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PLANT AND INSECT TRIGGERS FOR SEQUENTIAL USE OF GOSSYPLURE AND INSECTICIDES FOR PINK BOLLWORM CONTROL ACTIONS

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Abstract

In the cotton season of 1997, El-Behira Governorate, Kafr El-Dawar District, in 518 cotton feddans, Gossyplure (the sex pheromone of the pink bollworm (PBW), *Pectionophora gossypiella* Saunders was used in three different formulations (Lastfly, P.B. Rope and Selibate) in three different dosages (according to three different plant triggers and three different insect triggers) in two different applications against the 1st and the 3rd generations of the PBW. Three different insecticide applications (from different chemical groups), in differnt dosages were used against the two cotton leafworm, *Spodoptera littoralis* Boised (CLW) generations on cotton (Baona and Mesra generations), and in the mainwhile against the 2nd and 4th generations of the PBW. There was no significant difference (LSD0.05 = 5.64) in the boll infestation percentages when different pheromone and insecticide dosages were used against different plant and insect triggers. When 1/3 pheromone dosage was used against the low (≤3) plant and insect triggers (cotton nodes or/and PBW male moths/trap/night), the boll infestation mean was 8.21%. When 1/2 pheromone dosage was used against the intermediate (4-7) plant and insect triggers (cotton nodes and/or PBW male moths/trap/night), the boll infestation mean was 3.4%, while when a full dosage pheromone application was used against the high (≥8) plant and insect triggers (cotton nodes and/or PBW male moths/trap/night), the boll infestation mean was 3.63%. These results indicated the importance of using PBW pheromone disruption applications and insecticides against PBW and CLW on the following bases:

1. Using 1/3 pheromone dosage against the low (≤3) plant and insect triggers.

2. Using 1/2 pheromone dosage against the intermediate (4-7) plant and insect triggers.

3. Using a full dosage pheromone application against the high (≥8) plant and insect triggers.

4. Using two different pheromone applications against the 1st and 3rd PBW generations in cotton.

5. Using two different insecticide applications against the 2nd and the 4th PBW generations and in the mainwhile against and two CLW generations (in Mesra ands Baona).

INTRODUCTION

In Egypt, mainly pink bollworm (PBW), *Pectinophora gossypiella* (Saunders) and cotton leafworm (CLW), *Spodoptera littoralis* (Boisd) are the destructive insects of cotton. Since gossyplure indentification and confirmation (Hummel *et al.*, 1973), many formulations became available by different industrial companies worldwide (Campion 1984). In Egypt, gossyplure different formulations were used, microencapsulated formulation (Pectone) (Critchley *et al.* 1983), hollow fiber (NoMate), luminated flakes and microencapsulated formulations (Critchley *et al.* 1985), the plastic fiber formulation (provided by Sandoz of Switzerland), the laminate-flake formulation (provided by BASF of the Federal Republic of Germany) and the microencapsulated formulation (provided by ICI of the UK) (El-Adl *et al.* 1988), hollow fiber and microencapsulated formulations (Moawad *et al.* 1991), four new pheromone (gossyplure) formulations (Abdo *et al.* 1991), PB-Rope (long lasting) gossyplure formulation (Al-Beltagy *et al.* 1993), PB-Rope and stirrup formulations in sequential use with and/or insecticides (Al-Beltagy *et al.* 1995) and attract and kill technique [Sirene formulation (gossyplure + cypermethrin)] (Al-Beltagy and Haroun, 1996). All the above mentioned authors proved the efficiency of pheromone (gossyplure) applications in reducing PBW infestation.

This study was conducted as a suggested program by Al-Beltagy and Hamid 1995 to overcome both pink bollworm (PBW) and cotton leafworm (CLW) infestation in the cotton fields in Egypt by the sequential use of both gossyplure formulations and different groups of insecticides at plant and insect three different triggers.

MATERIALS AND METHODS

This study was conducted at 518 feddans, Bardalah village, Kafr El-Dawar District, El-Behira Governorate, 1997 season by June 16. Four delta pheromone traps (supplied with PBW sex pheromone source) were installed at the four corners of every cotton field of the cotton area. PBW male moths/trap/nigth were recorded for 3 successive nights before the 1st gossyplure application. Number of nodes were recorded by 50 random cotton plants for every cotton field. Recorded No. of nodes/plant and No. of PBW males/trap/could classified to 6 different triggers as follows:

Plant triggers

a. Low plant trigger (≤3 nodes/plant).
b. Intrmediate plant trigger (4-7 nodes/plant).
c. High plant trigger (≥ 8 nodes/plant).

2. Insect triggers

a. Low insect trigger (≤3 PBW males/trap/night).

b. Intrmediate insect trigger (4-7 PBW males/trap/night).

c. High insect trigger (≥ 8 PBW males/trap/night).

The cotton area was divided ito 3 sub-areas: (according to the surveyed triggers), about 50 feddans for the high plant and insect triggers (≥8), about 150 feddans for the intermediate plant and/or insect triggers (4-7) and about 318 feddans for low plant and/or insect triggers (≤3), Table 1. Three different gossyplure (the pink bollworm sex pheromone) formulations were used, in two different applications; lastfly, PB-Rope; and Seliblate, Table 2. Three different insecticide applications were applied to overcome cotton leafworm (CLW) infestation under gossyplure application against PBW (mainly against Baona and Mesra generations) and against the overlapping PBW 2nd and 4th generations. Four green boll samples were collected, at random, weekly from August 4th to September 10th, each boll sample contained 25 green mature (14-21 days old) bolls. Boll samples were collected from the four inside corners of each cotton field and transferred to the Laboratory, dissected and infestation percentages were calculated and recorded.

RESULTS AND DISCUSSION

Data shown in Table 3, pointed out that the three different treatments under the low triggers (≤3), when using 1/3 gossyplure dossage (in the 1st pheromone application), had the highest means of boll infestation percentages (7.53, 10.4 and 6.7%, respectively).

The three different treatments under the intermediate triggers (4-7), when using 1/2 dose gossyplure applications (in the 1st pheromone application), had the three intermediate boll infestation percentages (3.17, 3.68 and 3.35%, respectively), while the last treatment, under the high triggers (≥8), had a boll infestation percentage of 3.63%.

Although the average of boll infestation (8.21%) under the one-third pheromone applications was higher than the average of boll infestation (3.4%) under the half dose pheromone application and also higher than the mean of boll infestation (3.63%) under the full dose pheromone application. Data in Table 3 showed no significant (LSD = 5.64) difference between the mean of boll infestation percentages in the one third pheromone dosage application (8.21%) and in the half dosage pheromone

application (3.4) and consequetly, with the full dosage pheromone application (3.63%), when these application based on both plant (number of nodes /plant) and insect (number of PBW male moths/trap/night) triggers.

Campion (1984), Moawad *et al.* (1991) and Al-Bletagy and Hamid (1995) discussed the problem of the outbreak of cotton leafworm infestation in the cotton fields that treated with gossyplure (disruption technique) as a single program against PBW, that because of the problem of the cotton pest complex.

Table 4 showed a suggested strategy against PBW and CLW generations, that could be concluded from this study. In other words, if we have low plant and/or insect triggers (≤3) we have to apply the one third pheromone application dose (of any short-lasting gossyplure formulation), then followed with full dosage insecticide application (mixture) followed by half dosages of sequential use of gossyplure and insecticides. If we have the intermediate plant and/or insect triggers (4-7), we have to apply half dose pheromone application (of any short-lasting gossyplure formulation), then followed with the full dosage insecticide application (mixture), followed by a sequential use of a 2nd half dosage pheromone application and a full dosage insecticide applications. If we have the high plant and/or insect triggers (≥8), we have to apply a sequential use of full dosages pheromone and insecticide applications.

Toscano *et al* (1974) compared PBW infestation under insecticide applications based on hexalure trap catches (3.5-4.0 moths / trap) was better than an automatic schedule. Dhawan and Sidhu (1984) studied timing of insecticide spray on bases of PBW moth catches in gossyplure baited traps, Al-Beltagy *et al.* (1995) found that 8 PBW male moths/trap/week equals to 3.45% boll infestation and mentioned that both of them could be used as economic triggers for control action against PBW.

These results emphasized the importance of having good entry data of the two triggers (plant and insect triggers) before the 1st pheromone application against PBW and then we have to apply the followed sequential applications (of insecticides or gossyplure) as mentioned in Table 1 against both CLW and PBW, respectively.

Table 1. Different plant and insect triggers and the sequential usages of gossyplure of different formulations, dosages and insecticides and dates of applications.

Triggrs		1st application	The following sequential applicatons				
Plant	Insect		2 nd	3 rd	4 th	5 th	Treat No.
Nodes/ plant	PBW male/ trap/night	Pheromone dose(1)	insecticide mixture	pheromone type	insecticide dose (2)	insecticide dose (3)	
		June 21	July 6	July 22	Aug 7	Aug 31	
≤ 3	≤ 3	1/3	Dilfos	1/2 D Lastfly	1/2D	F.D	1
			Dilfos	Rope	1/2D	F.D	2
			Cutabron	Selibate	1/2D	F.D	3
4-7	4-7	1/2	Cutabron	Selibate	F.D	F.D	4
			Cutabron	Rope	F.D	F.D	5
			Cutabron	Lastfly	F.D	F.D	6
≥ 8	≥ 8	F.D	Dilfo	Selibate	F.D	F.D	7

D= Dose F.D Full dose (1) selibate (2) Laven (3) Meothrin

Table 2. Pheromone and insecticides used.

Chemical	Product	Formulation	Cone%	Rate/fed	a.i/ fed	Manufacturer
Phero-mone	1- Lastfly*	Kneaded	14.88	150 gm	22 mg	Fermone. Phocnix. USA
	2- Rope*	Polyethylene tubes		(automizer 150 ml 300 tub	20.6 gm	Shine-Etsu.
	3- Selibatc*	Rubber ring	8	100ring	26 gm	Japan Agriscnce. UK
Insec-ticides	4- Cutabron (1) 5- Delfos(2) 6- Larvin " Thiodicarb"(3)	EC EC D.F.	50 51 80	750 ml I L 500 gm	375 gm 510 gm 400 gm	I.C.I. UK Dow Elanco Rhone Poulenc
	7- Mcothrin "Fenpropathrin" (4)					Sumitomo. KZ. Egypt

* Gossyplure (a.i.) : (Z,Z) & (Z,E), 7, 11-hexadecadienyl acetate.

(P) Profenofos (Curacron) 47.34% (phosphorothioic acid O-(4-bromo-2-chlorophenyl)-O-ethyl S-propyl estr.
+ Chlorofluazuron (2.66%) N-[4-(3-chloro-5-trifluoromethyl-2-pyridyloxy)-3,5-dichlorophenyl]-N-(2,6-difluorobenzoyl) urea.

(2) Chlorpyrifos (dursban) 48%, O-O-diethyl-O-(3,5,6-trichloro-2-pyridyl) phosphorothioat. + hexaflumurone (Consult) 3,0%, 1-(3,5-dichloro-4-1,1,2,2-tetrafluoroethoxy) phenyl 3-(2,6-difluro-benzyl) urea.

(3) Thiodicarb, 3,7,9,13-tetramethyl-5,11-dioxa-2,8,14-trithio-4,7,9,12-tetraaza pentadeca-3,12-diene-6,10 dione.

(4) Fenpropathrin, alpha-cyano-3-phenoxybenzyl-2,2,3,3-tetramethyl cyclopropanecarboxylate.

Table 3. Means of bolls infestation % under different gossyplure formulations, dosages and insecticides according to the different triggers.

Control application dosages				Boll infestation %								Average
Treat. No.	1st	2nd	4th	Aug.				Sept.				
	Selibate dose	Gossy-plure	Insec-ticides	4	11	18	25	1	10	Total	Mean	
1	1/3	L	1/2	1.30	15.1	11.8	9.90	3.30	3.80	45.2	7.53	
2	1/3	R	1/2	0.00	16.4	25.8	14.5	5.70	0.00	62.4	10.4	8.21a
3	1/3	S	1/2	11.5	5.50	13.8	11.3	1.30	2.70	46.1	6.70	
4	1/2	S	1	2.20	4.70	4.60	5.4	0.00	2.10	19.0	3.17	
5	1/2	R	1	6.20	5.90	0.00	2.3	1.90	5.80	22.1	3.68	3.40a
6	1/2	L	1	0.67	2.00	4.67	2.00	2.67	8.00	20.1	3.35	
7	Full	S	1	0.00	9.20	10.0	2.6	0.00	0.00	21.8	3.63	3.63

LSD 0.05 = 5.64 means with the same leetter are not significantly different

L = Last fly, R = Rope and S = Selibate.

Table 4. The new strategy of gossyplure and Insecticide sequential applications based on plant and insect triggers thresholds.

Triggers (1)		Applications				
Plant	Insect	1st (2)	2 nd (3)	3 rd (4)	4 th (5)	5 th (6)
		Gossyplure	Insecticides mixture	Gossyplure	Insecticides	Insecticide
No.of nodes/ plant	No.of PBW male/trap/ might	Late June (20-30)	Early July (5-10)	Late July (20-30)	Early Aug. (5-14)	Late Aug. (20-30)
		1st PBW**	2nd PBW**	3rd PBW**	2nd CLW** 4th PBW	Both PBW and CLW**
≤ 3	≤ 3	1/3 dose	Full (4) dose	Half dose	Full dose	Full dose
4-7	4-7	1/2 dose	Full dose	Half dose	Full dose	Full dose
≥ 8	≥ 8	Full dose	Full dose	Half dose	Full dose	Full dose

(1) Before 1st gossyplure application

(2) Any short-lasting gossyplure formulation

(3) An insecticide mixture (OP+IGI) as cutabron or dilfos

(4) Applied by concentration according to the plant density

(5) A carbamate insecticide [as thiodicarb (Larven)]

(6) A pyrethroid insecticide

** Target generation

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المحددات النباتية والحشرية للإستخدام المتتابع للجوسيبلور والمبيدات لمكافحة دودة اللوز القرنفلية

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية – محطة بحوث وقاية النباتات بالاسكندريه.

استخدم الجوسيبلور (الفرمون الجنسي لدودة اللوز القرنفلية) في ثلاث صور تجهيزية مختلفة (لاست فلاي، بي بي – روب ، وسيليبت) بثلاث جرعات مختلفة (حسب ٣ حدود (نباتية – وحشرية) حرجة مختلفة) في معاملتين مختلفتين ضد الجيل الأول والثالث لدودة اللوز القرنفلية.

استخدمت ٣ معاملات بمبيدات مختلفة (من مجاميع مختلفة) بجرعات مختلفة أساسا ضد جيلي دودة ورق القطن (بؤونة ومسري)، وضد الجيلين الثاني والرابع لدودة اللوز القرنفلية، وذلك في مساحة ٥١٨ فدان في محافظة البحيرة ، موسم ١٩٩٧.

أوضحت نتائج النسب المئوية للإصابة في اللوز الأخضر عدم وجود فروق معنوية بين استخدام الجرعات المختلفة من التجهيزات المختلفة من الفرمون والمبيدات، فكان متوسط الاصابة في اللوز الأخضر عند استخدام ١ / ٣ جرعة ضد الحدود (النباتية والحشرية) الحرجة المنخفضة (≥ ٣ عقد نباتية أو ٣ فراشات / المصيدة / الليلة) هي ٨,٢١٪ في حين كان متوسط الاصابة عند استخدام ٢/١ الجرعة علي الحد المتوسط (٤-٧ عقدة نباتية، أو فراشة / المصيدة/الليلة) هي ٣,٤٪، وكان متوسط الاصابة عند استخدام الجرعة الكاملة علي الحد الأعلي (≤ ٨ عقد نباتية أو ٨ فراشات / المصيدة/ الليلة) هو ٣,٦٣٪ (أقل فرق معنوي = ٥,٦٤٪).

أوضحت هذه النتائج الأهمية القصوي لاستخدام الفرمون والمبيدات ضد دودة اللوز القرنفلية ودودة ورق القطن علي النحو التالي:

١. استخدام ٣/١ جرعة الفرمون عند تواجد الحد الأدني (≥ ٣) من الحدود النباتية والحشرية.

٢. استخدام ٢/١ جرعة الفرمون عند تواجد الحد الأوسط (٤-٧) من الحدود النباتية والحشرية.

٣. استخدام الجرعة الكاملة عند تواجد الحد الأعلي (≤ ٨) من الحدود النباتية والحشرية.

٤. توجيه معاملة الفرمون ضد الجيلين الأول والثالث لدودة اللوز القرنفلية.

٥. توجيه معاملة المبيدات ضد الجيلين الثاني والرابع لدودة اللوز القرنفلية وفي نفس الوقت جيلي بؤونة ومسري لدودة ورق القطن.