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EFFECT OF SOIL – BORNE FUNGI ON SUNFLOWER GROWTH AFTER DIFFERENT PRECEDING CROPS.

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ABSTRACT

The effect of preceding crops (faba bean, flax, Egyptian clover , canola , sugar beet and wheat) and soil borne fungi on growth aspects of sunflower was studed. Data showed that faba bean stimulated the growth of some fungi in the rhizosphere and rhizoplane of sunflower inculding *Penicillium sp.* Faba bean and sugar beat stimulated *Fusarium sp.* compared to flax, canola and wheat .

The Egyptain clover and faba bean significantly exhibited their effect by stimulating the rhizospheric and rhizoplanic fungi of sunflower . In addation , preceding crops did not show a singificant effect on the stem diamter of sunflower .

INTRODUCTION

Sunflower (*Helianthus annuus L.*) is one of the most important oil seed crop ranking the seconed to soybean as an oil crop (Fick ,1989) . Sunflower seeds contain high percentage of oil (30- 50%),that reaces 54% in some varieties , (Shabana and Abou – Khadra , 1976) .

Sunflower is subjected to several diseases inculding damping – off , root – rot , charcol rot , leaf spot and rust . These diseases cause serious reduction in seed yield and oil content . Also, sunflower has been affected by preceding winter crop such as wheat , flax, sugar beet , faba bean and Egyptian clover (Loomis and Coonor, 1992 , Khalil 2001 And Khalil , 2003). Cropping system of appropriate cropping pattern may facilitate better utilization of growth resources and reduce the reliance on chemical fertilizers.

The preceding crops such as legumes are reported to increase the soil fertility and nitrogen uptake (Danso and PapastyLianou , 1992), Several investigations emphasized the role of legumes in increasing the yield of the following non legumes crops .

The aim of this investigation was to study the effect of soil borne fungi formed during preceding crops on sunflower growth and yield .

MATERIALS AND METHODS

Two field experiments were carried out at Zarzoura Agricultural Research Station in El-Behera Governorate during the two successive 2000/2001 and 2001/2002 growing seasons of sunflower.the experiments were designed to study the effect of preceding crops and microflora formed in the soil on sun flower growth.

Rhizoplane samples were collected including the hole plant with the surrounding soil . The root system was shaken gently to get-rid of most of the adhering soil particles . One gram of the root system with the remaining adjacent soil particles was transferred to a wide mouth glass reagent bottle

containing 99 ml sterile distilled water . The bottles were shaken throughly for 5 minutes. One loopful was taken and streaked on PDA medium, three replicates were carried out from each sample.

The microflora of rhizosphere were examined by transfering one gram of each representative soil sample to a glass bottles containing 99 ml sterile distilled water. Soil extracts were treated as above mentioned in case of rhizoplane soil and placed on petri-dishes containing PDA medium .

Petri – dishes were then , incubated at 25±2C^0 for 3 days while the developed fungal colonies were counted and percentage of each fungus were calculated. Samples of microflora in rhizosphere and rhizoplane of the tested crops were taken periodically at 20 to 30 day intervals. A Randomized Complete Block Design was used in 4 replicates in both growing seasons according to (Gamez and Gomez , 1984) .

Experimental unit comprised 5 ridges (each 3 m long and 0.7 m widee = 10.5 m^2 in area) . Sunflower was sown in 20 May in 2000 and 25 May 2002 . While, hills (2 plants /hill) were spaced at 20 cm apart . The other winter preceding crops were sown and treated following the agricultural recommendation .

Sample of five plants was taken from each replicates to estimate sunflower yield, growth aspects as affected by the prevailing soil pathogens such as plant lenght , stem diameter , head diameter , number of leaves , weight of 100 seed and seed yield / fedan .

RESULTS

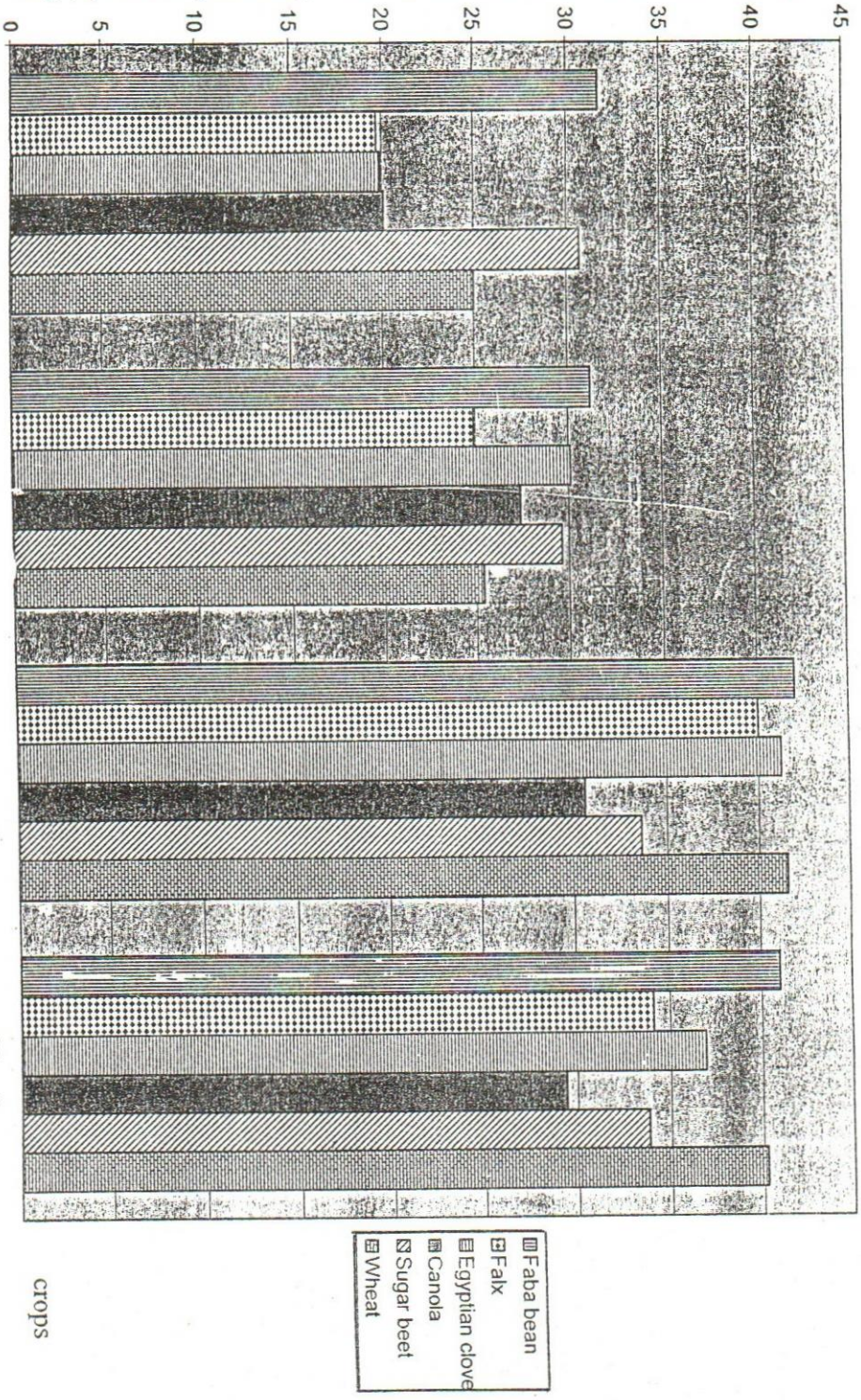
Comparative studies of soil microflora in rhizosphere and rhizoplane of preceding winter crops of sunflower.

The different genera of fungi inhabited the rhizosphere and rhizoplane microflora of canola , Egyptian clover , faba bean , flax , sugar beat and wheat plants were two studied in the successive growing seasons (2000/2001 and 2001 / 2002) during the period from December to March . Data are presented in Table (1) and illustrated in Fig (1).

Thirteen fungal genera were isolated from the rhizosphere and rhizoplane of the tested winter crops.*Penicillium* sp. was the most dominant fungus in six tested winter crops followed by *Fusarium sp.*. The highest occurance of *Penicillium* sp. and *Fusarium* sp . was (42.0 & 31.7 %) in the rhizosphere and (41.0 & 31.2 %) in the rhizoplane of faba bean , respectively.

Alternaria sp., *Aspergillus terreus*, *Btrodiplodia* sp., *Macrophomina phaseolina* , *Mucor* sp., *Myrothecium* sp., *Rhizoctonia solani* , *Rhizopus* sp., *Epicoccum* sp. and *Trichoderma* sp. were less frequent and ranged from (0.1 to 4.6 %) in all the tested samples. In contrast *Sclerotium rolfsii* was not found in the rhizoplane in all the samples of six tested winter crops.

Fig (1) : Mean percentage of fungi isolated from the six tested crops



Table(1) :Mean percentage of the fungi isolated from six tested winter crops during the two successive growing seasons(2000/2001and 2001/2002).

Fungi	Mean percentage of the fungi isolated from											
	Rhizosphere						rhizoplane					
	faba bean	flax	Egyptian clover	canola	Sugar beat	wheat	faba bean	flax	Egyptian clover	canola	sugar beat	wheat
Aleternaria sp.	4.2	4.6	4.5	3.7	2.3	3.5	1.7	3.9	2.8	2.5	2.2	4.4
Aspergillus flavus	5.8	9.6	11.0	21.2	20.1	14.4	8.3	8.8	14.0	19.9	15.8	12.3
Aspergillus niger	5.7	10.1	8.5	7.6	9.3	7.0	7.1	9.4	5.7	8.3	12.3	5.0
Aspergillus terreus	1.6	4.0	2.0	3.0	1.8	2.0	2.7	4.7	3.3	0.9	3.2	4.6
Btrodiplodia sp.	1.0	0.0	2.4	1.5	0.2	0.0	1.8	0.0	1.5	1.7	0.0	0.5
Fusarium sp.	31.7	19.7	19.9	20.1	30.7	25.0	31.2	24.9	30.1	27.4	29.6	25.4
Macrophomina phaseolina	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	2.2	0.6	0.3	1.0
Myrothecium sp.	1.6	1.4	1.6	0.0	0.0	0.0	1.1	0.0	0.1	0.9	0.0	0.0
Mucor sp.	1.4	0.6	4.4	1.9	0.1	1.0	1.5	2.1	3.4	4.3	1.1	1.1
Rhizoctonia solani	3.3	3.3	0.3	2.2	0.4	2.9	1.2	3.3	0.0	1.3	0.3	3.7
Rhizopus sp.	1.6	3.7	0.7	3.6	0.6	1.6	2.3	3.7	0.0	2.9	0.3	1.4
Epicoccum sp.	0.0	2.2	2.4	4.3	0.9	0.0	0.0	3.6	0.0	0.0	1.1	0.0
Sclerotium rolfsii	0.0	0.3	0.0	0.3	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichoderma sp.	0.1	0.5	0.0	0.0	0.0	0.0	0.1	1.5	0.0	0.0	0.0	0.4
Penicillium sp.	42.0	40.0	41.2	30.6	33.6	41.5	41.0	34.1	36.9	29.4	33.8	40.2
Total colonies	1092	735	707	671	894	790	1050	877	813	653	626	988

$$\% = \frac{\text{No.of fungal colonies x 100}}{\text{Totol No. of fungal colonies}}$$

Effect of the preceding winter crops on percentage of sunflower survival plants

Data in Table (2) show the effect of the six winter preceding crop (canola , Egyptian clover , faba bean , flax , sugar beet and wheat) on percentage of sunflower survival plants . The obtained results showed increasing in survival plants when sunflower grown after Egyptian clover (63.68 and 50.55 %) in the two growing seasons , respecively . Also , the high percentage of survival plants was obtained when sunflower was grown after faba bean (61.65 and 50.35%) , in the2000/2001 and 2001 / 2002 growing seasons respectively . The lowest percentage of survival plants were found when sunflower was grown after flax by (43.68 and 35.03 %) in the two seasons , respectively .

Table (2): Effect of the preceding winter crops on percentage of sunflower survival plants in the two growing seasons 2000/2001 and 2001 / 2002.

Preceding crops	* Mean percentage of survival plants	
	2000/2001	2001/2002
canola	** 56.55	48.98
Egyptian clover	63.68	50.55
faba bean	61.65	50.35
flax	43.68	35.03
sugar beet	49.38	46.90
wheat	46.60	45.33
L.S.D : 0.05%	N.S.	4.49

*** The data were recorded 40 days after planting .**
*** * Mean of 4 replicates .**

Effect of preceding winter crops on the growth parameters and yield of sunflower .

Data in Table (3) show the effect of the six tested preceding crops on sunflower yield and growth parameter in the two growing seasons .

1-Plant height

The tested preceding winter crops had significant effect on plant hight of sunflower . Egyptian clover and faba bean had the better effect than the other tested preceding winter crops .

2.Stem diameter :

The stem diameter of sunflower did not show significant differences in the two growing seasons among the six tested winter crops preceding sunflwoer plantation .

3.Head diameter

Head diameter was significantly affected by the preceding winter crop in both seasons 2000/2001 and 2001 / 2002. The highest values was obtained when
sunflower was grown after faba bean (15.4 cm) durig season, of 2000/2001and it was (15.5 cm) after Egyptian clover during 2001/2002 growing season..

Table (3) : Mean of sunflower characters as affected by preceding winter crops during 2000 / 2001 and 2001 / 2002 growing seasons .

Preceding crop	plant hight (cm)		stem diameten (cm)		head diameten (cm)		No . of leaves leaves / plant		weight of 100 seed (gm)		seed yield / fed . (kg)	
	2000 2001	2001 2002	2000 2001	2001 2002	2000 2001	2001 2002	2000 2001	2001 2002	2000 2001	2001 2002	2001 2001	2001 2002
canola	169.15	166.95	1.8	1.54	15.3	14.85	17.5	18.75	6.35	6.475	1027.5	1016.25
Egyptian clover	175	167.4	1.8	1.538	14.4	15.5	23	25	6.96	7.875	1400	1350
fababean	171.9	167.7	1.473	1.53	15.4	15.3	21	22.5	6.97	7.388	1340	1335
flax	166.9	147.5	1.73	1.553	12.9	13.03	19	20.75	6.43	6.15	856.3	867.5
sugar beat	162.6	167.85	1.49	1.535	13.4	14.38	19	19	6.25	5.983	945	850
wheat	164.7	167.0	1.75	1.54	13.85	14.85	19	22	6.65	6.65	1075	1050
L.S.D. at 0.05 %	3.92	10.61	N.S	N.S	0.68	0.93	1.33	1.00	0.284	0.368	48.11	24.64

4.Weight of 100 seed and seed yield

It was found that weight of 100 seed was significantly affected by preceding crops in both growing seasons .The weight of 100 seed was obtained when sunflower was grown after faba bean and Egyptian clover (6.97 and 6.96 gm), respectively , durning the growing season of 2000 / 2001, while, in the season of 2001/ 2002 it reached (7.38 and 7.87 gm) in faba bean and Egyptian clover, respectively . Also, the highest values of seed yield / fad. were obtained when sunflower was grown after Egyptian clover followed by faba bean in the two growing seasons.

5. Number of leaves / plant.

The data evidenced that number of leaves /plant of sunflower was significant affected by the previous winter crops used as preceding crops. significantly affected plant of sunflower. The results indicated that the highest number of leaves plant were obtained from sunflower plants grown after Egyptian clover as 23 and 25 leaves / plant in 2000 / 2001 and 2001 / 2002 seasons, respectively. Also, the highest number of leaves / plant were obtained when sunflower was grown after faba bean in each of the growing seasons.

DISCUSSION

Thirteen fungal genera were obtained from the rhizosphere and rhizoplane of six preceding winter crops (canola, Egyptian clover, faba bean, flax, sugar beat and wheat). *Penicillium* sp. was the dominant fungus in all tested rhizosphere and rhizoplane samples of the six crops tested.

The highest occurrence of *penicillium* sp. (42.0 and 41 %) was found in the rhizosphere and rhizoplane of faba bean followed by wheat (41.5 and 40.2 %). *Fusarium* sp. was recorded at a range from (19.7 to 31.7%) and 24.9 to 31.2 % in the rhizosphere and rhizoplane of flax and faba bean, respectively. These results are in agrement with this obtained by Temiett. and Pramotton , (1990) ; Mohamed , (1990) ; Ksiezniak and Kobus, (1993) and Khakimova and Mannanov , (2001) .

Data of microflora associated with rhizosphere and rhizoplane of six tested winter crops were in agrement with the findings of Hanafy *et.al.*, (1996) who found the following fungi *Alternaria* sp., *Aspergillus terreus, Btrodiplodia sp. Epicoccum* sp.,*Sclerotium rolfsii and Trichoderma* sp. in the rhizospheric and rhizoplanic zones.

During the different stages of sunflower growth several fungal diseases caused pre – and post – emergance damping – off (Achbani and Tourvieille, 2000 and Molinero – Ruiz and Melero – Vara, 2002). Preceding crops canola, Egyptian clover, faba bean, flax, sugar beat and wheat were apart of several factores affecting pre – and post – emergence. Data obtained show that the survival sunflower plants were highest when grown after Egyptian clover and faba bean (63.68, 61.55 % and 50.55, 50.35 %) in the two growing seasons of 2000/2001 and 2001/2002, respecticely. On the other hand, the survival plant were less by (43.68 and 35.05 %), respectively when sunflower was grown after flax.

Generally, the most of legumenious crop showed to stimuled the microbial activeties in the rhizosphere more than the other tested crops. These results are in agreement with those obtained by Hoflich et al., (2002).

Preceding winter crops (canola, Egyptian clover, faba bean, flax, sugar beat and wheat) showed significant effect on sunflower plant hight, head diameter, weight of 100 seed / plant , seed yield/ feddan and number of leaves / plant of the succeeding sunflower plants in the two growing seasons2000/2001and2001/2002.

Egyptian clover and faba bean as preceding crop to sunflower favourably affected these parameters compared with the other tested winter crops. Similar results were obtained by Konnecke, (1967) who found that faba bean is a good preceding crop. Also, (Khobarova, 1967 Page et.al., 1982; Abshahi et al.,.1984; Hargrove,1986. and Danso and Papastylianou, 1992) found that different leguminous crops had similar residual effects , but clover and bean were the best .

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تأثير فطريات التربة علي نمو محصول عباد الشمس بعد محاصيل مختلفة سابقه

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إجريت تجربتين حقليتين بمحطة البحوث الزراعية بزرزورة بالبحيرة خلال موسمي زراعة عباد الشمس ٢٠٠٠- ٢٠٠١ و فى ٢٠٠١ – ٢٠٠٢ وذلك لدراسة تأثير المحاصيل السابقة لزراعته وهى (الفول البلدي والكتان والبرسيم المصري والكانولا وبنجر السكر والقمح) و ايضا فطريات التربة الناشطة فى هذة الزراعة علي مظاهر النمو وقد اظهرت النتائج أن زراعة الفول البلدي كمحصول سابق لعباد الشمس نمو بعض الفطريات حول منطقة الريزوسفير rhizosphere والمنطقة الملامسة مباشرة للجذر rhizoplane لنبات عباد الشمس وأهمها *Penicillium sp.* بينما يشجع الفول البلدي وبنجر السكر نمو الفطر *Fusarium sp.* مقارنة بالكتان والكانولا والقمح .

ومن ناحية أخرى أدت زراعة البرسيم المصري والفول البلدي قبل عباد الشمس إلي حدوث بعض التأثيرات لعنوية علي استجابة المحصول لتأثير فطريات التربة كما أوضحت الدراسةأن المحاصيل السابقة لزراعة عباد الشمس لم يكن لها تاثير على سمك السيقان .