

**Sunflower Plants as Attractants
To Beneficial Insects and Repellents
To Insect Infestations on Cotton, Soybean,
and Sugarbeet Crops**

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ABSTRACT

Intercropping of sunflower plants within the field plantations of the three crops of Cotton, soybean, and sugarbeet were found to act significantly as attractants for the following beneficial biological control agents: *Chrysopa vulgaris* Shcn.; *Leucopis puncticornis aphidivora* Rond; *Coccinella undecimpunctata* Reiche; *Paedeurs alfieri* Koch; *Syrphus corrollae* F.; and *Monomorium pharaonis* L. Simultaneously, the intercropping of the sunflower plants within these three crops was significantly repellent to the field infestations of the *Spodoptera littoralis* Boisd.; *Aphis gossypii* Glov. ; *Thrip tabaci* L.; *Bemisia tabaci* Gennandius; *Empasca lybica* de Berg, and *Tetranychus urticae* Koch. This dual benefit of sunflower interplantation suggests an obviously advantageous practice for pest management within the frame of the universally adopted policy of integrated pest and crop control management.

INTRODUCTION

The role of foliar chemicals in retarding or preventing consumption of foliage by pests has been clearly established. However, few studies have addressed the negative effects of floral chemistry on insect herbivory. Reproductive structures should, expectedly, be well defended to assure adequate propagation of plant genes, (Mullin *etal* 1991). Foliar sesquiterpenes including the epoxide argofyllin, A, I, diterpenoic acids may explain antibiosis in sunflower against insect infestations (Rogers, 1981). Kares *et al.*, (1993) found that maize plants favoured more predaceous insects, while sunflower favoured more parasitoids when they were cultivated around cotton plants. Taman *etal*. (1995) were able to demonstrate the ability of sunflower plants cultivated around inter sugarbeet fields to increase the population density of the beneficial insects under field conditions. The present investigation was planned to compare the impact of cultivating sunflower plants around field plots of either cotton, soybean or sugarbeet on population density of both beneficial or destructive insect pests.

MATERIALS AND METHODS

1- Field Experiment

A field (2100m²) was chosen at the Agriculture Research Experiment Station Sabahia, Alexandria. This area was divided into 18 plots. Six treatments (3 plots each), were cultivated with: A, Sugarbeet (Hh mono 74); B, one row of sunflower (Hybrid 64-80) sown around sugarbeet; C, Cotton (Giza 70); D, one row of sunflower sown around cotton; E, soybean (Clark); F, one row of sunflower sown around soybean. All plots were sown on the first of April 1998 except soybean and sunflower around soybean plots which were sown on the first of May 1998, and all plots received the normally recommended agricultural practices.

2- Population density of the various insects:

For studying the population density of various insects, *Aphis gossypii*, *Tetranychus urticae*, *Bemisia tabaci*, *Thrips tabaci*, *Empoasca larybica* and *Spodoptera littoralis* on sugarbeet, cotton and soybean plant

samples, each of 100 plant leaves were inspected at-random at weekly intervals. Also weekly samples were taken by means of double random insect sweeping net strokes from each plot. Collected insects were thoroughly examined in the laboratory and the predators were identified and counted.

3- Statistical analysis:

Statistical analysis was applied by using the computer programming for the estimate T-values (Snedecor and Cochran, 1971).

RESULTS AND DISCUSSION

Tables 1,3, and 5 demonstrate the impact of sunflower intercropping on the population levels of the beneficial predators in the fields of cotton, sugarbeet and soybeans in 1998 season respectively. The data showed significant increase of these biological control agents in the plots surrounded by the sunflower plants. Similarly the levels of population of these predators on the sunflower plants were significantly more than those in cotton, or sugarbeet or soybean plants monoculture. These data suggest that the sunflower plants are attractive to these beneficial insects. The attractive effect is expected to be demonstrated as a reflection to the phytochemistry of the growing sunflower plants (Le Quesne *et al.* 1986). On the other hand, tables 2,4 and 6 show that sunflower plants alone or when surroundings any of the three crops: cotton, sugarbeet, or soybean are negatively affecting the field population levels of infestation of the five recorded insect pests of *Spodoptra littoralis*, *Aphis gossypii*, *Trips tabaci*, *Bemisia tabaci*, and *Empoasca lybica*. The data clearly shows that these insect infestations are competitively attracted to sunflower plants. This trend was repeated significantly in the three crops of cotton, sugarbeet and soybean. The phytochemical characteristics of the sunflower as shown by Mullin *et al.* (1991); suggest that monoterpenes in sunflower plants can act either as stimulant or antifeedant. This phenomenon of interaction can be explained as reported by Metcalf (1986) who stated that triterpenoidal-derived electrophiles act as patent feeding stimulants for corn rootworm.

Table (1): Impact of sunflower intercropping on the population levels of predators in cotton field 1998.

Date of Inspection	Averages number of beneficial insects Individuals											
	C. vulgaris			C. undecimpunctata			L. P. aphidivora			P. alferii		
	A	B	C	A	B	C	A	B	C	A	B	C
June 15	-	16	12	-	20	25	-	-	-	3	2	4
22	-	15	10	-	20	28	-	-	-	-	2	3
29	-	15	15	9	19	21	-	-	-	4	2	2
July 6	2	26	30	9	28	26	-	7	5	4	12	15
13	5	22	20	13	32	28	-	7	5	-	15	15
20	10	28	15	7	26	22	1	9	12	5	10	10
27	15	32	35	12	38	40	1	7	11	7	9	11
August 3	19	35	30	12	42	37	2	8	11	4	15	14
10	8	15	11	3	20	15	3	5	9	4	17	20
17	8	14	15	3	16	18	2	4	9	5	15	22
24	5	34	28	5	26	30	1	3	2	7	11	28
31	4	28	30	5	24	15	4	9	12	8	11	25
Total	76	280	251	78	311	305	14	59	76	51	121	165
Mean	6.3	23.3	20	6.5	26	25	1.16	4.9	6.3	4.2	10	14
L. value	0.0001**			0.0001**			0.002**			0.003**		

A = On cotton only B= On cotton surrounded by sunflower C= On sunflower surrounding cotton

Table (2): Impact of sunflower intercropping on the insect infestation levels in cotton field 1998

Date of inspection	<i>A. gossypii</i>			<i>T. tabaci</i>			<i>E. lubea</i>			<i>B. tabaci</i>			<i>S. littoralis</i>		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
June 15	522	203	500	-	-	5	45	16	52	-	-	-	2	-	2
22	1230	250	1030	4	-	6	60	15	57	-	-	-	4	-	4
29	1428	285	1240	4	-	8	50	20	42	-	-	-	5	-	4
July 6	257	78	225	4	-	12	42	12	35	30	22	35	7	-	9
13	104	20	96	8	4	12	31	14	28	52	24	35	18	-	17
20	95	20	84	8	4	9	55	8	49	63	30	50	23	5	21
27	65	15	54	8	-	10	30	8	35	75	45	52	54	12	51
August 3	52	10	47	8	-	9	27	8	30	345	83	157	67	10	75
10	224	45	197	10	4	8	20	8	25	253	90	192	81	20	92
17	495	199	357	10	4	8	-	-	-	240	132	280	97	40	96
24	190	40	201	-	-	-	-	-	-	295	160	290	131	58	120
31	110	22	91	-	-	-	-	-	-	105	198	201	180	79	167
Total	4772	1187	4042	64	16	87	360	109	353	1458	784	1292	669	224	658
Mean	398	99	337	5,3	1,3	7,2	30	9	29	121,5	65	108	55,7	18,7	55
t. value	0,046*			0,004**			0,004*			0,043*			0,049*		

A= On cotton only B= On cotton surrounded by sunflower C= On sunflower surrounding cotton

Table (3): Impact of sunflower intercropping on the population levels of predator sugarbeet field 1998

Date of Inspection	Averages number of beneficial insects individuals														
	<i>C. vulgaris</i>			<i>S. corollae</i>			<i>M. pharaonis</i>			<i>L.P. aphidivora</i>			<i>C. undecimpunctata</i>		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
May 15	5	35	21	-	2	-	12	20	21	-	-	-	2	2	5
8	9	52	32	-	-3	-	26	24	25	-	-	-	2	3	6
15	2	22	12	2	5	2	50	47	30	-	2	-	5	6	6
22	2	20	13	2	8	6	32	52	48	-	3	2	2	8	12
21	7	7	3	2	11	9	17	37	40	-	2	-	5	8	10
July 6	16	5	14	7	2	15	14	25	25	-	5	8	6	7	9
10	5	14	11	-	-	-	17	20	18	-	8	11	5	10	9
20	-	-	-	-	-	-	-	32	35	-	-	-	5	8	9
27	-	-	-	-	-	-	-	15	25	-	-	-	10	10	10
July 4/7	-	-	-	-	-	-	-	-	-	-	-	-	12	10	10
110	2	-	-	10	-	-	-	-	-	-	-	-	6	15	10
117	5	5	-	11	-	-	-	-	-	-	-	9	-	-	5
Total	35	169	99	29	44	35	168	275	267	-	20	36	69	82	96
Mean	3	14	8.3	204	3.7	3	14	22.9	22	-	1.7	4	5.7	7	8
t. value	0.02*			0.5			0.2			0.02*			0.14		

A= On sugarbeet only B= On sugarbeet surrounded by sunflower C= On sunflower surrounding sugarbeet

Table (4) : Population density of the *A. gossypii*; *T. urtica*; *E. lybica* and *S. littoralis* on sugarcane different treatments (1998 season)

Date of inspection	<i>A. gossypii</i>			<i>T. urtica</i>			<i>E. lybica</i>			<i>N. viridula</i>			<i>S. littoralis</i>		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
May 1/5	120	11	54	11	-	10	25	2	15	-	-	-	2	-	4
8	170	15	76	15	-	10	30	5	35	-	-	-	4	-	4
15	98	9	89	30	19	27	55	9	60	-	-	-	5	-	4
22	45	5	32	59	7	32	58	13	66	105	22	96	5	-	4
29	32	-	25	52	5	41	140	20	111	75	15	70	10	-	11
June 6/6	65	13	47	63	15	57	220	60	120	35	9	33	17	2	15
13	73	22	72	75	20	62	360	95	191	50	10	47	25	5	20
20	-	-	-	-	-	-	415	140	290	10	5	11	120	32	93
27	-	-	-	-	-	-	-	-	-	10	5	12	122	29	85
July 4/7	-	-	-	-	-	-	16	-	8	15	5	16	115	25	79
11	20	-	25	8	-	10	22	-	8	10	2	10	-	-	-
18	16	-	18	8	-	10	25	-	16	9	-	8	-	-	-
Total	639	75	438	321	66	258	1366	344	920	319	73	296	425	93	319
Mean	53	6.1	36.5	26.7	5.5	21.5	113.8	28.6	77.5	86.5	6	24.7	35	7.7	26
t. value	0.007**			0.019*			0.06*			0.07*			0.08*		

A = On sugarcane only B = On sugarcane surrounded by sunflower

C = On sunflower surrounding sugarcane

Table (5): Impact of sunflower intercropping on the population levels of predators in soybean field 1998

Date of Inspection	Averages number of beneficial insects individuals								
	<i>C. vulgaris</i>			<i>C. undecimpunctata</i>			<i>L. P. aphidivora</i>		
	A	B	C	A	B	C	A	B	C
June 1/5	-	-	15	5	12	35	-	-	-
8	-	-	22	5	15	25	-	-	-
15	-	2	21	2	10	17	-	-	-
22	3	12	28	9	14	31	-	-	-
29	5	11	23	9	13	30	-	4	-
July 6/7	9	11	23	8	11	20	-	4	9
13	9	19	35	7	11	21	-	4	6
20	7	15	24	3	7	15	-	3	6
27	-	9	14	5	8	14	-	2	4
August 3/8	-	9	16	5	7	16	-	3	7
10	-	8	11	2	5	14	-	3	7
17	-	5	11	3	5	10	-	1	2
Total	33	101	243	63	118	248	-	24	4.1
Mean	2.7	8.4	20	5.2	9.8	20.7	-	2	3.4
t. value	0.01*			0.001**			0.00**		

A = On soybean only B= On soybean surrounded by sunflower
C= On sunflower surrounded soybean

Table (6): Impact of sunflower intercropping on the insect infestation levels in soybean field 1998

Date of inspection	A. gossypii			T. urtica			E. lybica			S. littoralis		
	A	B	C	A	B	C	A	B	C	A	B	C
June 1/6/1998	1226	102	903	1824	365	848	-	-	-	5	-	-
8/6	432	93	320	2520	504	1050	-	-	-	8	-	-
15/6	88	10	71	3420	684	1870	-	-	-	22	-	-
22/6	35	-	28	3815	761	1940	-	-	-	65	7	9
29/6	22	-	17	4210	802	2013	-	-	-	82	25	37
July 6/7	20	-	13	5220	1044	2462	-	-	-	-	-	-
13/7	30	-	15	2889	578	1973	56	-	-	-	-	-
20/7	140	46	84	344	120	210	78	21	43	45	-	-
27/7	92	28	70	335	97	201	130	65	84	96	22	45
3/8	131	35	98	200	55	87	25	12	15	134	44	67
10/8	920	124	306	75	22	31	18	7	12	148	49	93
17/8	1730	153	907	21	-	2	4	-	-	211	70	102
Total	4866	591	2832	24873	5032	2687	341	105	154	803	217	263
Mean	4055	49	236	2072	419	1057	57	17	13	68	18	28
t. value	0.04*			0.006*			0.04*			0.02*		

A = On soybean only B = On soybean surrounded by sunflower C = On sunflower surrounding soybean

Mc Laren (1986) reported that it is often not possible to separate interference from competition and allelopathy. Indirectly attracting the insect pests to sunflower plants is expected to simultaneously attract the predators and which are favoured with the presence of higher population density of their host insect pests on sunflower plants. Abdel Bary (1997) interpreted the less resistant cotton cultivar (Giza 70) to bollworm, to be due to the high percent of terpenoides. The conclusion we reached recommends the use of intercropping of sunflower within large fields of either cotton, sugarbeet, or soybean crops to manage the insect infestations and to build up the population of the beneficial insects.

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الملخص العربي

تحميل زراعة نباتات عباد الشمس وسط نباتات القطن وبنجر السكر وفول الصويا

أ.د. فريدة علي طمان

معهد بحوث وقاية النباتات - محطة بحوث الصحبة - الإسكندرية

مركز البحوث الزراعية - الدقى - الجيزة

وجد أن تحميل زراعة نباتات عباد الشمس وسط نباتات المحاصيل الاقتصادية الثلاثة: القطن - بنجر السكر وفول الصويا يؤدي إلى زيادة معنوية لإحصائيات لتعداد الأعداء الحيوية على كل من المحاصيل الثلاثة بالإضافة إلى صفوف نباتات عباد الشمس ومن الأعداء الحيوية التي تم تسجيل زيادة تعدادها: حشرات أبو العيد ١١ نقطة - الرواحة - لمد المن - ذبابة المرفس والليكوبس مفترس المن. وفي نفس الوقت تم تسجيل خفض معنوي في تعداد الآفات الأتية: دودة ورق القطن - من القطن - تربس القطن - الجاسيد - الذبابة البيضاء والعنكبوت الأحمر على كل من المحاصيل الثلاثة. ورغم وجود تعداد لتلك الآفات على نبات عباد الشمس فلم يثبت حدوث ضرر اقتصادي منها وعلى ذلك يمكن التوصية بالاستفادة من هذه الظاهرة في برامج مكافحة متكاملة لتلك المحاصيل الاقتصادية بتوزيع صفوف من نبات عباد الشمس وهو محصول صيفي بطبيعته وسط زراعات المحاصيل الصيفية الثلاثة: القطن وبنجر السكر وفول الصويا.