factor was phosphorous fertilization levels were applied once along the cultivation rows, while nitrogen fertilizer as urea (46% N) at 280 kg ha^{-1} splitted twice, the first at post field emergence after two weeks and the second application at the beginning of floral buds formation.

Studied characters

Weeds kind: weed kind were designated, classified according to their families, life cycle, leaf kind and number of weeds were counted.=

Weed density (plant m^{-2}): Weeds kind and counting their density were performed at 20 and 40 days from sowing in an area of $1m^2$.

Weed dry weight (gm^2): Weeds were cut randomly at the soil surface level from squared meter area ($1m^2$); Packed in bags with openings for ventilation, placed in the oven at 70 C^o until weight stability.

100-seeds weight (gm): One hundred seed were weight from middle rows of each experimental unit

No. of seeds per head: were counted as an average of five plants taken randomly from the middle rows, and estimated depending upon the 500 seeds head was calculated

Seeds yield (tone ha^{-1}): it was estimated from the harvesting of five plants by multiple the averages of plant seed with the plant density.

Statistical analysis

ANOVA analysis was performed according to the analysis of variance (ANOVA) and comparing between the averages according to the least significant differences (L.S.D) at the probability level (0.05%) (18).

RESULTS AND DISCUSSION

Weeds Type

It is clear from data in Tables 1 and 2 that weedy treatments were full of wild safflower (*Carthanus oxacanthus* L.), Wild beet (*Beta vulgaris* L.), Mallow (*Malva* rotundifolial L.) and as (annual weeds) and nut grass (*Cyperus rotundus* L.). gohnson grass (*Sorghum halepense* L.), field bind weed (*Convolvulus arvensis* L.), as (Perennial weeds). The percentage of broad-leaved and narrow – leaved weeds were 64.33 and 35.66%, respectively. The percentages of annul weeds and perennial weeds were 55.25 and 44.75% in first season, respectively. In second season the percentages were almost similar to the percentages in the first season i.e. 67.75 and 32.25%, for broad and narrow leaves weed, respectively. The perennial weeds had slight increase when compared with the first season by 48.50%, while annual weeds gave 51.50%.

Table 1. Weeds plant kind found at experiment of field English, Families, Scientific names

No	English name	Family	Scientific name
1	Wild safflower	Compositae	*Carthamus oxyacanthus* L.
2	Prickly lettuce	Compositae	*Lactuca scariola* L.
3	Wild beets	Chenopodiacea	*Beta vulgaris* L.
4	Button weed	Malvaceae	*Malva rotundifolia* L.
5	Purslane	Portulacea	*Portulaca oleracea* L.
6	Smeller Bind Weed	Convolvulacea	*Convolvulus arvensis* L.
7	Syrian Bind Weed	Convolvulacea	*Convolvulus scammonia* L.
8	Nutgrass	Cyperaceae	*Cyperus rotundus* L.
9	Johnson grass	Poaceae	*Sorghum halepense* L.
10	Hairy - node bear grass	Poaceae	*Dichanthium annulatum* L.

Table 2. Weeds life cycle of grown weeds and their classification based on leaf-shape and their present percentages in both season of 2015

No	English names	Life cycle	Percentages of weeds		leaf-shape	Percentages of weeds	
			spring	fall		spring	Fall
1	Wild safflower	annual weed	% 55.25	% 51.50	Broad leaves	% 64.33	% 67.75
2	Prickly lettuce						
3	Wild beets						
4	Button weed						
5	Purslane						
6	Smeller Bind Weed	Perennial weed	% 44.75	% 48.50	Narrow leaves	% 35.66	% 32.25
7	Syrian Bind Weed						
8	Nutgrass						
9	Johnson grass						
10	Hairy - node bear grass						

Weeds density (plant m^2)

Results in Table 3 referred to the significant differences between different treatment as influenced by cultivation system (ploughed and zero –tillage). A field of zero-tillage had minimum number of weeds in m^2 16.39 and 14.88 plant, in both season, respectively compared with 61.61 and 82.98 plant m^{-2} for same season, respectively. This may be attributed that ploughed treatment encouraged weeds seed to germinate and grow good seed bed for germination of weed seeds (4). Also the less amount of weeds in the ploughed treatment, may be due to the allellopathic effect of sunflower plants residual where this crop is considered with high content of allellopathic compounds compared with other crops (13). It is clear from Table 3 that phosphorous fertilizer treatment significantly increased of weeds density in the sunflower field in both seasons where density increased from 35 .42 and 47.56 plant m^{-2} at the l00kg ha^{-1} P_20_5 to reach the highest average (42.50) and (51.35) plant m^{-2} at the 300 kg ha^{-1}. This could be due that phosphor which was on essential elements after nitrogen and its presence in suitable quantities reduce the competition between plants on nutrients, and hence the density of plants was increase in the unit area. This result in agreement with the findings of Freymani et al., (8) in their experiment about the effect of N.P.K on weeds biology where phosphors increased the weeds density especially broad leaves weeds compared with no application of N.P.K. It is clear from Table 3, that weed density reached 78.00 and 97.86 plant m-^{2} in the weedy treatment with significant difference of un-weedy treatment where no weed plants present in both seasons. The interaction between cultivation system and phosphors fertilization was significant only in spring season (Table 3). Zero –tillage treatment was recorded the lowest weed density (12.33 plant m^{-2}) at the lowest level 100 kg ha^{-1} of phosphors, while the ploughed treatment at 200 and 300 kg ha^{-1} had the highest weed density (64.00 and 62.33 plant ha^{-1}), respectively with no significant difference in the spring seasons (Table 3). The reason of increased weeds density in the ploughed treatment at higher phosphorus level may be due to suitable conditions for weed seed germination and growth with absence or reduced plant residual of sunflower (allylopathy) in the ploughed treatment with the high utilization of fertilizer due to soil excitation and spread of fertilizer between cultivation rows. Results Table 3 also in referred to significant interaction between cultivation system and weed treatment in both seasons, non-weedy treatments of ploughed was up on the ploughed treatments were showed full absence of weeds (0.00 plant ha^{-1}) in both seasons. However, weedy and ploughed treatments had the highest average of plant density 123.22 and 165.97 plant ha^{-1} in both seasons, respectively. The interaction between weedy treatment and phosphorus fertilizer, there was significant effect, only in fall season. All phosphorus fertilizer levels were howed full absence of weeds plants (0.00 plant m^{-2}) without significant difference between them, while weedy treatment at 300kg ha^{-1} P_2O_5 gave the highest weed density 102.70 plant m^{-2} in the fall season (Table 4). The absence of weeds in the non weedy treatments was an expected result due to the hand –weeding and sunflower plant has large vegetative system and broad leaves which enable the plant to strongly compete with weeds especially at the late stages of plant growth. For third order interaction, there was no significant effect in both season (Table 3).

Table 3. effect of treatments on weeds density (plant m^{-2}) in spring and full season

cultivation system (C)	weeds treatments (W)	Spring season				Fall season			
		phosphorous fertilizer (kg h^{-1}) (P)			C × W	phosphorous fertilizer (kg h^{-1}) (P)			C × W
		100	200	300		100	200	300	
ploughed	weedy	117.00	124.67	128.0	123.22	164.67	163.37	169.87	165.97
	non-weedy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zero- tillage	weedy	24.67	31.67	42.00	32.78	25.57	28.17	35.53	29.76
	non-weedy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LSD 0.05			N.S*		2.82		N.S		1.92
Mean (p)		35.42	39.08	42.50		47.56	47.88	51.35	
LSD 0.05			2.11				2.93		
C			C × P		Mean (C)		C × P		Mean (C)
ploughed		58.50	62.33	64.00	61.61	82.33	81.68	84.93	82.98
Zero- tillage		12.33	15.83	21.00	16.39	12.78	14.08	17.77	14.88
LSD 0.05			2.93		3.14		N.S		2.43
W			W × P		Mean (w)		W × P		Mean (w)
Weedy		70.83	78.17	85.00	78.00	95.12	95.77	102.70	97.86
non-weedy		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LSD 0.05			N.S		2.46		3.47		1.17

N.S: Nat Significant

Weed dry weight (gm m^{-2})

Results were showed significant effect of all factors and their interaction in both season for this character except the interaction between cultivation system and phosphorus fertilizer and triple interaction only in spring season where no significant effect present (Table 4). Zero-tillage treatment was recorded the lowest weed dry weight (13.5 and 13.40 gm m^{-2}) in both seasons, respectively, compared with the highest average (47.25 and 64.00 gm m^{-2}) in both season for the ploughed treatments. This may be due to the fact that ploughing practice encouraged weeds seeds germination and growth vigorously compared with the zero-tillage treatments where it lacks the good seed bed for weed seeds germination (4). The reasons of declining weeds weight in the Zero-tillage practice was due to the declined number of weed in this treatment (Table 3). It is clear from Table 4 that the phosphors fertilization significantly increased the dry weight of accompanied weeds to the sunflower crop in both seasons where the dry weight increased from 26.13 to 35.49 gm m^{-2} at 100 kg ha^{-1} P_2O_5 to reach the highest weight 34.50 and 44.08 gm m^{-2} at 300 kg ha^{-1}. This may be due that phosphor is one of the essential elements and it availability reduces the competition between plants. Hence, plants growth and their weights will be increased. This result was in agreement with the weeds density which was reflected to the dry weight of weeds as illustrate in Table 3. Zero –tillage treatments at 100 kg h^{-1} of P_2O_3 showed the lowest average of weeds dry weight 10.59 plant m^2 compared with 72.19 plant m^2 at 300 kg ha^{-1} of P_2O_5 (Table 4). The increases of weed dry weight in the ploughed treatments at highest level of phosphorous fertilizer could be due to the conditions for weed germination and weeds growth with the absence of reduction of the residual effect of sunflower (allylopathy) in the ploughed treatment which increased the benefit of fertilizer between rows which, in turn, increase weed density (Table 4) and increased their dry weight. For the interaction, it was observed from (Table 4) that the interaction between both cultivation systems for ploughed and non-ploughed treatments in the absence of weeds, there was no weight of weeds. This was expected as these treatment were free of weeds due to the hand weeding compared with weedy and ploughed treatments which gave the highest average of weeds dry weight 94.51 and 129.81 gm m^{-2} in both seasons. The interaction between all levels of phosphorous fertilizers and non – weedy treatments had the lowest weed dry weight (0.00 gm m^{-2}) while the weed treatment at the highest level of P_20_5 gave the highest average 69.01 and 88.16 gm m^{-2} in both seasons, respectively. The triple interaction between all phosphorous levels of ploughed and unploughed in the absence of weed gave the lowest dry weight of weeds (0.00 gm m^{-2}) in the fall season only. However, this interaction of ploughed treatment at the highest level of phosphorous fertilizer (300 kg ha^{-1}) gave the highest average of weed weight (144.39 gm m^{-2})

Table 4. Effect of treatments on weed dry weight (gm m^{-2}) in spring and full seasons

cultivation system (C)	weeds treatments (W)	Spring season				Fall season			
		phosphorous fertilizer (kg h^{-1}) (P)			C × W	phosphorous fertilizer (kg h^{-1}) (P)			C × W
		100	200	300		100	200	300	
ploughed	weedy	84.93	95.45	103.14	94.51	120.78	124.25	144.39	129.81
	non-weedy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zero- tillage	weedy	19.58	24.45	34.87	26.30	21.17	27.28	31.93	26.79
	non-weedy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LSD 0.05			N.S		3.90		3.75		1.59
Mean (p)		26.13	29.98	34.50		35.49	37.88	44.08	
LSD 0.05			1.95				2.20		
C			C × P		Mean (C)		C × P		Mean (C)
ploughed		42.46	47.72	51.57	47.25	60.39	62.13	72.19	64.90
Zero- tillage		9.79	12.23	17.44	13.15	10.59	13.64	15.97	13.40
LSD 0.05			N.S		4.74		2.70		2.01
W			W × P		Mean (w)		W × P		Mean (w)
Weedy		52.26	59.95	69.01	60.40	70.98	75.77	88.16	78.30
non-weedy		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LSD 0.05			3.27		2.99		3.62		1.01

Number of seeds per head

Results in Table 5 shows significant effect of cultivation systems in the fall seasons and phosphorous fertilizer levels and weeds treatment in both seasons. interaction between cultivation systems and fertilizer levels was significant in the fall season, while for other interactions there was no significant effect on this character. Zero- tillage treatment gave the highest average of seed head (755.8 seeds) only in the fall season compared with the lowest average 665.6 seed $head^{-1}$ for the ploughed treatment increased this character in both seasons to 707.2 and 685.5 seeds per head, respectively at l00 kg with no significant differences at 200 kgh^{-1} in the fall season to increase again gradually to reach the peak (760 .0 and 732. 9 seeds) at 300 kg h^{-1}. This may be due to the role of phosphor in improving crop growth which consequently increased yield components and seed yield including number of seed per head. This results were in agreement with the findings of other researcher (5, 16) they found that increased level of phosphorus fertilizers increased number of seed $head^{-1}$. Absence of weeds in both seasons was significantly superior which produced the highest average of seed head 717. and 699.5 in both seasons, respectively (Table 5). This result, was due to the absence of weeds competition with the main crop on water, space and nutrients which allow the crop to grow naturally and producing highest number of seeds as more nutrient were available.

Table 5. Effect of different treatments on number of seeds per head in spring and full seasons

cultivation system (C)	weeds treatments (W)	Spring season				Fall season			
		phosphorous fertilizer (kg h^{-1}) (P)			C × W	phosphorous fertilizer (kg h^{-1}) (P)			C × W
		100	200	300		100	200	300	
ploughed	Weedy	698.0	731.3	741.5	723.6	639.8	650.3	676.1	655.4
	non-weedy	711.2	753.2	779.8	748.1	677.4	659.4	690.3	675.7
Zero- tillage	Weedy	686.1	712.4	733.1	710.5	711.2	741.5	779.8	744.2
	non-weedy	713.5	748.0	785.5	749.0	725.7	771.5	804.9	767.4
LSD 0.05			N.S		N.S		N.S		N.S
Mean (p)		702.2	736.2	760.0		685.5	702.7	732.9	
LSD 0.05			19.40				17.87		
C			C × P		Mean (C)		C × P		Mean (C)
Ploughed		704.6	742.2	760.6	735.8	658.6	654.9	683.2	665.6
Zero- tillage		699.8	730.2	759.3	729.8	718.5	756.5	792.3	755.8
LSD 0.05			N.S		N.S		27.1		32.1
W			W × P		Mean (w)		W × P		Mean (w)
Weedy		692.0	721.9	737.3	717.1	675.5	695.9	727.9	699.8
non-weedy		712.4	750.6	782.6	748.5	701.5	715.5	747.6	721.5
LSD 0.05			N.S		10.60		N.S		4.9

100-seeds weight (gm)

Zero-tillage treatments were significantly superior in the fall season by producing the highest average of 100 seeds weight 7.75 gm (Table 6). It was clear from this Table that the highest level of fertilizer 300 kg ha^{-1} was significantly superior in both seasons and produced the highest weight 7.56 and 7.57 gm. The lowest level of phosphorus fertilizer produced (100 kg ha^{-1}), the lowest average (7.39 gm) in the spring season. However, the level of 200 kg ha^{-1} had 7.44 gm in the fall season with no significant differences between 100 and 200 kg ha^{-1}. The reason of increased 100 seed weight may due to the availability of enough phosphor during the plant growth stages. This was in agreement with the findings of (6) who achieved an increased of 100 seeds weight after the application of phosphor. It was also clear from Tables 9 and 10 that the absence of weeds treatments was significantly superior and gave the highest value of 100 seeds weight (7.54 and 7.57gm) in both seasons, compared with the weedy treatments which gave the lowest average 7.41 and 7.39 gm.The interaction between zero-tillage fertilized with the 300 kg ha^{-1} phosphors gave the highest average 7.80 gm. in fall season with the significant differences with other interaction with ploughed treatments fertilized with all phosphors levels (100, 200 and 300 kg h^{-1}) gave the lowest average 7.42, 7.32 and 7.34, respectively with no significant differences between them. The interaction between the absence of weeds treatment and 300 kg ha^{-1} phosphors level achieved the highest level 7.76 gm in the fall season while the weedy treatment fertilized with 200 kg ha^{-1} gave the lowest average (7.23 gm) with no significant differences between this treatment and 100 and 200 kg ha^{-1}.=

Table 6. Effect of treatments on 100-seeds weight (gm) in spring and full seasons

cultivation system (C)	weeds treatments (W)	Spring season				Fall season			
		phosphorous fertilizer (kg h^{-1}) (P)			C × W	phosphorous fertilizer (kg h^{-1}) (P)			C × W
		100	200	300		100	200	300	
ploughed	weedy	7.35	7.41	7.48	7.42	7.65	6.98	7.15	7.26
	non-weedy	7.45	7.48	7.62	7.51	7.19	7.65	7.53	7.46
Zero- tillage	weedy	7.31	7.41	7.50	7.41	7.45	7.48	7.62	7.51
	non-weedy	7.46	7.58	7.66	7.57	7.46	7.59	7.99	7.68
LSD 0.05			N.S		N.S		0.22		N.S
Mean (p)		7.39	7.47	7.56		7.44	7.42	7.57	
LSD 0.05			0.05				0.12		
C			C × P		Mean (C)		C × P		Mean (C)
ploughed		7.40	7.45	7.55	7.46	7.42	7.32	7.34	7.36
Zero- tillage		7.39	7.50	7.58	7.49	7.45	7.53	7.80	7.60
LSD 0.05			N.S		N.S		0.14		0.07
W			W × P		Mean (w)		W × P		Mean (w)
weedy		7.33	7.41	7.49	7.41	7.55	7.23	7.38	7.39
non-weedy		7.46	7.53	7.34	7.54	7.33	7.62	7.76	7.57
LSD 0.05			N.S		0.04		0.17		0.12

Seeds yield (gm $plant^{-1}$)

Zero – tillage treatments showed significant superiority in the seeds yield in the fall season by giving the highest average 57.47 gm $plant^{-1}$ compared with 48.96 gm $plant^{-1}$ of ploughed treatments. This was due to the increased number of seed $head^{-1}$ (Table 5). Also, it was clear Table 7 that with increasing phosphorus fertilizer level, significantly increased the seed yield in both seasons from 51.95 and 51.17 gm $plant^{-1}$ at 300 $kgha^{-1}$. This may be due that phosphor is amongst the essential elements and it's enough availability improves plant growth seed yield components (Tables 5 and 6) which may leads to increase seed yield. This results were in agreement with other studies showed the sunflower crop responded to increased levels phosphors (P_2O_5) to the soil improved growth characters and sunflower seed yield (1, 2, 16). It was clear from these Tables that un-weedy treatments gave the highest seeds yield in both seasons 56.46 and 54.69 gm $Plant^{-1}$, respectively, compared with the weedy treatments which gave the lowest averages 53.17 and 51.71 gm $plant^{-1}$ in both seasons, respectively. For interaction between cultivation system and phosphorus fertilizer, there was significant effect on seed yield only

in the fall season where un ploughed treatments at 300 kg ha^{-1} gave the highest average of 61.86 gm $plant^{-1}$ compared with 47.93 gm $plant^{-1}$ in ploughed treatments at 200 kg ha^{-1} with no significant difference with the interaction of ploughed treatments at 100 kg ha^{-1} level (Table 7). It was also clears from Table 7 that the interaction between unploughed and ploughed treatments with the presence of weed with no significant differences between their combinations when the combination between un weedy treatments and 300 kg ha^{-1} gave the highest average 58.16 gm per plant. The lowest average of 50.42 gm $plant^{-1}$ was for weedy treatment at the 200 kg ha^{-1} level with no differences with weedy and un-weedy treatments at the 100 kg ha^{-1}. For other interaction there was no significant effect on this character (Table 7). It can be concluded that the use of zero-tillage in sunflower significantly reduced weeds density in the field which in turn reduced weed competition to the main crop which may leads to increase seed yield and its components. However, increased phosphorous levels increased weeds density, their dry weights and the seed yield. This suggests that weeds depletes part of the phosphorus fertilizer applied to the main crop.

Table 7. Effect of treatments on seeds yield (gm $plant^{-1}$) in spring and full seasons

cultivation system (C)	weeds treatments (W)	Spring season				Fall season			
		phosphorous fertilizer (kg h^{-1}) (P)			C × W	phosphorous fertilizer (kg h^{-1}) (P)			C × W
		100	200	300		100	200	300	
ploughed	weedy	51.29	54.22	55.49	53.67	48.90	45.41	48.30	47.54
	non-weedy	52.95	56.30	59.40	56.22	48.70	50.45	52.00	50.38
Zero- tillage	weedy	50.18	52.81	55.01	52.67	52.95	55.43	59.40	55.93
	non-weedy	53.25	56.70	60.17	56.71	54.13	58.57	64.31	59.01
LSD 0.05			N.S		1.19		N.S		N.S
Mean (p)		51.92	55.01	57.52		51.17	52.47	56.00	
LSD 0.05			1.39				1.98		
C			C × P		Mean (C)		C × P		Mean (C)
ploughed		52.12	55.26	57.44	54.94	48.80	47.93	50.15	48.96
Zero- tillage		51.72	54.76	57.59	54.69	53.54	57.00	61.86	57.47
LSD 0.05			N.S		N.S		1.64		2.07
W			W × P		Mean (w)		W × P		Mean (w)
weedy		50.74	53.51	55.25	53.17	50.92	50.42	53.85	51.73
non-weedy		53.10	56.50	59.78	56.46	51.42	54.51	58.16	54.69
LSD 0.05			N.S		0.69		1.35		0.99

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