Field Evaluation of some Insecticide Treatments against Cotton Bollworms and their Side Effects on Two Natural Enemies

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Abstract: Two field experiments were carried out during 2013 and 2014 cotton seasons, at AbouElmatameer, El-Behira Governorate to evaluate the efficiency of some insecticide treatments against two cotton bollworms, pink bollworm (PBW), *Pectinophora gossypiella*, and spiny bollworm (SBW), *Earias insulana*. The side effects of all insecticide treatments against lady beetle, *Coccinella undecimpunctata* and aphid lion, *Chrysopa carnea* were also determined. Results revealed that, fipronil field rate (FR) / lufenuron (0.5 FR) and spinetoram (FR) / lufenuron (0.5 FR) mixtures achieved the highest efficacy against PBW, where the mean reduction% in cotton bolls infested by PBW were 88.8 and 89.2% in 2013 & 88.7 and 89.6% in 2014 cotton seasons, respectively. Fipronil (FR) / lufenuron (0.5 FR) mixture significantly achieved the highest reduction% in cotton bolls infested by SBW (90.3 and 90.2% in 2013 and 2014 cotton seasons, respectively). Fipronil becomes in the 2nd rank in terms of efficiency against the SBW followed by spinetoram (FR) / lufenuron (0.5 FR) mixtures and cypermethrin (FR) / lufenuron (0.5 FR) mixtures. On the other hand, spinetoram, chlorpyrifos or cypermethrin each alone achieved the least reduction percentages in cotton bolls infested by PBW and SBW in both seasons. Fipronil recorded the least side effects against lady beetle whereas 18.1 & 14.4% reduction and 8.2 & 6.4% reduction of aphid lion were recorded in 2013 and 2014 cotton seasons, respectively. Cypermethrin (FR) / lufenuron (0.5 FR) mixture has a harmful effects against lady beetle and aphid lion. It can be concluded that, fipronil and its mixture with lufenuron (0.5 FR) can be used in a program for PBW and SBW management in cotton fields.

Keywords: *Insecticides, Field evaluation, Cotton bollworms, Natural enemies.*

1. Introduction

Cotton is a source for fibers and the seeds provide an important source of food for livestock and humans **(Luttrell *et al.*, 1994)**.In Egypt, cotton is liable to be attacked by different insects from the seedling stage to the mature stage. Amongthese insects, are the pink bollworm (PBW), *Pectinophora gossypiella*, and spiny bollworm (SBW), *Earias insulana*, the most injurious insects causing a severe reduction in cotton yield and quality **(Lohag and Nahyoon, 1995, Ahmad *et al.*, 2003; El-Aswad and Aly, 2007)**.Larvae of pink bollworm attack plants at the beginning of the fruiting stage causing a great loss to the cotton bolls, fibers and seeds which is reflected on the cotton production **(Khurana and Verma, 1990)**. The larvae of *E. insulana* attack soft and growing tissues especially terminal bud of main stem, flower buds and bolls **(Munro, 1987)**, whichultimately shed **(Atwal, 1994)**. When neglected, these two bollworms cause enormous damage and loss, qualitatively and quantitatively to the crop **(El-Feel *et al.*, 1993)**.

The production of cotton fibers depends mainly upon the efficient control of these insects. Chemical control is still adopted as one of the major techniques for combating these serious pests. The effectiveness of different pesticides against bollworms was studied by several authors **(Khan *et al.*, 2007; Balakrishman *et al.*, 2009 and Magdy *et al.*, 2009)**.Development of resistanceof those insects against most tested insecticide groups **(Osman *et al.*, 1991 and Hassan, 2007)** leads to the continuing need for new, effective and economical insecticides for crop protection **(Casida and Quistad, 2005)**.Therefore, new insecticides will be required to replace the old one **(Argentine *et al.*, 2002)**. Also, improve new methods and strategies of insect control are mandatory to help in meeting the fiber and food requirements of an ever-expanding world population with a minimum impact on the environment.

The phenylpyrazole insecticide fipronil and the spinosyn insecticide spinetoram are among the promising alternatives with a unique mode of action. Fipronil has been reported to block GABA receptors **(Buckingham *et al.*, 1994; Hosie*et al.*, 1995)** and insect inhibitory ionotropic glutamate receptors **(Raymond *et al.*, 2000; Smith *et al.*, 1999)**.Spinetoram interacts with both γ-aminobutyric acid receptors and nicotinic acetylcholine receptors in a manner distinct from the interactions by other insecticides **(Watson, 2001)**. Therefore, it is expected that fipronil or spinetoram lack cross-resistance with other known insecticides. Fipronil or spinetoram has an excellent activity against broad spectrum of insects **(Mulrooney, 2002; Kirst, 2010)**.

The development of insecticide resistance may be reduced, by selecting products from different insecticide groups that possessing different mode of action for sequential insecticide rotation program. Therefore, the objective of this study is to evaluate the field efficiency of fipronil and spinetoram compared with chlorpyrifos and cypermethrin against two cotton bollworms PBW and SPW. Mixtures of the four tested insecticides with the 0.5 FR of lufenuron were also evaluated. Integration between the natural enemies and the chemical control is valuable in IPM programs. Impact of tested insecticides on the natural enemies must be studied. So, the side effects of all insecticide treatments against lady beetle and aphid lion were also considered.

2. Materials and Methods

2.1. Insecticides:

Fipronil (Rado-X® 80% WG), used at 40 gm / fed., was produced by Jiangsu Tuoqiu Agrochemical Co. Spinetoram (Radiant® 12%SC), used at 100 ml / fed., and chlorpyrifos (Dursban® 48% EC), used at 1 liter / fed., were produced by Dow Agrosciences Co. Alpha-cypermethrin (Alpha-cypermethrin® 10% EC), used at 250 ml / fed., was produced by Tagros Chemicals India Limited. Lufenuron (Match® 5%EC), used at 125 ml / fed. (0.5 FR), was produced by Syngenta.

2.2.Field trials and the experimental design:

Field trials were conducted during two cotton seasons 2013 and 2014 at AbouElmatameer, El-Behira Governorate. Cotton variety Giza 86 was cultivated at May 3, and May 6, during 2013 and 2014 seasons, respectively. All cultural practices were carried out according to “good agricultural practice”. Treatments were fipronil, chlorpyrifos, spinetoram, cypermethrin and the mixture of each of these insecticides with the 0.5 FR of lufenuron. All treatments in addition to control were arranged in a randomized complete block design with four replicates (each was 84 m^2 in area). Plots have been separated from each by unplanted rows. Insecticide applications were carried out using Knapsack sprayer equipment (CP3) at the rate of 250 liter per fed. Spraying took place at July27,August11, andAugust26,during 2013 cotton season and July 30, August 13, and August 28, during cotton season 2014, respectively. Each treatment was sprayed three times with 14-days intervals.

Percentages of the two bollworm (PBW or SBW) infestationswere assessed according to the technique of **El-Heneidy *et al.* (1987)**. Fifty green bolls were collected from each replicate (200 bolls from each treatment) at random from diagonals, where the counting was carried out before insecticides application, seven, and fourteen days after each spray. Boll samples were transferred to the laboratory, dissected and checked both externally and internally, and percentages of boll infestations by PBW or SBW were calculated.At the same time, number of lady beetle and aphid lion were counted on ten cotton plants. The reduction percentages of PBW or SBW infestations and the side effects on the two predators were calculated in all treatments according to **Henderson and Tilton equation (1955)**. Data was presented as means for each insecticide spray and general means for each insecticides sequence. Means were compared for significance using analysis of variance (ANOVA) test (LSD at $P < 0.05$) (SAS Statistical software, 1999).

3. Results

3.1.Efficacy of tested insecticides on the infestation of cotton bolls byPBW:

Results in Tables (1 and 2) represent the reduction percentages in cotton bolls infested by PBW as a result of some insecticide treatments at 2013 and 2014 cotton seasons. Data revealed that, fipronil (FR) / lufenuron (0.5 FR) and spinetoram (FR) / lufenuron (0.5 FR) mixtures achieved the highest reduction percentage in cotton bolls infested by PBW. Fipronil alone and chlorpyrifos (FR) / lufenuron (0.5 FR) mixture treatments came in the second rankin terms of efficiency. The general mean of reduction percentages in cotton bolls infested by PBW caused in fipronil (FR) / lufenuron (0.5 FR) treatment were 88.8 and 88.7% in 2013 and 2014 cotton seasons, respectively. Spinetoram (FR) / lufenuron (0.5 FR) mixtures achieved 89.2 and 89.6% in cotton bolls infested by PBW in 2013 and 2014 cotton seasons, respectively. On the other hand, chlorpyrifos and cypermethrin achieved the least reduction percentages in cotton bolls infested by PBW in both seasons.

Mixing the half field rate of lufenuron with tested insecticides improved the field performance of these insecticides against PBW especially chlorpyrifos and cypermethrin. Reduction percentage of cotton bolls infested by PBW was increased from 75.3% to 83.4% in 2013 and from 75.3% to 84.7% in 2014 when cypermethrin alone and with the 0.5 FR of lufenuron, respectively. When chlorpyrifos was mixed with the half field rate of lufenuron reduction% in cotton bolls infested by PBW

3.2. Efficacy of tested insecticides on the infestation of cotton bolls by SPW:

Results presented in Tables (3 and 4) revealed that, fipronil (FR) / lufenuron (0.5 FR) significantly achieved the highest reduction% in cotton bolls infested by SBW in both cotton seasons 2013 and 2014. Fipronil becomes in the 2nd rank in terms of efficiency against the SBW followed by spinetoram (FR) / lufenuron (0.5 FR) mixtures and cypermethrin (FR) / lufenuron (0.5 FR) mixtures. Spinetoram, chlorpyrifos or cypermethrin, each alone achieved the least reduction% in cotton bolls infested by SBW (Tables 3 and 4). Fipronil (FR) / lufenuron (0.5 FR) reduced the cotton bolls infested by SBW in 2013 and 2014 by 90.3 and 90.2%, respectively. Fipronil alone reduced the

Table (1): Reduction percentages of PBW larvae after treatment by different insecticides at different time intervals (season 2013):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	81.4	85.4	**83.4 bc**	80.6	86.3	**83.5 b**	83.2	86.9	**85.1 b**	**84.0 b**
Chlorpyrifos	75.3	79.7	**77.5 d**	76.9	76.4	**76.7 c**	76.5	79.3	**77.9 d**	**77.4 d**
Spinetoram	80.1	83.7	**81.9 c**	81.5	84.2	**82.9 b**	80.6	80.8	**80.7 c**	**81.8 c**
Cypermethrin	74.3	76.8	**75.6 d**	75.3	74.2	**74.7 d**	73.9	77.4	**75.6 e**	**75.3 d**
Fipronil/lufenuron	85.9	90.3	**88.2 a**	85.8	90.5	**88.2 a**	90.1	90.2	**90.1 a**	**88.8 a**
Chlorpyrifos/lufenuron	82.5	86.0	**84.3 b**	84.1	84.2	**84.1 b**	84.3	85.5	**84.9 b**	**84.4 b**
Spinetoram/lufenuron	87.9	90.5	**89.2 a**	88.8	88.3	**88.6 a**	89.1	90.6	**89.9 a**	**89.2 a**
Cypermethrin/lufenuron	81.3	83.6	**82.4 bc**	84.4	82.6	**83.5 b**	84.0	84.7	**84.4 b**	**83.4 bc**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at $P < 0.05$).

Table (2): Reduction percentages of PBW larvae after treatment by different insecticides at different time intervals (season 2014):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	83.2	85.5	**84.3 bc**	82.3	86.2	**84.3 bc**	82.6	87.1	**84.8 bc**	**84.5 bc**
Chlorpyrifos	77.6	80.4	**79.0 d**	77.2	77.6	**77.4 d**	77.1	77.5	**77.3 d**	**77.9 d**
Spinetoram	81.8	83.9	**82.9 c**	83.0	84.1	**83.6 c**	83.8	84.2	**84.0 c**	**83.5 c**
Cypermethrin	74.3	77.0	**75.7 e**	76.8	75.3	**76.0 d**	73.2	75.4	**74.3 e**	**75.3 e**
Fipronil/lufenuron	87.8	89.1	**88.5 a**	88.4	90.5	**89.4 a**	87.9	88.4	**88.2 a**	**88.7 a**
Chlorpyrifos/lufenuron	84.3	86.4	**85.3 b**	85.1	85.7	**85.4 b**	85.4	85.8	**85.6 b**	**85.4 b**
Spinetoram/lufenuron	88.9	90.7	**89.8 a**	90.1	89.6	**89.8 a**	88.6	89.5	**89.1 a**	**89.6 a**
Cypermethrin/lufenuron	83.5	84.3	**83.9 bc**	85.2	83.8	**84.5 bc**	85.4	86.0	**85.7 b**	**84.7 b**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at $P < 0.05$).

cotton bolls infested by SBW by 85.2 and 84% in 2013 and 2014 cotton seasons, respectively (Tables 3 and 4).was increased from 77.4% to 84.4% in 2013 and from 77.9% to 85.4% in 2014 (Tables 1 and 2).It is also recorded that, the half field rate of lufenuron increased the efficacy of the tested insecticides against SBW when they were used in mixtures. The highest effect of mixing the half field rate of lufenuron was in the case of cypermethrin where the reduction in cotton bolls infested by SBW increased from 76.2% to 82.7% in 2013 and from 73.2% to 80.2% in 2014. Reduction in cotton bolls infested by SBW increased from 77.6% to 82.4% in 2013 and from 73.7% to 80.3% in 2014, when chlorpyrifos was mixed with the half field rate of lufenuron.

3.3. Side effects of tested insecticides against lady beetle and aphid lion:

Results in this study revealed that, cypermethrin (FR) / lufenuron (0.5 FR) mixtures has the highest side effects against lady beetle followed by cypermethrin alone which is followed by spinetoram (FR) / lufenuron (0.5 FR) mixtures. The reduction% in lady beetle numbers caused by cypermethrin (FR) / lufenuron (0.5 FR) mixtures were 57.1 and 48.8% in 2013 and 2014, respectively. On the other hand, fipronil has the least side effects against lady beetle whereas reduction% was 18.1 and 14.4% in 2013 and 2014 seasons, respectively (Tables 5 and 6).

Concerning aphid lion, chlorpyrifos, spinetoram and cypermethrin each in mixture with lufenuron (half field rate) recorded the highest side effects, where reduction% was 16.5, 16.7 and 16.5% in 2013 & 11.9, 12.5 and 12.4% in 2014 seasons, respectively (Tables 7 and 8).Fipronil recorded the least reduction% in aphid lion numbers. Fipronil reduced the numbers of aphid lion by 8.2% in 2013 and 6.4% in 2014 (Tables 7 and 8).

4. Discussion

Cotton is liable to be attacked by many insect pests. Pink bollworm and SBW are the most destructive insect pests infested cotton in Egypt and worldwide causing most of the economic losses in cotton yield. Reducing of economic loss depends mainly on the successfulcontrol of these insects which achieved by insecticides. However, the evolution of resistance in these insect pests to insecticides requires the use of new insecticides with different mode of action and different strategies for management of these insect pests. In this study, fipronil and spinetoram were evaluated against PBW and SBW compared to chlorpyrifos and cypermethrin. Mixtures of each of these insecticides with 0.5 FR lufenuron were evaluated as a strategy to overcome the development of insecticide resistance. Fipronil and spinetoram in mixture with 0.5 FR lufenuron achieved the highest cotton bolls protection against PBW. Also, fipronil in mixture with 0.5 FR lufenuron recorded the highest efficacy against SBW. Our findings are in agreement with **Pedibhotla *et al.*, (1999)**, where they mentioned that fipronil is among the developed insecticides with unique modes of action, which has a potential for the management of lepidopterous pests of cotton. Fipronil is primarily a stomach poison with some contact activity that can be effectively used against both chewing and piercing-sucking pests **(Colliot*et al.*, 1992)**.

Fipronil exerts its action through blocking the γ-aminobutyric acid (GABA)-gated chloride channel in insects **(Hainzl and Casida, 1996)**. It is reported that, fipronil possesses a high level of toxicity to insects because of its specificity to (GABA)-gated chloride channel/ionopore complex **(Aajoud *et al.*, 2003)**. It had become a popular insecticide with several applicationsranging from agricultural to veterinary use **(Wilde *et al.*, 2001; Jennings *et al.*, 2002)**. Fipronil has shown excellent activity against a broad spectrum of insect orders, and has shown no obvious cross-resistance to other action mechanism insecticides **(Grant *et al.*, 1998)**. Many researches indicated that fipronil was transformed to the more toxic sulfone metabolites by cytochrome P450-mediated microsomal monooxygenase in insect **(Zhao *et al.*, 2005)**.Mixtures of the tested insecticides each with the 0.5 FR of lufenuron achieved more protection for cotton bolls against PBW and SBW than the insecticides alone. When single insecticide failed to give adequate control, growers resorted to the use of insecticide mixtures. The most common mixtures were of pyrethroids plus OPs, advocated on the basis of their having different modes of action, to broaden the spectrum of activity in complex pest situations and manage resistant pest populations **(Ahmad, 2008)**. Many studies reported that, mixtures of insect growth regulators with spinosad had resulted in potentiating effects on mosquitoes **(Darriet and Corbel, 2006)** and cotton leafworm **(El-Guindy *et al.*, 1983; Abdel Rahman and Abou-Taleb, 2007)**.

Natural enemies are a key component of IPM, and they are often recommended as the first line of defense in an IPM program **(Lugojja *et al.*, 2001)**. In the present study, cypermethrin (FR) / lufenuron (0.5 FR) mixtures have the highest negative effects against lady beetle and aphid lion followed by cypermethrin alone which is followed by spinetoram (FR) / lufenuron (0.5 FR) mixtures. On the other hand, fipronil has the least side effects on the two predators. These results are compatible with **Grafton and Gu (2003)**, when they demonstrated that synthetic pyrethroids recorded a significant adverse effects on the predatory vedalia beetle larvae and adults. The most crucial requirement for pesticides is that they must be compatible with biological control. Therefore, pesticides that are most selective and have no adverse effects on beneficial organisms should be used **(Nasreen *et al.*, 2007)**. So the use of selective pesticides is an important strategy for pest control.

Table (3): Reduction percentages of SBW larvae after treatment by different insecticides at different time intervals (season 2013):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	84.4	86.2	**85.3 b**	84.9	85.0	**84.9 b**	85.4	85.4	**85.4 b**	**85.2 b**
Chlorpyrifos	77.1	80.1	**78.6 f**	78.0	77.4	**77.7 e**	76.3	76.6	**76.5 e**	**77.6 f**
Spinetoram	78.9	81.7	**80.3 e**	81.2	82.1	**81.6 d**	80.9	82.2	**81.5 d**	**81.2 e**
Cypermethrin	73.8	75.7	**74.8 g**	76.0	77.9	**76.9 e**	76.8	77.0	**76.9 e**	**76.2 g**
Fipronil/lufenuron	88.4	90.9	**89.6 a**	90.1	91.2	**90.6 a**	90.7	90.8	**90.7 a**	**90.3 a**
Chlorpyrifos/lufenuron	80.4	81.6	**81.0 de**	82.8	83.2	**83.0 c**	83.3	83.2	**83.2 c**	**82.4 d**
Spinetoram/lufenuron	82.6	82.8	**82.7 c**	83.7	83.1	**83.4 c**	83.6	84.1	**83.8 c**	**83.3 c**
Cypermethrin/lufenuron	81.0	83.6	**82.3 cd**	82.8	83.4	**83.1 c**	82.7	83.0	**82.8 c**	**82.7 cd**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at P < 0.05).

Table (4): Reduction percentages of SBW larvae after treatment by different insecticides at different time intervals (season 2014):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	84.1	83.9	**84.0 b**	84.4	84.1	**84.3 b**	83.5	83.8	**83.7 b**	**84.0 b**
Chlorpyrifos	74.1	73.5	**73.8 e**	74.0	74.1	**74.0 f**	73.7	72.9	**73.3 e**	**73.7 f**
Spinetoram	78.4	78.1	**78.3 d**	78.4	79.4	**78.9 e**	79.2	78.6	**78.9 d**	**78.7 e**
Cypermethrin	73.6	73.0	**73.3 e**	73.5	74.0	**73.7 f**	72.5	72.8	**72.7 e**	**73.2 f**
Fipronil/lufenuron	88.7	90.2	**89.4 a**	89.3	91.3	**90.3 a**	91.0	90.8	**90.9 a**	**90.2 a**
Chlorpyrifos/lufenuron	81.6	79.8	**80.7 c**	80.0	80.3	**80.1 d**	80.1	80.0	**80.1 c**	**80.3 d**
Spinetoram/lufenuron	81.4	81.7	**81.5 c**	81.7	83.1	**82.4 c**	82.1	83.3	**82.1 b**	**82.2 c**
Cypermethrin/lufenuron	80.5	80.7	**80.6 c**	80.2	80.0	**80.1 d**	80.0	79.8	**79.9 cd**	**80.2 d**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at P < 0.05).

Table (5): Reduction percentages of lady beetle after treatment by different insecticides at different time intervals (season 2013):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	16.5	16.3	**16.4 h**	16.4	20.1	**18.2 g**	18.5	20.6	**19.5 g**	**18.1 h**
Chlorpyrifos	37.6	35.5	**36.5 f**	35.5	40.9	**38.2 e**	42.0	44.1	**43.1 e**	**39.3 f**
Spinetoram	40.9	39.0	**39.9 e**	39.0	42.9	**40.9 d**	43.9	45.9	**44.9 d**	**41.9 e**
Cypermethrin	48.0	47.5	**47.8 b**	47.5	50.3	**48.9 b**	49.9	50.5	**50.2 b**	**49.0 b**
Fipronil/lufenuron	19.9	19.4	**19.7 g**	19.4	23.9	**21.7 f**	22.8	24.3	**23.5 f**	**21.6 g**
Chlorpyrifos/lufenuron	43.0	41.6	**42.3 d**	41.6	46.7	**44.2 c**	45.5	48.5	**47.0 c**	**44.5 d**
Spinetoram/lufenuron	45.4	46.1	**45.8 c**	46.1	49.2	**47.7 b**	49.0	50.6	**49.8 b**	**47.7 c**
Cypermethrin/lufenuron	56.3	56.3	**56.3 a**	56.3	57.7	**57.0 a**	58.1	58.3	**58.2 a**	**57.1 a**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at $P < 0.05$).

Table (6): Reduction percentages of lady beetle after treatment by different insecticides at different time intervals (season 2014):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	11.5	11.1	**11.3 g**	13.4	13.6	**13.5 f**	13.6	20.6	**17.1 c**	**14.4 g**
Chlorpyrifos	27.0	26.7	**26.8 e**	33.3	35.3	**34.3 d**	40.1	44.1	**42.1 b**	**34.4 e**
Spinetoram	28.1	28.8	**28.5 d**	34.6	35.0	**34.8 cd**	42.8	45.9	**44.4 b**	**35.9 e**
Cypermethrin	39.7	40.4	**40.0 b**	42.0	44.7	**43.3 b**	47.4	50.5	**48.9 a**	**44.1 b**
Fipronil/lufenuron	15.8	16.3	**16.0 f**	15.5	16.2	**15.9 e**	15.3	24.3	**19.8 c**	**17.2 f**
Chlorpyrifos/lufenuron	32.8	33.9	**33.3 c**	34.5	37.3	**35.9 c**	39.3	48.5	**43.9 b**	**37.7 d**
Spinetoram/lufenuron	39.0	39.9	**39.4 b**	42.2	44.2	**43.2 b**	43.8	46.1	**45.0 b**	**42.5 c**
Cypermethrin/lufenuron	46.5	48.5	**47.5 a**	47.5	49.0	**48.3 a**	50.5	50.6	**50.6 a**	**48.8 a**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at $P < 0.05$).

Table (7): Reduction percentages of aphid lion after treatment by different insecticides at different time intervals (season 2013):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	8.4	6.9	**7.7 c**	7.7	8.2	**7.9 d**	8.8	9.4	**9.1 d**	**8.2 e**
Chlorpyrifos	13.0	14.2	**13.6 b**	13.8	15.5	**14.6 c**	17.5	18.6	**18.0 a**	**15.4 bc**
Spinetoram	12.9	13.5	**13.2 b**	14.4	15.3	**14.8 c**	16.0	17.9	**16.9 b**	**15.0 c**
Cypermethrin	14.3	13.5	**13.9 b**	15.4	16.4	**15.9 b**	17.2	18.5	**17.9 a**	**15.9 b**
Fipronil/lufenuron	8.4	7.5	**8.0 c**	8.4	8.1	**8.2 d**	9.5	10.7	**10.1 c**	**8.8 d**
Chlorpyrifos/lufenuron	15.4	15.3	**15.3 a**	16.5	15.9	**16.2 ab**	17.2	18.7	**18.0 a**	**16.5 a**
Spinetoram/lufenuron	15.2	15.0	**15.1 a**	16.7	17.1	**16.9 a**	17.5	18.6	**18.1 a**	**16.7 a**
Cypermethrin/lufenuron	15.5	15.5	**15.5 a**	16.5	16.5	**16.5 ab**	17.0	18.0	**17.5 ab**	**16.5 a**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at P < 0.05).

Table (8): Reduction percentages of aphid lion after treatment by different insecticides at different time intervals (season 2014):

Treatments	% Reduction									
	First spray		**Mean of 1st spray**	Second spray		**Mean of 2nd spray**	Third spray		**Mean of 3rd spray**	**General mean**
	1st week	2nd week		1st week	2nd week		1st week	2nd week		
Fipronil	5.9	5.5	**5.7 d**	6.2	6.6	**6.4 d**	6.7	7.5	**7.08b**	**6.4 e**
Chlorpyrifos	10.6	10.7	**10.6 c**	10.6	10.0	**10.3 b**	12.0	12.3	**12.11a**	**11.0 c**
Spinetoram	10.3	10.7	**10.5 c**	11.2	10.6	**10.9 b**	11.9	12.2	**12.03a**	**11.2 c**
Cypermethrin	11.2	10.4	**10.8 c**	11.7	12.5	**12.1 a**	12.8	13.1	**12.93a**	**11.9 ab**
Fipronil/lufenuron	6.2	6.3	**6.2 d**	6.9	8.3	**7.6 c**	7.7	8.2	**7.96b**	**7.3 d**
Chlorpyrifos/lufenuron	11.3	10.5	**10.9 bc**	11.5	12.9	**12.2 a**	12.5	12.8	**12.61a**	**11.9 b**
Spinetoram/lufenuron	11.8	11.8	**11.8 a**	12.6	13.0	**12.8 a**	13.5	12.3	**12.93a**	**12.5 a**
Cypermethrin/lufenuron	11.8	11.6	**11.7 ab**	12.6	13.0	**12.8 a**	12.7	12.6	**12.64a**	**12.4 ab**

Numbers within the same column with a letter in common are not significantly different according to analysis of variance (ANOVA) test (LSD at P < 0.05).

In conclusion, fipronil and spinetoram achieved acceptable results against PBW and SBW. Mixing the tested insecticides with 0.5 FR of lufenuron improved their efficiency. More studies are needed for the incorporation of fipronil and mixtures with lufenuron in a rotation with insecticides of different mode of action for PBW and SBW management. Whereas, application of insecticides in sequential improved the efficiency of control process compared to the several applications with the same insecticide.

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الكفاءة الحقلية لبعض المبيدات ضد ديدان اللوز و التاثيرات الجانبية على بعض الاعداء الطبيعية

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أجريت التجارب بحقول القطن خلال موسمى ٢٠١٣ و ٢٠١٤ بمركز أبو المطاميربمحافظة البحيرة لتقييم كفاءة المعاملة ببعض المبيدات ضد ديدان اللوز(دودة اللوز القرنفلية ودودة اللوز الشوكية) و كذلك تقدير التاثيرات الجانبية لهذه المعاملات ضد حشرتى أبو العيد و أسد المن. أوضحت النتائج، أن خلائط فيبرونيل (بالجرعة الحقلية) / لوفينيورون (بنصف الجرعة الحقلية)، سبينيتورام (بالجرعة الحقلية) / لوفينيورون (بنصف الجرعة الحقلية) تبدى أعلى كفاءة ضد ديدان اللوز القرنفلية ، حيث كانت نسب خفض إصابة اللوز الاخضر بدودة اللوز القرنفلية ٨٨,٨ ، ٨٩,٢% خلال موسم ٢٠١٣ ، و كانت ٨٨,٧ ، ٨٩,٦% خلال موسم قطن ٢٠١٤على التوالى. خليط الفيبرونيل (بالجرعة الحقلية) / لوفينيورون (بنصف الجرعة الحقلية)يظهر معنوية عالية فى خفض إصابة اللوز بدودة اللوز الشوكية (٩٠,٣، ٩٠,٢% خلال موسم ٢٠١٣، ٢٠١٤ على التوالى). الفيبرونيل يحتل المرتبة الثانية فى الكفاءة ضد ديدان اللوز الشوكية يتبعه خليط سبينيتورام (بالجرعة الحقلية) / لوفينيورون (بنصف الجرعة الحقلية) وخليط سيبرميثرن/ لوفينيورون (بنصف الجرعة الحقلية). كما يتضح أن السبينيتورام ، الكلوربيريفوس و السيبرميثرن كلا بمفرده أقل فاعلية فى خفض نسب الاصابة بدودة اللوز القرنفلية ودودة اللوز الشوكية بكلا الموسمين. بالنسبة للتاثيرات الجانبية للمعاملات أوضحت النتائج أن الفيبرونيل سجل أقل نسبة خفض لتعداد أبو العيد و كانت ١٨,١ ، ١٤,٤% و نسبة خفض لتعداد أسد المن التى كانت ٨,٢ ، ٦,٤% خلال ٢٠١٣ و ٢٠١٤على التوالى ، بينما كان خليط سيبرميثرن(بالجرعة الحقلية)/ لوفينيورون (بنصف الجرعة الحقلية) أكثر ضررا ضد حشرات أبو العيد و أسد المن. من هذة النتائج يتضح أن الفيبرونيل و مخاليطه مع اللوفينيورون (بنصف الجرعة الحقلية) يمكن أن يكون من المبيدات الواعدة فى برامج مكافحة ديدان اللوز القرنفلية و الشوكية فى حقول القطن.