

**EFFICACY OF SOME SEQUENTIAL CHEMICAL INSECTICIDES FOR
CONTROLLING THE COTTON JASSID, *EMPOASCA SPP.*
(HOMOPTERA, CICADELLIDAE) AND LEAF INJURY IN COTTON
FIELDS, BENI – SUIF GOVERNORATE, EGYPT**

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Abstract

Field experiments of sequential chemical insecticides were carried out at Beni- Suef Governorate, Egypt in the two successive cotton growing seasons 2010 and 2011 to control cotton jassid (*Empoasca spp*) and its injury in cotton crop.

On this study, the Recommend Ministry Program was developed for control cotton bollworms and cotton Jassid insect together. The 3rd sequential treatment (Pestban 48% E.C. → Cyperco 20% EC → Neomyl 90 % SP → Mosiplan 20 % SP) was the most effective followed by the 2nd sequential treatment (Pestban 48% EC → Cyperco 20% EC → Mosiplan 20 % SP → Imidor 35 % SC) during 2010 and 2011 seasons, when compared with the (RMP) (Pestban 48% E.C. → Cyperco 20% EC → Sylilan 72% EC). The total percentages of reduction were 85.6, 88.2 % for cotton Jassid and (83.9 , 75.3%) a compared with (67.8 and 53.9 %) for Ministry program respectively.

The sequential treatments 1st and 4th (Pestban 48% EC → Cyperco 20% EC → Neomyl 90 % SP → Marshal 20% EC) and (Pestban 48% EC → Cyperco 20% EC → Neomyl 90 % SP) were the least effective .The seasonal parentages of reduction were (76.6 , 77.7 %) and (75.3 , 72.8 %) in the two seasons as a compared with (67.8 and 53.9 %) for the Ministry program, respectively.

The efficiency of four sequential treatments rotation program on the jassid injuries (*Empoasca spp.*) on the cotton leaves compared with the untreated check . The seasonal percentage reduction of jassid leaf injury were (73.61 , 64.5 , 60.68 and 35.56 % for 3rd , 2nd , 1st and 4th sequential programs as a compared with 30.38 % for the Ministry program.

Concerning the effect of these programs on the actual yield, The average actual yield for the 3rd , 2nd , 1st and 4th programs were 9.21 , 8.39 , 8.06 and 7.48 kentar / fed. as compared with the (RMP) and untreated check , (6.33 and 4.61 kentar / fed.), respectively.

On the other hand, the effect of these programs on, fiber length at 2.5 % SL, Uniformity ratio, fiber strength (Pressley index) and fiber fineness (micronaire reading). The 3rd sequential treatment was the most effective when compared with untreated check. The average values were (31.75 , 85.78 , 9.38 and 4.45 compared with the untreated check , (31.35 , 83.15 , 8.13 and 3.85), respectively.

INTRODUCTION

Cotton is a world wide fiber crop. In Egypt, cotton is a very important crop that is cultivated mainly for fibers in industry and seeds for oil which is of great value. Cotton plants in Egypt have been attacked by numerous pests from planting till harvest, including sap sucking pests, cotton leaf worms and cotton bollworms, causing serious damage to plants and crop yield.

Cotton leafhopper or cotton jassid (*Empoasca spp.*), (Homoptera: Cicadellidae) considered one of the most destructive pests on many vegetables and field crops (Nault and Ammar, 1989). The main problem of this pest is transmission of many plant pathogens among different hosts causing enormous losses in both quantity and quality of the attacked crops. Nielson, (1968).

Nymphs and adults injure cotton leaves through injection of toxic saliva while feeding inside veins. The first symptom is a yellowish turning to reddish coloration of the margin of leaves followed by dryness. Depending on the plant stage, infestation level, and duration of infestation, leafhopper attacks can reduce plant growth, cause the abortion of the first fruiting branch and increase shedding of squares and young bolls by affecting the photosynthesis. Borah, (1995), Patel and Patel (1998) , Rafique and Shah (1998) and Sudhakar *et. al.* (1998).

The effectiveness of different pesticides against cotton bollworms and sap sucking pests was studied by several authors (Khan *et. al.* 2007 and Magdy *et. al.* 2009). Besides of the cotton bollworms, sucking insect pests, cotton aphid, whitefly, and Jassid attack cotton plants at different growing stages and cause serious damage in cotton leaves.

In Egypt, jassid infestation was insignificant , however, few years ago it has become a serious pest. Heavy infestation with this sucking insect causes extensive reduction in cotton yield and quality, especially in Beni Suef Governorate which famous for medical and aromatically crops. Therefore, it needs time to develop and implement such strategies for pest management of cotton in our country.

The objective of the present study is to develop the "Recommended Ministry Program" for control of cotton bollworms and cotton jassid infestation and injuries to select the most effective pesticides sequences against cotton jassid in relation to cotton yield quantity and quality.

MATERIALS AND METHODS

1. Evaluation of the sequential chemical insecticides against cotton jassid

1.1. Experimental design

Field experiments were conducted during 2010 and 2011 growing seasons at Sids Agricultural Research Experimental Farm, Agricultural Research Center, Beni-Suef Governorate, Egypt. An area of about half feddan (2100 m²) was planted with cotton variety 'Giza 80' sown after clover at 10th and 6th March during the two seasons, respectively. The experimental area was divided into plots (1/50 feddan for each). Each plot was separated from the adjacent one by a half meter belt (barrier) to minimize the interference of spray drift from one treatment to another. The four replicates of the six sequence treatments were arranged in completely randomized block design.

1.2. Tested compounds

The compounds were applied consequently in a sequence as shown in Table (1).

Table. 1. The tested sequences pesticides and application rates during 2010 and 2011growing seasons.

Sequence Time and rate of application	1 st spray (5 July)	2 nd spray (19 July)	3 rd spray (2 August)	4 th Spray (16 August)
Sequence 1	Pestban (Chlorpyrifos EC 48%) 1litre / Fed.	Cyperco (Cypermethrin 20% EC) 300ml / Fed.	Imidor (Imidaclopride 35% SC) 75 ml /100 litre	Marshal (carbosulfan 20% EC (100 ml / fed.)
Sequence 2	Pestban (Chlorpyrifos EC 48%) 1litre / Fed.	Cyperco (Cypermethrin 20% EC) 300ml / Fed.	Mosiplan Acetamiprid 20% SP) 25 gm / 100 litre	Imidor (Imidaclopride 35% SC) 75 ml /100 litre
Sequence 3	Pestban (Chlorpyrifos EC 48%) 1litre / Fed.	Cyperco (Cypermethrin 20% EC) 300ml / Fed.	Neomyl((Methomy I 90% SP) 300 gm / fed.	Mosiplan Acetamiprid 20% SP) 25 gm / 100 litre
Sequence 4	Pestban (Chlorpyrifos EC 48%) 1litre / Fed.	Cyperco (Cypermethrin 20% EC) 300 ml / Fed.	Neomyl ((Methomy I90% SP) 300gm / fed	-----
Sequence 5	Pestban (Chlorpyrifos EC 48%) 1litre / Fed.	Cyperco (Cypermethrin 20% EC) 300ml / Fed.	Sylian (Profenofos 72%EC) 750ml / Fed.	-----
Without Treatments	-----	-----	----	----

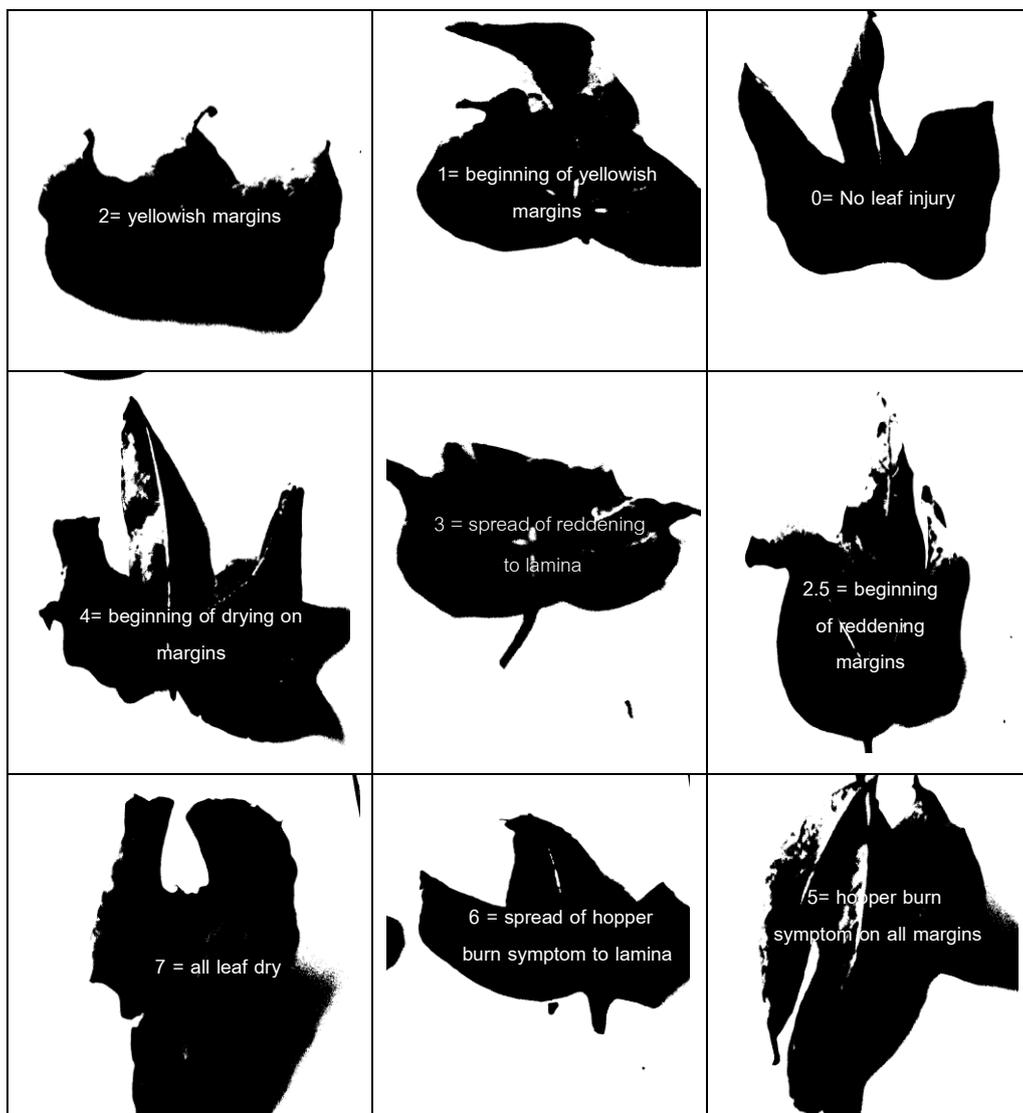
1.3. Sampling technique

The number of nymphs and adults of cotton jassid (*Empoasca spp.*) were counted by the sweep net technique. The insect were counted by 10 double strokes per replicate. Fourty double strokes net for each treatment and control, before and

weekly after insecticide applications. Weekly counts were started from 5th July until 14th of September during two seasons. The percent reduction of cotton jassid infestation was calculated according to Henderson and Tilton equation (1955).

2. Estimation of jassid injury on cotton leaves

Jassid injury on leaves was assessed using the following grade scale (Renou *et. al.*, 1998) : 0 = no leaf injury, 1 = beginning of yellowish margins, 2 = yellowish margins, 2.5 = beginning of reddening margins, 3 = spread of reddening to lamina, 4 = beginning of drying on margins, 5 = hopper burn symptom on all margins, 6 = spread of hopper burn symptom to lamina and 7 = all leaf dry or burnt.



3. Determination of cotton yield and fiber prosperities

Seed cotton yield / feddan was measured as the weight of seed cotton as Kg / plot and transformed to kentar / feddan.

3.1 Fiber length, measured using the Digital Fibro Graph Model 530 expressed as 2.5 and 50% span length according to the standard method of May and Bridges(1995).

3.2 Fiber strength: determined by pressley index using the pressley instrument as reported by **A.S.T.M. (1979)**.

3.2 Fiber fineness (Mic): was measured by micronaire apparatus and expressed in stander micronaire units (May and Bridges,1995). All fiber properties tested were measured under the standard conditions of temperature ($21 \pm 1^\circ\text{C}$) and relative humidity % (65 ± 2 % R.H.) at the laboratory of the Cotton Technology Research Division , Cotton Res. Institute in Giza.

4. Statistical analyses

Data obtained were subjected to the analysis of variance and the means were compared using the LSD test at $P < 0.05$.

RESULTS AND DISCUSSION

1. Evaluation of sequence treatments against cotton jassid

Data presented in Table 2 and Fig. (1) show the efficiency of four sequential treatments rotation program on the infestation of cotton jassid, *Empoasca spp.* compared with the Recommended Ministry Program (R.M.P.). Each rotation program included 3 or 4 successive sprays. The 3rd sequential treatment (Pestban 48% E.C. → Cyperco 20% EC → Neomyl 90 % SP → Mosiplan 20 % SP) was the most effective followed by the 2nd sequential treatment (Pestban 48% E.C. → Cyperco 20% EC → Mosiplan 20 % SP → Imidor 35 % SC) during 2010 and 2011 seasons, when compared with the (RMP) (Pestban 48% E.C. → Cyperco 20% EC → Sylian 72% E.C.). The total percentages of reduction were 85.6 and 88.2 %) for cotton Jassid and (83.9 and 81.0 %) compared with (67.8 and 53.9 %) for Ministry program respectively. The sequential treatments 1st and 4th (Pestban 48% E.C. → Cyperco 20% E.C. → Neomyl 90 % SP → Marshal 20% E.C.) and (Pestban 48% E.C. → Cyperco 20% EC → Neomyl 90 % SP) were the least effective. The seasonal parentages of reduction were (76.5 & 75.3 %) and (77.7 & 72.8 %) in the two seasons as a compared with (67.8 and 53.9 %) for the Ministry program, respectively. These results are agree with those obtained Misra *et. al.* (2002) who reported that Profenofos was found effective in combination with Cypermethrin for controlling the leafroller, *Sylepta derogate*. Also,

Razaq *et. al.* (2005) studied the efficacy of conventional insecticides on cotton crop during 2002 and 2003 season against cotton jassid, *Amrasca devastans* (Dist.) Diaphenthiuron, acetamiprid, imidacloprid and thiamethoxam proved to be the most effective in reducing jassid population below ETL (1-1.5 / leaf) up to seven days after application during both the years. Tayyib *et. al.* (2005): studied the efficacy of some new-chemistry insecticides for controlling the sucking insect pests and mites on cotton. Four insecticides, Novastar 56 EC (bifenthrin + abamectin) at 500 ml /acre, Deltaphos (deltamethrin + triazophos) at 600 ml / acre, Confidor 20 SL + Tracer at 250 + 100 ml /acre and Confidor 20 SL at 250 ml / acre were sprayed twice at fortnightly intervals in order to ascertain the mortality of the pests on cotton. These insecticides proved highly effective for the control of sap sucking insects and mites on cotton. Recently , Saleem *et. al.* (2012) determination the efficacy of different organophosphate pesticides Profenofos, Dimethoate , Acephate and Malathion against jassid (*Amrasca devastans*) feeding on okra crop that reduced its population. They add that Profenofos was unable to reduce the pest population.

Table. 2. Efficacy of some sequential chemical insecticides for controlling the cotton jassid (*Empoasca* spp.) during 2010 and 2011 seasons.

Treatments	Pre spray population	2010 season												Seasonal average
		No. of individuals / 40 double strokes at indicated days after spraying												
		1 st Spray			2 nd spray			3 rd spray			4 th spray			
		7	14	Av.	7	14	Av.	7	14	Av.	7	14	Av.	
Sequence 1	169	112	114	113.0	45	54	49.5	42	35	38.5	38	59	48.5	62.4
		43.8	54.0	48.9	82.8	73.8	78.3	86.9	90.2	88.6	92.0	88.5	90.3	76.5 b
Sequence 2	174	53	45	49.0	30	54	42.0	28	64	46.0	34	85	59.5	49.1
		74.2	82.4	78.3	88.9	74.6	81.7	91.5	82.6	87.1	93.1	84.0	88.5	83.9 a
Sequence 3	187	45	95	70.0	35	31	33.0	42	39	40.5	26	47	36.5	45.0
		79.6	65.4	72.5	87.9	86.4	87.2	88.2	90.2	89.2	95.1	91.8	93.4	85.6 a
Sequence 4	198	100	104	102.0	45	84	64.5	68	71	69.5	35	53	44.0	70.0
		57.2	64.2	60.7	85.3	65.3	75.3	81.9	83.1	82.5	93.7	91.2	92.5	77.7 b
Ministry program	123	55	45	50.0	78	81	79.5	78	114	96.0	35	49	42.0	66.9
		62.1	75.1	68.6	59.1	46.1	52.6	66.6	56.3	61.4	89.9	86.9	88.4	67.8 c
Control	167	197	245	221.0	259	204	231.5	317	354	335.5	470	509	489.5	319.4
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L. S. D.														8.69
2011 season														
Sequence 1	225	81	110	95.5	75	82	78.5	102	109	105.5	157	180	168.5	112.0
		64.8	70.1	67.5	83.8	77.9	80.9	78.1	81.9	80.0	76.6	69.1	72.8	75.3 b
Sequence 2	217	46	76	61.0	39	58	48.5	45	79	62.0	156	209	182.5	88.5
		79.3	78.6	78.9	91.3	83.8	87.5	90.0	86.4	88.2	75.9	62.8	69.3	81.0 a
Sequence 3	257	52	100	76.0	36	76	56.0	23	52	37.5	35	65	50.0	54.9
		80.2	76.2	78.2	93.2	82.1	87.6	95.7	92.5	94.1	95.4	90.2	92.8	88.2 a
Sequence 4	219	102	123	112.5	95	85	90.0	119	124	121.5	116	159	137.5	115.4
		54.5	65.7	60.1	79.0	76.5	77.7	73.8	78.9	76.3	82.2	71.9	77.1	72.8 b
Ministry program	189	98	130	114.0	70	85	77.5	198	219	208.5	335	378	356.5	189.1
		49.3	58.0	53.6	82.1	72.7	77.4	49.5	56.8	53.1	40.6	22.7	31.6	53.9 c
Control	220	225	360	292.5	454	363	408.5	456	590	523.0	656	569	612.5	459.1
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L. S. D.														9.45

The values marked with the same letter are not significantly different according to L. S. D. test at 5 % level.

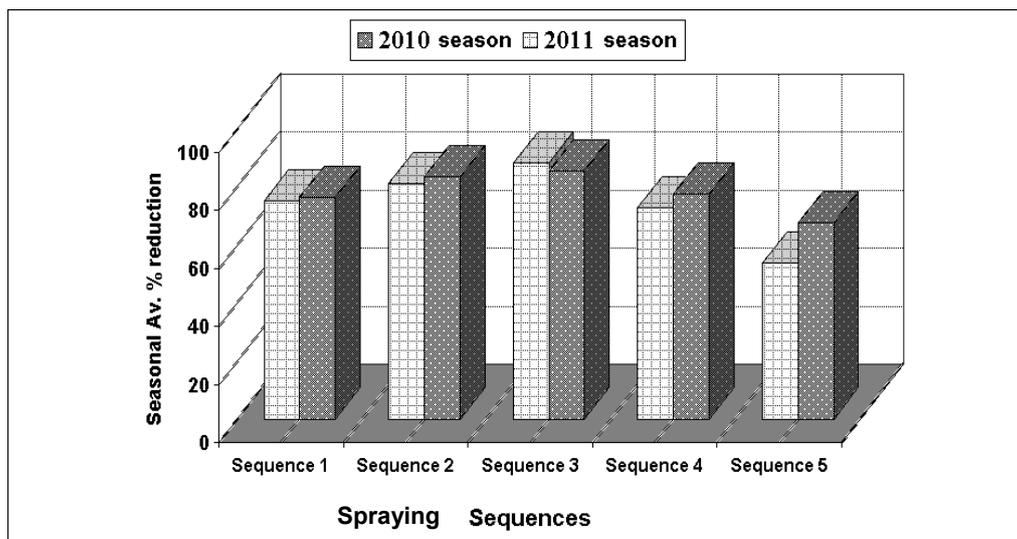


Fig. 1. Seasonal percentage of reduction in infestation of cotton jassid after spraying some sequential chemical insecticides during 2010 and 2011 seasons.

2. Effect of insecticides sequence sprays on jassid leaves injury

Data presented in Table (3) and Fig. (2) show the efficiency of four sequential treatments rotation programs on the cotton jassid leaves *Empoasca spp.* compared with the untreated check. The 3rd sequential treatment (Pestban 48% EC → Cyperco 20% EC → Neomyl 90 % SP → Mosiplan 20 % SP), the 2nd sequential treatment (Pestban 48% EC → Cyperco 20% EC → Mosiplan 20 % SP → Imidor 35 % SC) and the 1st sequential treatment (Pestban 48% EC → Cyperco 20% EC → Neomyl 90 % SP → Marshal 20% EC) were high significantly as compared with untreated check, while, no significantly between the 4th sequential treatments and the (R.M.P) (Pestban 48% E.C. → Cyperco 20% EC → Sylia 72% E.C.) when compared with untreated check during 2011 season. The seasonal jassid leaf injury were (0.34 ,0.72 and 0.97) a compared with (2.14, 2.4 and 3.18) for 4th sequential treatments, the (R.M.P) and untreated check, respectively. On the other hand, the seasonal percentage reduction of jassid leaf injury were (73.61, 64.5 and 60.68%) as a compared with 30.38 % for the Ministry program. The 4th sequential treatments was the least effective. the seasonal percentage reduction of jassid leaf injury were 35.56% as a compared with 30.68 % for the Ministry program.

Table. 3. Effect of insecticides sequence sprays on jassid leaves injury and percentage reduction of jassid injury in cotton leaves.

Sequences	Average injury leaves by insect jassid after indicated date					Seasonal average
	19 July	2 August	16 August	30 August	14 September	
Sequence 1	0.36	0.64	0.88	1.29	1.67	0.97 **
Sequence2	0.35	0.69	1.32	0.58	0.66	0.72 **
Sequence 3	0.37	0.67	0.18	0.10	0.39	0.34 **
Sequence 4	0.38	0.69	1.60	3.39	4.65	2.14 n.s
R. M. P	0.37	0.69	1.60	3.96	5.37	2.40 n.s
Control	0.47	1.75	3.9	4.41	5.81	3.18
L. S. D. at 0.05						1.35
% Reduction of jassid injury in cotton leaves						
Sequence 1	23.23	63.43	74.77	70.76	71.21	60.68 a
Sequence2	24.98	60.30	62.19	86.75	88.56	64.56 a
Sequence 3	20.68	61.40	94.91	97.74	93.32	73.61 a
Sequence 4	20.27	60.29	54.22	23.17	19.84	35.56 b
R. M. P *	21.08	60.29	54.15	10.26	7.60	30.68 b
Control	0.00	0.00	0.00	0.00	0.00	0.00
L. S. D. at 0.05						24.79

The values marked with the same letter are not significantly different according to L. S. D. test at 5 % level.

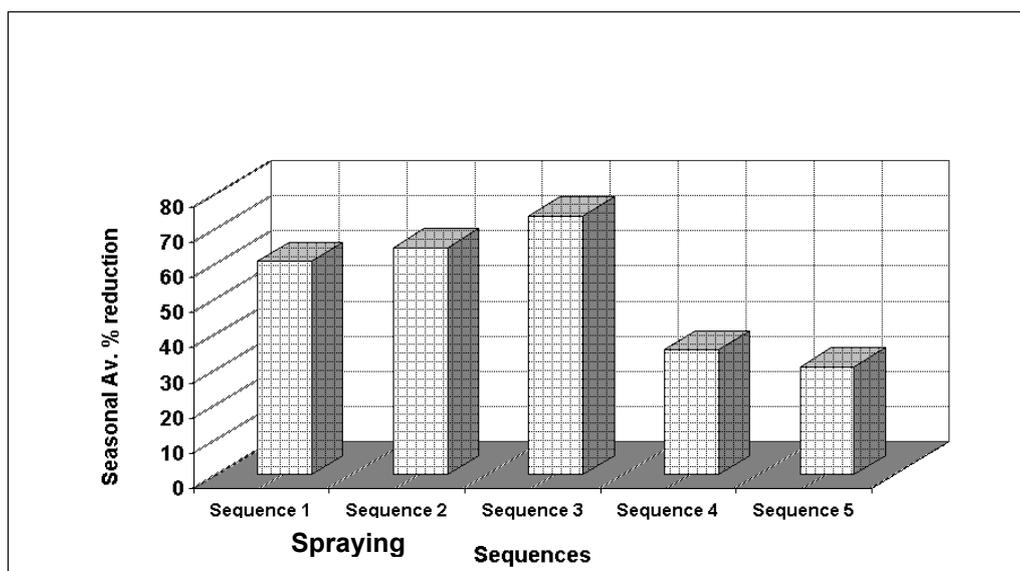


Fig. 2. Effect of insecticides sequence sprays on percentage of reduction of Jassid injury in cotton leaves.

3. Effect of insecticides sequence sprays on cotton quantity and fiber properties.

Data presented in Tables 4 show the effect of different insecticides sequence sprays on some cotton properties (on cotton quantity and fiber properties). Concerning the effect of these programs on the actual yield, the 3rd sequential treatment (Pestban 48% E.C. → Cyperco 20% EC → Neomyl 90 % SP → Mosiplan 20 % SP) was the most effective followed by the 2nd sequential treatment (Pestban 48% E.C. → Cyperco 20% EC → Mosiplan 20 % SP → Imidor 35 % SC) during 2011 season, when compared with untreated check and the (RMP) (Pestban 48% EC → Cyperco 20% EC → Sylian 72% EC). The average actual yield for the 3rd and 2nd programs were 9.21 and 8.39 kentar / fed. as compared with the (RMP) and untreated check , (6.33 and 4.61 kentar / fed.), respectively. EL- Tabbakh (2002) reported that the number of bolls /plant and seed cotton yield per plant were higher when treated with insecticides, Actellic, Durspan and Larvin . Results in Table (4) illustrate that fiber length at 2.5 % SL affected by these programs. The highest values were 31.75 , 31.65, 31.73 and 31.62 mm for 3rd , 2nd , 1st and 4th sequential pesticides programs as a compared with the Ministry Program and untreated check (31.4 and 31.35 mm), respectively.

The differences in fiber strength (Pressley index) did not affected by these sequential programs but were significantly with untreated check. As shown in Table (4), while , the difference in fiber fineness (micronaire reading) as affected by these programs. The highest value of micronaire reading (4.45 micronaire unit) resulted from

3rd program as compared with the Ministry Program (4.04 micronaire unit). These sequential pesticides programs and ministry program significant effects on micronaire reading with untreated check.

Table. 4. Effect of insecticides sequence sprays on the quantity and quality of cotton (actual yield and fiber properties) during 2011 season.

Sequences	Av. Actual yield / kentar / Fed.	Fiber properties			
		Fiber length 2.5 % Sl.	Uniformity ratio	Pressley index	Micronaire reading
Sequence 1	8.06 ± 0.50 b	31.73 ± 0.15 a	84.45 ± 0.26 b	9.33 ± 0.77a	4.35 ± 0.05a
Sequence 2	8.39 ± 0.37 a	31.65 ± 0.46 a	84.23 ± 0.31 b	9.38 ± 0.54a	4.23 ± 0.08 a
Sequence 3	9.21 ± 0.57 a	31.75 ± 0.27 a	85.78 ± 0.26 a	9.38 ± 0.65a	4.45 ± 0.15 a
Sequence 4	7.48 ± 0.43 b	31.62 ± 0.33 a	84.43 ± 0.54 b	8.25 ± 0.25a	4.05 ± 0.15 a
R. M. P	6.33 ± 0.36 c	31.40 ± 0.31 b	83.90 ± 0.61 c	8.25 ± 0.43a	4.05 ± 0.15 a
Control	4.61 ± 0.40 d	31.35 ± 0.39 b	83.15 ± 0.33 c	8.13 ± 0.41b	3.85 ± 0.15 b
L. S. D. at 0.05	0.86	0.23	0.77	1.1	0.63

The values marked with the same letter are not significantly different according to L. S. D. test at 5 % level.

These results are agree with Sharma and Agarwal (1992) who studied the effect of insecticidal application Fenvalarate and Cypermethrin on the fibre quality and seed cotton . The results indicated that a higher oil content in seeds of the cotton gave higher fibre length, fibre strength at the 50% boll formation stage. In this respect, Osman *et. al.* (2006) reported that oil and protein content was increasing significantly in cotton seed of Barakat –90 when treated with Chlorpyrifos. But there was no significant in cultivar Barac –67. Jiang *et. al.* (2009) studied the effect of Confider SL 20% applied by different methods on growth, development and fibre quality of cotton . Confider SL 20% applied in watering root shows better effects on cotton fibre qualities, especially in fibre length, length uniformity, elongation, the index of short fibre as well as textile index. Confider SL 20% foliar application display the good function on cotton development, whereas the treatments Confider SL 20% applied in watering root obviously improve the fibre quality .

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تأثير برامج متتابعة من المبيدات الحشرية التقليدية ضد حشرة جاسيد القطن *EMPOASCA SPP.* وأضرارها في حقول القطن ، محافظة بنى سويف ، مصر

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أجريت تجربة حقلية استخدم فيها تتابعات مختلفة من المبيدات الحشرية التقليدية مقارنة ببرنامج الوزارة المسجل لمكافحة ديدان لوز القطن في مصر لمكافحة حشرة جاسيد القطن مع تقييم أضرارها حيث لا يوجد برنامج مخصص لمكافحة هذه الحشرة. وحيث أن هذه الحشرة كانت آفة ثانوية لا تمثل أى مشكلة ولا يوجد لها ضرر اقتصادي إلا أنها تفاقمت منذ سنوات قليلة ماضية وأصبحت تمثل خطورة على كمية وجودة المحصول وخاصة في محافظة بنى سويف حيث تشتهر هذه المحافظة بزراعة محصول العنبر والعنب . اهتمت هذه الدراسة بتطوير برنامج الوزارة بما يتناسب مع مكافحة ديدان اللوز وحشرة جاسيد القطن حيث تم استبدال الرشة الثالثة بدلا من المبيد الفوسفورى سليان ٧٢% EC بالمبيد الكريماتى نيوميل ٩٠ % SP في تتابع أو إضافة رشة رابعة من المبيدات المتخصصة للحشرات الثاقبة الماصة. أظهرت النتائج أن البرنامج التتابعى الثالث والمكون من أربع رشات متتابعة وهى (بستبان ٤٨ % EC و سبيركل ٢٠ % EC و نيوميل ٩٠ % SP ومزبلان ٢٠ % SP) كان من أفضل البرامج في خفض نسبة الإصابة بحشرة جاسيد القطن وأضراره يليه البرنامج الثانى (بستبان و سبيركل ومزبلان واميدور) ثم البرنامج الأول (بستبان و سبيركل و اميدور و مارشال) ثم البرنامج الرابع (بستبان و سبيركل و نيوميل) وكانت النسبة المئوية للخفض في التعداد (٨٥,٦ ، ٨٣,٩ ، ٧٦,٥ ، ٧٧,٧%) و(٨٨,٢ ، ٨١,٥ ، ٧٥,٣ ، ٧٢,٨%) بالمقارنة مع برنامج وزارة الزراعة الموصى به لمكافحة ديدان اللوز ٦٧,٨ و ٥٣,٩ % في كلا الموسمين على التوالي . وكانت متوسط النسبة المئوية للخفض في الضرر لهذه الآفة عن الكنترول ٧٣,٦١ و ٦٤,٥٦ و ٦٠,٦٨ و ٣٥,٥٦ % مقارنة ب ٣٠,٦٨ % ببرنامج الوزارة، على التوالي.

ومن ناحية أخرى تم دراسة هذه التتابعات على كمية المحصول وجودة التيلة. حيث كانت كمية المحصول للتتابع الثالث والثاني والأول والرابع (٩,٢١ و ٨,٣٩ و ٨,٠٦ و ٧,٤٨ قنطار قطن زهر للفدان مقارنة ٦,٣٣ و ٤,٦١ لبرنامج الوزارة والكنترول على التوالي. وكان هناك فروق معنوية في طول التيلة عند ٢,٥ % ومعامل انتظام الطول و المتانة (معامل برسلى) والنعمومة والمتمثلة في قراءة الميكرونيير حيث كان أفضل التتابعات هو التتابع الثالث حيث بلغت (٣١,٧٥ و ٨٥,٧٨ و ٩,٣٨ و ٤,٤٥) مقارنة بالكنترول (٣١,٣٥ و ٨٣,١٥ و ٨,١٣ و ٣,٨٥)، على التوالي.