Efficiency of imidacloprid, thiamethoxam and profenophos alone or in mixtures for controlling the sucking insect pests and mites in cotton under field condition

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ABSTRACT: The efficacy of some insecticides for controlling the some sucking insect pests of cotton; *jassid empoasca Spp*., *Bemisia tabaci*, *thrips tabacea* nd *Tetruncus Urticae* was determined. Three insecticides were used separately at full recommended rate or in mixtures at haf recommended rate, imidacloprid, thiamethoxam and profenophos, alone or in mixtures (imidacloprid + profenophos, 75cm+375ml/fed), (thiamethoxam+ profenophos, 100gm+375ml/fed) against the highest populations of jassids, *Bemisia tabaci*, *thrips tabaci* and *mites*. The present work was conducted during two successive seasons 2012 and 2013 in Beni- suef Governorate on the Cotton crop by spraying the tested insecticides alone and mixtures of both imidacloprid and thiamethoxam with profenophos to estimate the percentage of reduction of jassids, *Bemisia tabaci*, *thrips tabaci* and *mites* at different intervals which include (24 hours) to estimate the immediate effect, as well as after 3, 7 and 15 days to evaluate the resedual effect. Results indicated that imidacloprid, thiamethoxam and profenophos, alone proved to reduce jassids, *Bemisia tabaci* thrips tabaci and mites populations up to 14 days after treatment throughout both seasons. Whereas, combination of imidacloprid and thiamethoxam with profenophos, at half recommended rate showed the high efficiency with reduction percentage reached to 100.0% at 24 hours exposure time during 2012 and 2013 seasons. Also, these results indicted to the initial kill and residual effect of these insecticides was highly persistent up to 15 days. The overall results appeared promising in combination with insecticides as result of significant increasing its reduction percent.

KEYWORDS: imidacloprid, thiamethoxam, profenophos, mixtures, jassids, *Bemisia tabaci thrips tabaci* and *Tetruncus Urticae.*

1.INTRODUCTION:

The sucking insects like Jassid, *Bemisia tabaci*, *Trips* and *Mites* are of considerable importance. Their attacks start from the beginning of the crop and continue till its maturity. They play havoc every year by desaping the leaves and reducing the crop vitality, which results in less number of flowers and bolls and reduced yield. About 40 – 50 per cent of the crop is damaged only due to the attacks of sucking insects. In certain years, their heavy outbreaks due to favorable weather conditions result in total destruction of the crop in parts of the country (**Yunus*et al*., 1980**).The tetranychid mites alone could cause a loss of 21 per cent in cotton yield In case of severe mite infestation, the losses could go as high as 35 per cent **(Smith Meyer, 1981).**These insects have been mostly controlled with conventional insecticides including either one or only a component of the new chemistry combination insecticides by **Ahmad and Baig (1987), Ahmed and Hasan (1993), Tufail*et al*. (1995), Hamed *et al*. (1997) , Saleem and Khan (2001), Saleem *et al*. (2001)and Aslam *et al*. 2003)**

One of the forms to avoid the resurgence of pests is the use of selective insecticides for controlling target pest. In addition, there is growing global concern over the environmental impacts of pesticide use. Hence, it is urgent to develop new groups of insecticides acting selectively on certain insects to combat highly resistant insect pest, and to conserve their efficacy by applying insecticide resistance management strategies **(Horowitz *et al.*, 1998**). Neonicotinoids are selective insecticides against sucking pests, used intensively since imidacloprid was first introduced in 1991. Neonicotinoids act as a nicotinic acetylcholine receptor and therefore have specific activity against the insect nervous system **(Maienfisch *et al.*, 2001**). They are considerably less toxic to humans than the organophosphorus and carbamate insecticides. Several primary target insect pests for neonicotinoids insecticides have been shown a high potential for resistance development **(IRAC 2008**). Insecticide mixtures especially those with different modes of action are usually applied in the field to enhance the spectrum to control multiple pests in the presence of stimulus attack. They are also may possesses certain advantages including, increasing the efficacy to control a single pest, to delay the development of insecticide resistance, improve the efficiency of the application because mixture often used at lower doses than the doses of each component separately and also reduce the side effects of non-target organism and environment and to combat current resistance in a pest species. Using mixtures as a countermeasure for resistance management in insect pests has been recommended (**Ahmad 2004).** and also reduce the side effects of non-target organism and environment.

The aims of present study to evaluate the efficacy of the imidacloprid, thiamethoxam and profenophos alone at the recommended rates or in mixtures with profenophos at the half recommended rate on s*jassid jassid empoasca Spp , Bemisia tabaci*, *thrips*Tabacae, *Tetruncus urticae* under field condation.

2.MATERIALS AND ETHODS

2.1.Insecticide Used: Imidacloprid 35% S.C (Imidor) at 75 cm/100L
Thiamethoxam (Actara 25%WP) 200gm/ fed profenofo (Selecron s 72 % E.C) as OP insecticide at 750cm/ fed

2.2.Experimental design: The experiments were carried out at Beni- suef Governorate, Egypt during the 2012 and 2013 cotton growing seasons. The experimental area was about 1050 m2, divided into equal parts of 210 m^2.. Every treatment as well as the untreated plots was replicated four times in a completely randomized block design. To evaluate the efficiency of these treatments, 25 cotton leaves per replicate were chosen randomly from the bottom, middle, and the top of the cotton plants (2 + 1 + 2 leaves per plant). The upper and lower leaf surfaces were examined carefully early at the morning and numbers of insects, and *Tetruncus urticae* counts were recorded. Leaf sampling and insect counting were made just before the spraying and at 24h, 3, 7 and 15 days after the spraying. The reduction percent of the population was estimated by using **Henderson and Tilton's equation (1955)**. Data were analyzed by subjected to analysis of variance (ANOVA). Means were determined for significance at 0.05 using LSD test.

3.RESULTS:

Results in Table (1) indicated that full recommended rate of imidacloprid and thiamethoxam, and profenophos, against *Empoasca* spp, were effective at 24 h. from application.. Reduction percentage in the two successive seasons (2012 and 2013) recorded (86.66, 93.33, 85.43 %), and 92.14, 83.41, 91.32 % reduction on jasid for imidacloprid, thiamethoxam and profenophos, in the two tested seasonsseasons respectively.
Means in each rows followed by different letters are significantly different from each other at < 0.0 5(Duncan test).

Considerable decrease in reduction was noticed at 3, 7, and 15-days intervals observations with the tested treatments throughout the two tested season's (2012 and 2013). Reduction at 3 days intervals recorded (79.51, 72.72and 63.63)(, (83.81, 62.43and 74.72) for imidacloprid, thiamethoxam and profenophos, in the two respectively. Reduction at 7 days were (61.53, 69.23 and 53.84 %)61.53) ,, 54.84 and 69.23 %) in the two tested seasons. Also, at 15 days reduction percent were (37.5, 18.75 and 25.0), (37.5, 20.0 and16.75) for imidacloprid, thiamethoxam and profenophos, in the two seasons respectively. Mixtures of the tested neonicotinoids with profenophos were conducted in the two successive seasons (2012 and 2013) with half-recommended rate led to excellent efficacy (100% reduction percent) at 24 h. Reduction percent were decreased at 3 day intervals reached to (90.90, 81.81), (72.72, 81.81 %). Also, at 7 day intervals was((69.23, 61.53) and (53.84, 69.23), in the two seasons respectively. at 15-days post-treatments reduction percent was (18.75, 12.5%) and (31.25, 37.5%) for (imidacloprid + profenophos) and (Thiamethoxam + profenophos) mixtures, respectively.

Regarding *Bemisia tabaci*, results in Table (2) indicated that full recommended rate of the tested insecticides alone showed the same effects mentioned trend for reduction percentage at 24 h. from application. Reduction percentage recorded (83.33, 85.71), (75.0, 86.66) and (93.33, (83.33for imidacloprid, thiamethoxam and profenophos in the two successive seasons (2012 and 2013), respectively. Considerable drop in reduction was noticed at 3, 7, and 15-days intervals of observations as illustrated

Means in each rows followed by different letters are significantly different from each other at < 0.0 5 (Duncan test)

In Table (2). Mixtures of imidacloprid or thiamethoxam with profenophos in the two successive seasons (2012 and 2013) with half-recommended rate at 24 h. showed significant increasing activity against, *B. tabaci* leading to excellent efficacy (100% reduction percent). On the other hand, Reduction percent were very decreased at 3, 7 and 15 days intervals lead to be similar to the mentioned results with *jassid*.

Data in Table (3) indicated that, population density of *Trips* tabace were reduced after application of imidacloprid, thiamethoxam, and profenophos compared to untreated plots at different exposure dates during the

Table 1: Reduction percentages of *empoasca Spp* after field application of different insecticide treatments during 2012 and 2013 growing seasons

Treatment	24 h	3-days	7 Days	15-days
***Jassid Empoasca* spp.,2012**				
imidacloprid	86.66 a	79.51 a	61.53 a	37.5 a
Thiamethoxam	93.33 a	72.72b	69.23 b	18.75 b
profenophos	85.43 b	63.63c	53.84 c	25.0 c
imidacloprid+profenophos	100.0c	90.90 d	69.23 d	18.75 d
Thiamethoxam+ profenophos	100.0c	81.81 e	61.53 e	12.5 e
L.S.D at5 %	1.7	1.37	1.79	1.2
***Jassid Empoasca* spp.,2013**				
imidacloprid	92.14 a	83.81 a	61.53 a	37.5 a
Thiamethoxam	83.41 b	62.43 b	54.84 b	20.0 b
profenophos	91.32 c	74.72 c	69.23 c	16.75 c
imidacloprid + profenophos	100.0d	72.72 d	53.84 d	31.25 d
Thiamethoxam + profenophos	100.0d	81.81 e	69.23 e	37.5 e
LSD at 5%	2.1	1.9	2.3	1.7

Table 2: Reduction percentages of *Bemecia Tabace* after field application of different insecticide treatments during 201 2and 201 3growing seasons

Treatment	24 h	3-days	7 Days	15-days
***Bemecia Tabace* 2012**				
imidacloprid	83.33 a	71.42a	53.33a	22.22a
Thiamethoxam	75.0 b	64.28b	46.66b	11.11b
profenophos	93.33 c	78.57c	40.0c	16.66c
imidacloprid + profenophos	100.0d	85.71d	66.66d	27.77d
Thiamethoxam+ rofenophos	100.0e	92.85e	80.0e	44.44e
L.S.D at5 %	1.9	1.4	1.5	1.8
***Bemecia Tabace* 2013**				
imidacloprid	85.71 a	81.81a	61.53a	37.5a
Thiamethoxam	86.66 b	72.72b	69.23b	18.75b
profenophos	83.33 c	63.63c	53.84c	25.0c
imidacloprid + profenophos	100.0d	90.90d	69.23d	18.75d
Thiamethoxam+ rofenophos	100.0d	81.81e	61.53e	12.5e
LSD at 5%	2.7	1.15	1.75	2.9

two seasons. During 2012-2013 seasons, imidacloprid, thiamethoxam and profenophos reduced the population of *Trips tabace* with a reduction (93.33, 75.31, and 83.33) and (85.71, 91.34, 82.75) during the two tested seasons when these insecticides were used alone at full recommended rate at 24h from treatments. On contrast these reduction percent were increased to 100.0 % when imidacloprid, thiamethoxam mixed with profenophos at half recommended rate at the same time during the two seasons respectively.

Means in each rows followed by different letters are significantly different from each other at < 0.0 5 (Duncan test.

Results in Table 4 showed a significant reduction on the population of *tranychus urticae* compared to untreated plots at different exposure dates during the two seasons. Results in Table 4 showed the reduction percentage of different insecticides on *Tetruncus urticae* at 24, 3, 7 and 15 days. During 2012 season imidacloprid, thiamethoxam and profenophos caused a significant reduction in the population of *Tetruncus urticae* with a reduction percentage 86.66, 96.66 and 93.33 % respectively when these insecticides were used alone at full recommended rate at 24h from treatments. Considerable drop in reduction was noticed at 3, 7, and 15-days intervals of observations as illustrated in Table (4). These reduction percent were increased to 100.0 % when thiamethoxam, imidacloprid mixed with profenophos at half recommended rate at the same time. During 2013 season, results showed that imidacloprid, thiamethoxam, and profenophos caused a significant reduction in the population of *Tetruncus urticae* reached to 92.14, 85.71 and 94.13 % when these insecticides were used alone at full recommended rate from 24h from treatments. Considerable drop in reduction was noticed at 3, 7, and 15-days intervals of observations as illustrated in Table (4). These reduction percent were very increased to 100.0 % when imidacloprid, thiamethoxam, mixed with profenophos at half recommended rate at the same time. Means in each rows followed by different letters are significantly different from each other at < 0.0 5(Duncan test).

4.DISCUSSION:

In this study, imidacloprid, thiamethoxam, and profenophos caused a high significant reduction in cotton jassid and white fly trips tabace and mite populations. In addition, the efficiency and residual effects of these in-

Table 3: Reduction percentages of *Trips tabace* after field application of different insecticide treatments during 201 2and 201 3growing seasons

Treatment	24 h	3-days	7 Days	15-days
***Trips tabace* 2012**				
imidacloprid	93.33 a	76.92a	66.66a	26.31a
Thiamethoxam	75.31 b	61.53b	46.66b	21.05b
profenophos	83.33 c	69.23c	53.33c	31.57c
imidacloprid + profenophos	100.0d	84.61d	73.33d	36.84d
Thiamethoxam + profenophos	100.0d	84.61e	66.66e	36.84e
L.S.D at5 %	1.81	1.88	2.01	1.81
***Trips tabace* 2013**				
imidacloprid	85.71a	71.42	62.5a	25.0a
Thiamethoxam	91.34b	64.28a	43.75b	20,0b
profenophos	82.75c	78.57b	56.25c	15.0c
imidacloprid + profenophos	100.0d	85.71c	68.75.5d	10.0d
Thiamethoxam + profenophos	100.d	71.42d	62.5e	30.0e
LSD at 5%	1.9	1.4	1.6	2.3

Table 4: Reduction percentages of *Tetruncus urticae* after field application of different insecticide treatments during 201 2and 201 3growing seasons

Treatment	24 h	3-days	7 Days	15-days
***tranychus urticae* 2012**				
imidacloprid	86.66 a	66.66a	56.25a	15.78a
Thiamethoxam	96.66 b	60.0b	43.75b	10.52b
profenophos	93.33 c	73.33c	62.5c	15.78c
imidacloprid + profenophos	100.0 d	80.0d	56.25d	26.31d
Thiamethoxam + profenophos	100.0 d	86.66e	50.0e	21.05e
L.S.D at5 %	1.8`	2.11	1.44	1.6`
***tranychus urticae* 2013**				
imidacloprid	92.14 a	81.81a	61.53a	37.5a
Thiamethoxam	85.71 a	72.72b	69.23b	18.75b
profenophos	94.13 b	63.63c	53.84c	25.0c
imidacloprid + profenophos	100.0 c	72.72d	69.23d	18.75d
Thiamethoxam + profenophos	100.0c	81.81e	61.53e	12.5e
LSD at 5%	2.4	1.37	1.13	2.6

secticides persisted up to 15 days against jassid*, empoasca Spp, thrips tacacea ,,Bemisia tabaci* and *tranychus urticae*. Similar results indicated that neonicotinoid insecticides were highly effective against cotton aphid and reduced the population of this pest (up to 15days) under field conditions (**Shi *et al*., 2011; El-Naggar and Zidan, 2013).** In addition, when outbreaks occur in cotton aphid populations, insecticides application is the only effective tactic to suppress this pest and consequently insect predators often got killed which resurge the pest again and thus more sprays are needed**.**

Also, our results indicate that all insecticides were effective as leaf treatments at 24h of on both insects jassid, *thrips, whiteflies*, *Bemisia tabaci* and *tranychus*. Other investigators reported that imidacloprid showed satisfactory control of sucking pests (**Maienfisch *et al*., 2001; Magalhaes *et al*., 2009**). Such a difference in performance between imidacloprid and thiamethoxam has been reported the obtained results are in agreement with those of several investigators. **Misra (2002**) found that imidacloprid as well as thiamethoxam proved significantly superior in. Also, all insecticides induced a fast initial effect after two weeks of treatment (**El-Naggar and Zidan 2013**). The neonicotinoid, imidacloprid proved to be effective against aphids, jassids, and whitefly. It could reduce the need for foliar sprays by at least four applications (**Zhang *et al*., 2014).**

Mixtures of various compounds which acting on different sites has been adopted to slow down insecticide resistance evolution, safe and cost effective based on the optimum use of existing compounds (**Martin *et al*., 2003**). Theoretically, insecticide mixtures can delay the onset of resistance development more effectively than rotation of insecticides if resistance to each compound is independent and rare **(Curtis, 1985**). Neonicotinoids act agonistically on nicotinic acetylcholine receptors **(Elbert *et al*., 2007**) and have been shown to have no or less cross-resistance to conventional insecticides **(Mokbel 2007**). In the present study, the synergistic effect between profenofos (acetyl choline esterase inhibitors) with acetamiprid and thiamethoxam (neonicotinoids) may be due to either Ops caused accumulation of acetylcholine at the junction of motor nerve and ganglia of the autonomic nerves system leading to enhance the nerve impulse firing in the post synaptic membrane or inhibiting esterase which play a certain role in metabolism of neonicotinoids. Neonicotinoids may work as agonists and exhibit excitatory effect to nicotinic acetylcholine receptors. Therefore, both cholinesterase inhibitors and neonicotinoids have a similar net result on the transmission of nerve impulses. Also, different insecticides applied separately at full recommended rate or in mixtures at half recommended rate in order to see their efficacy against the sucking insect pests and mites of cotton at different time intervals, acetamiprid, thiamethoxam alone in mixtures with profenofos at half recommended rate proved to be the most effective as it reduced the maximum population of jassid, whitefly, thrips and mite at 24h from treatments. These findings are in complete conformity with those of **Tufail *et al*. (1995), Saleem and Khan (2001**), who reported good control of sucking insects with this insecticide. Confidor 20 SL (imidacloprid) @ 250 ml/acre was almost equally effective against the sucking insects like jassid, whitefly and thrips. These results agree with those of **Mullins and Christie (1995), Tufail*et al*. (1995), Hamed*et al*. (1997), Saleem and Khan (2001) and Saleem *et al*. (2001**), who found this insecticide very effective against the sucking insects of cotton.

Generally, the present work showed that tested neonicotinoids can be used effectively to control jassid, thrips, whiteflies, Bemisia tabaci and mite in cotton fields. The tested mixtures proved excellent efficacy to tested pests

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فاعلية مركبات الاميداكلوبراید و السیامیثوکسام منفرده ومخلوطه بالبروفینوفوس ضد الجاسید والتربس والعنکبوت الاحمر و الذبابة البیضاء علی نبات القطن تحت الظروف الحقلية

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معهد بحوث وقاية النباتات –مركز البحوث الزراعية- الجيزة- مصر

الملخص العربى:

الجاسيد والتربس والعنكبوت الحمر والذبابة البيضاء من الآفات الهامة علي نباتات القطن في مصر.وتم إجراء هذا البحث في موسمين متعاقبين(2.12و2013) لتقدير فاعلية مركبين من مركبات النيونيكوتينويد (الاميداكلوبراید و السیامیثوکسام) والمركب الفسفوري البروفينوفوس منفردة وخليط كلا منهم مع البروفينوفوس والمفاضلة بينهم في نسبة الخفض لكلا من الجاسيد والتربس والعنكبوت الحمر والذبابة البيضاء و ذلك بتقدير النسب المئويه للخفض بعد الرش فى الحقل بها على فترات مختلفه و مقارنة كفائتها فى المكافحه فى كل فترة من هذه الفترات وقد تمت التجربة فى حقول القطن بمحافظه بنى سويف بمعدلات الاستخدام الموصي بها من الاميداكلوبراید و السیامیثوکسام ومركب بالبروفينوفوس منفردة .وبالنسبة للمخاليط فتم خلط نصف المعدل الموصي بها من مبيدات نيونيكوتينويد مع نصف المعدل من مركب البروفينوفوس وتقدير نسب الخفض لكلا من الجاسيد والتربس والعنكبوت الاحمر و الذبابة البيضاء حيث تم فحص عينات عشوائية من نباتات القطن قبل الرش مباشرة وبعد 24 ساعة لتقدير الاثر الفورى و3ايام و 7 أيام و15يوم من الرش لتقدير الاثر الباقى . ودلت النتائج علي أن استخدام هذة المبيدات بالمعدلات الموصي به قد اثر على تعداد هذة الافات موضع الدراسة وقد أعطي نسب خفض مختلفه.أما عند خلط نصف معدلات الاستخدام لمبيدات نيونيكوتينويد مع بالبروفينوفوس فأعطت نتائج تفوق استخدام كل مركب بمفردة. وعلي هذا فإن إستخدام المخاليط المختبرة بنصف معدل الاستخدام زاد من فاعليتها. ويمكن الإستفادة من نتائج هذة الدراسة في تقليل معدل استخدام هذة المبيدات وبالتالي تقليل التلوث البيئي وتقليل الضغط الإنتخابي لمقاومة الحشرات ضد فعل المبيدات.