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# EFFECTIVENESS OF CERTAIN INSECT GROWTH INHIBITORS ON COTTON LEAF WORM

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ABSTRACT: Field experiments were carried out in 1998 and 1999 cotton seasons at Sharkia Governorate. Two insect growth inhibitors (IGI 's), i.e. lufenuron and flufenoxuron were applied at recommended rates onto cotton plants infested with larval population of cotton leaf worm (CLW). The efficacies of the two IGI 's against 2nd and 4th larval instar of CLW were determined under laboratory conditions. The toxicity lasting effect of food consumption were evaluated. The results showed that:

1) The tested IGI 's, were proven to be potent chemicals against larval stages of cotton leaf worm. Data confirmed that lufenuron more toxic than flufenoxuron. Five days after application, lufenuron caused the maximum (100%) reduction in CLW larval infestation. Flufenoxuron reached maximum reduction (100 %) after 7 days of application. Both IGI 's nullified adult emergence from treated larvae and lowered markedly cotton leaf worm food consumption by the exposed 2nd and 4th instar larvae of CLW.
2) Both antimoulting compounds remained effective against 2nd and 4th larval instars for twenty one days minimum. Accordingly, lufenuron and flufenoxuron are long lasting chemicals.
3) Strikingly, no normal adult was emerged at any time after lufenuron application till the experimental end time during the two seasons. But in case of flufenoxuron 17.5 % of the pupated treated 2nd instar larvae were emerged at zero time during 1998 season. During 1999 season, 5 – 12.50 % of the starting insects succeeded to emerge after their exposure for 2 days

**feeding on flufenoxuron treated leaves collected after 7, 14 and 21 days of application, respectively.**

4) **Mean of food consumption (g / larva / day) of 4th instar larvae was higher than that of 2nd instar larvae after 0, 7, 14 and 21 days. Mean of food consumption was decreased in the treated larvae as compared with that of the untreated ones at all periods tested. Mean food consumed by CLW 2nd or 4th instar larvae from lufenuron treated leaves were lower than that from flufenoxuron treated leaves.**

**Key words:** *Lufenuron – Flufenoxuron – IGR 's – cotton leaf worm – Efficiency – Food consumption.*

## INTRODUCTION

Cotton plants are liable to be attacked by several pests all over their life span, i.e. early in the season during seedling stage, mid season and late in the season during the fruiting stage. Cotton leaf worm, *Spodoptera littoralis* (Boisd.), the most destructive pest, attack all parts of cotton plant including green bolls.

Lufenuron (Match) is an insect growth inhibitor (IGI) interfering with chitin synthesis. This mode of action is specific for arthropods. Because only immature stage (larvae, nymph) form chitin, lufenuron does not affect adults. For some insects it acts also as an ovicide. For larvae, it acts mainly by ingestion. It is not systemic but some translaminar action has been shown with *Spodoptera littoralis* on cotton. The main uses are against larvae of lepidopterous pests of many crops.

Flufenoxuron (Cascade) is an acylurea insect growth regulator with high levels of acaricidal activity. It kills pest mites and insects through interference with chitin formation during cuticle development in insect juvenile stage. Failure of the cuticle to develop fully, causes death of insects during the moulting process between the various larval stages. Obvious results about leufenuron and flufenoxuron and other insect growth inhibitors were reported by many authers (Mulder and Giswijt, 1973; Turunen, 1977; Ascher and Nemny, 1976; Tanton and Khan, 1978; Stewart and Philogene,

1983; Shaaban and Mourad. 1994 and Zaki, 2001.

The present work aimed to investigate the potency of lufenuron and flufenoxuron to manage cotton leaf worm, *Spodoptera littoralis* under field and field - laboratory experiments.

## MATERIALS AND METHODS

### 1. Pesticides used.

a) Match 5 % EC (lufenuron)

b) Cascade 5%EC (flufenoxuron).

Chemical group of the two tested compound is acyl urea. The chemicals were obtained from the Research Institute for plant protection, A.R.C., Egypt.

### 2. Experiments.

#### 2.1. Field experiment.

Field experiments were carried out at Minia El-Kamh, Sharkia Governorate during 1998 and 1999 cotton seasons. The two tested compound were used at rates of application, 12.5 and 6 gram a.i. / fed. for flufenoxuron and lufenuron, respectively.

Cotton seeds of Giza 85 Var. was sown on March 16 and April 5 in 1998 and 1999 growing seasons, respectively. The experimental area (about ¾ feddan) was divided into 4 subareas represented 4 replicates. Each subarea contained 3 plots, one plot was left without any pesticide application as a check. The two IGI's were tested in the other two plots.

The experimental area was left without any collection of leaf worm egg masses for 10 days before insecticide application. Spray of the IGI 's was carried out on June 20th and 27th during 1998 and 1999 growing season, respectively.

A knapsack hand sprayer with one nozzle boom and 200 liters of insecticide solution per feddan was used. The number of larvae was counted on 100 hills per each treatment directly before application and after 1,3,5 and 7 days of application. The formula of Henderson and Tilton (1955) was used to calculate the percentage of reduction in the larval population. The reduction in larval population one day after application was calculated and considered initial kill. The average reductions in larval infection after 3,5 and 7 days of application was calculated and considered the residual effect of the two tested IGI's.

## 2.2. Field – laboratory experiments.

### 2.2.1. Rearing technique under laboratory conditions.

Egg-masses of the cotton leaf worm, *S.littoralis* (CLW) were collected early in the seasons from cotton field in Sharkia Governorate before the beginning of any chemical control programme and maintained in one Lb glass jars capacity covered with muslin cloth under laboratory conditions of 25 ± 2 C° and 65 ± 5 % R.H.. Newly hatched larvae were fed daily with a fresh castor bean leaves, then transferred to 2Lb glass jars. Larvae were allowed to pupate in such jars containing saw dust. Pupae were transferred into petri dishes bedding with filter paper in which they were kept in cages (35 × 35 × 35 cm) until adult emergency. The emerged adults were fed with 15 % sugar solution and provided with leaves of *Nearuim oleander* (L.) for egg laying.

### 2.2.2. Treatments.

Leaf samples were collected randomly after dryness of the wetted cotton leaves following insecticidal application (zero time), 7, 14 and 21 days post treatment with flufenoxuron and lufenuron at the rates of 12.5 and 6 gram a.i / fed., respectively. Treated leaves were offered to the laboratory reared 2nd and 4th instar larvae of *S. littoralis* in 1 Lb. glass jar capacities. Ten larvae of each instar were used for each treatment in 4 replicates. The treated - larvae were kept under laboratory conditions and examined after 48 hours feeding, the dead and alive larvae were counted. The survived larvae were transferred to another clean glass jars and supplied with untreated cotton leaves until pupation. Percent mortality were corrected according to Abbott's (1925) formula.

Pupation and adults emergency percentages were counted from survival larvae in each treatment.

### 2.2.3. Effect of flufenoxuron and lufenuron on food consumption of cotton leaf worm.

The following steps were followed for the determination of food consumption's:

1- Moisture content was determined in fresh cotton leaves at 80C° for 24 hours, then percentage of dry weight in plant samples was calculated.

2- In the day of spraying, 4 jars of ½ kg. capacities were prepared to each replicate. Ten 2nd and ten 4th instar larvae were put to feed on defined weight of treated fresh cotton leaves for 2 days only, thence after on untreated leaves until pupation.
3- Remaining leaves of feeding were taken daily and dried at 80C° for 24 hours. Dry weight was calculated for remaining leaves.
4- Average of daily food consumption for each larva was calculated (on the basis of dry weight).
5- Previous steps were carried out with check.

## RESULTS AND DISCUSSION

Field and field – laboratory experiments were conducted to evaluate the efficacy of lufenuron and flufenoxuron against CLW during 1998 and 1999 cotton seasons. Data obtained are shown in Tables 1 and 2 for field experiments and in Tables 3,4,5,6,7 and 8) for the field – laboratory experiments.

### 1. Field experiment.

Data obtained in Tables (1 and 2) show that after one day of spraying, lufenuron revealed higher initial reduction of infestation (60.12 – 63.77 %) than flufenoxuron (33.74 – 41.87 %). It is to be mentioned here that, quite high infestation with CLW were recorded at the start of the experiment, (2001 – 2151 per 100 hills). Reduction percentages of larval population were 89.99, 100 and 100 % in the 1st season and 92.33, 100 and 100 % in the 2nd season after 3, 5 and 7 days, respectively for lufenuron. The respective values were 54.25, 79.0 and 100 % (in the 1st season) and 61.65, 82.65 and 100 % (in the 2nd season) for flufenoxuron. The average of residual activities was 96.66 % for lufenuron that was higher than that of flufenoxuron (77.75 %) in the 1st season. The same trend of data was recorded in the second season. However, one week after application, the percent reduction in CLW infestation was the same (100 %) for both antimoulting insecticides.

Accordingly, lufenuron was proven to be more rapid and effective against CLW than flufenoxuron. Five days after application, lufenuron caused the

maximum (100 %) reduction in CLW larval infestation. Flufenoxuron reached maximum reduction 100 % after 7 days of application.

Raslan, (1994) reported that complete protection to cotton plants against attack of cotton leaf worm was obtained when IGR's – insecticides mixtures were sprayed during the initial of infestation. El-Maghraby *et al.* (1999) studied the efficiency of three IGRs, i.e, diflubenzuron, methoxyfenozide and lufenuron, applied at the recommended and half recommended rates and compared with three recommended insecticides against the cotton leaf worm, *Spodoptera littoralis*. Three days after application, the tested insecticides were more effective than the tested IGR's while after 7 days, the IGR's at the recommended rate were as good as tested insecticides.

## 2. Field – laboratory experiments.

A field laboratory experiment was conducted to study the effect of lufenuron and flufenoxuron against the 2nd and 4th instar larvae of *S. littoralis* as well as the effect on pupation, adult emergence and food consumption after zero time, 7, 14 and 21 days of treatment during 1998 and 1999 season. Data are represented in Tables (3, 4, 5, 6, 7 and 8).

### 2.1. Effects of lufenuron and flufenoxuron:

#### 2.1.1. Effect on 2nd instar larvae.

Data presented in Table (3) show percent mortalities after feeding on treated leaves until pupation during 1998 season. Treated leaves were collected after 2 hours of spraying that was considered zero time, then after 7, 14 and 21 days of spraying. In case of feeding on treated leaves at the zero time, lufenuron caused 60.52 and 100% mortalities after 2 and 5 days of feeding. Lower mortalities were measured for flufenoxuron that caused 50.0, 72.22, 78.78, 78.78, 81.25 and 81.25% mortalities after 2, 5, 7, 9, 11 and 13 days of feeding, respectively. After 7 days of treatment, lufenuron caused lower mortalities as compared to that at zero time. The recorded mortalities were 55, 94.59 and 100 % mortalities after 2, 5 and 7 days of feeding. Relatively lower mortalities were recorded for flufenoxuron that caused 45, 72.97, 76.47, 76.47 and 100 % mortalities after 2, 5, 7, 9

and 11 days of feeding, respectively indicating relatively lower mortalities as compared to those at the zero time of application. After 14 days of treatment, lufenuron caused 7.5, 77.5, 88.88, 88.88, 90.62 and 60.62 % mortalities after 2, 5, 7, 9, 11 and 13 days of feeding, respectively. For flufenoxuron the respective mortalities were 25, 70, 72.22, 72.22, 90.62 and 90.62 % indicating very weak initial and good residual effects. Twenty – one days after application lufenuron caused 5.0, 74.35, 86.11, 86.11 and 100 % mortalities, while flufenoxuron caused 17.5, 66.6, 69.44, 69.44 and 100 % mortalities after 2, 5, 7, 9 and 11 days of feeding, respectively. Such data indicated the good residual effect. The experimented data showed that both antimoulting compounds remained effective for twenty one days minimum. Accordingly, lufenuron and flufenoxuron are long lasting chemicals. Lufenuron was more toxic than flufenoxuron till 7 days after application. Higher initial and residual effects were recorded for lufenuron as compared to that of flufenoxuron. However after 14 days of application, lower initial toxicities were measured for lufenuron as compared to that of flufenoxuron. The contrary was true concenrning residual and latent effects. Both chemicals reached maximum mortality at 5 – 11 days after exposure. Strikingly noted that no normal adults were emerged at any time after IGI 's application up to 21 days except for flufenoxuron at zero time where only 17.5 % of the pupated insects, i.e. 7.5 % from the starting number of 2nd instar larvae were emerged as adults. This general trend of data was almostly the same during the second season.

Accordingly, lufenuron exerted higher toxicities than flufenoxuron concerning initial and residual effects. Moreover, lufenuron lasted highly effective for longer periods as compared to that of flufenoxuron. Lufenuron reached maximum mortality (100 %) to 2nd instar larvae exposed to and feeded on cotton leaves pre-treated with lufenuron 21 days before. The respective mortality for flufenoxuron was 68.75 %, in the second season, after nine days feeding CLW, 2nd instar – larvae. So, lufenuron seemed to be more potent, last longer and higher effective than flufenoxuron against CLW on cotton.

No adults emergence was noted for lufenuron till the experiment end time. For flufenoxuron 5, 5 and 12.5 % of the starting insects (2nd instar larvae) succeeded to emerge after larval exposure for 2 day- feding on treated leaves after 7, 14 and 21 days of application, respectively during the second season only.

**2.1.2. Effect on 4th instar larvae.**

The same general trend of data was noted during the two seasons (Tables 5 and 6). This may give confidence with the experimental results.

Data presented in Table (5) show percent mortalities after feeding 4th instar larvae of CLW on treated leaves collected 2 hours (zero time), 7, 14 and 21 days after spray time. In case of feeding on treated leaves at zero time, lufenuron caused 50, 91.42 and 100 % mortalities while flufenoxuron caused 40, 77.14 and 100 % mortalities, respectively after 2, 5 and 7 days of feeding and exposing the fourth instar larvae to the IGI's treated leaves. Seven days after application, lufenuron caused 47.22, 86.48 and 100 % mortalities, after 2, 5 and 7 days of exposure and feeding. Flufenoxuron caused lower mortalities at the respective periods. The same general trend was noted in the second season (Table 6).

After 14 days of IGI 's application lufenuron caused 47.36, 72.72, 87.5, 87.5, 87.5, 87.5 and 87.5 % mortalities after 2, 5, 7, 9, 11 and 13 days of feeding, respectively. Lower mortality was calculated for flufenoxuron after 2 days only.

Twenty – one days after application, lufenuron and flufenoxuron caused more or less the same values of mortalities after 5, 7, 9, 11 and 13 days of exposure by feeding. Accordingly, under each condition and after 0, 7, 14 and 21 days of application lufenuron was more potent than flufenoxuron. Oftenly, higher initial, latent initial and residual mortalities were recorded for lufenuron as compared to the respective values for flufenoxuron.

Up to seven days after application lufenuron reached maximum mortality (i.e. excellent control) while flufenoxuron remained at 84.37 % mortality indicating very good control. No adult emergence were recorded for both chemicals tested. Pupated insects failed to give live adults

whatever normal or malformed. In spite of the pupation of 20 % of treated insects by lufenuron or flufenoxuron, all pupae were malformed and failed to give adults. No insect pupation and consequently no adult emergence was recorded for lufenuron at any time after application till 21 days, during 1999 season. However adult emergence was 100 % from pupated insects indicating 2.5 % of the starting number of larvae exposed to flufenoxuron treated leaves 7 and 21 days after application. Healthy adult emergence was generally nullified during 1999 season.

The obtained results are in agreement with those recorded by Omayma *et al.* (1982) who found that percentage of mortality of *S. littoralis* larvae fed on Dimilin treated leaves for one day proportionally increased with time of feeding on untreated leaves and completely failed to pupate. In other cases, the percentage of pupation was significantly low (1 to 20). Khalil and Watson (1986) found that low mortalities of *S. littoralis* (28.32 %) was obtained with diflubenzuron alone when applied at (50, 100 and 125 g.a.i./ fed.) 24 h., after treatment, while 98.4 – 93.3 % mortalities were obtained when diflubenzuron was combined at 100 g.a.i. / fed. with fenvalerate at 100 g.a.i. / fed. Positive correlation was found between insect feeding period and its mortality percent. Rizk and Attia (1990) studied the effect of hexafluron and flufenoxuron when were administered orally at 10 – 200 ppm to 4th instar larvae of *S. littoralis*. Increase in concentration up to 50 ppm for flufenoxuron caused decreases in larval growth rates. Growth rate reductions and percentage mortalities were positively correlated with increases in feeding periods. Concentration above 100 (for flufenoxuron) and 200 ppm (for hexafluron) seemed to have antifeedant properties. Gomaa *et al.* (1995) found that after 2 days of treatment, the IGI 's compounds were not effective. The mortality of larvae began after three days. After 7 days the mortalities were 31, 24, 28 and 6 % for diafenthiuron, buprofezn, pyriproxyfen and control, respectively.

### 2.1.3. Effect of lufenuron and flufenoxuron on food consumption.

Data presented in Tables (7 and 8) show the effect of the tested insect growth inhibitors. lufenuron

and flufenoxuron on food consumption of the 2nd and the 4th instar larvae of *S. littoralis* at zero time, 7, 14 and 21 days of the respective IGI 's spray time.

Data presented in Table (7) show that the mean of food consumption (g. / Larva / day) of 2nd instar larvae fed on lufenuron sprayed leaves was 0.0095, 0.0334, 0.0491 and 0.0264 g. / larva / day while higher consumptions i.e. 0.0254, 0.0324, 0.0521 and 0.0208 g / larva / day were measured for flufenoxuron treated leaves after 0, 7, 14 and 21 days of treatment, respectively. The same general trend of data was noted in the second season (Table –8).

Mean food consumption for the 4th instar larvae was 0.0218, 0.0458, 0.0223 and 0.0135 g / larva / day on lufenuron treated leaves while it was 0.0338, 0.0478, 0.0234 and 0.0222 g / larva / day on flufenoxuron treated leaves, respectively after 0, 7, 14 and 21 days of IGI 's application. The same general trend was measured in the second season.

The present data showed that mean of food consumption (g / Larva / day) was always higher for the 4th instar CLW larvae as compared to that for the second larval instar. This relation was valid at any time, i.e., 0, 7, 14 and 21 days after IGI 's spray time. Mean food consumed was decreased in the treated larvae as compared with that for untreated larvae at all periods of the experiment i.e. 0, 7, 14 and 21 days after IGI 's application. Mean food consumed by cotton leaf worm larvae from lufenuron treated leaves was always lower markedly than that consumed from flufenoxuron treated leaves considering the same larva ,instar and period after spray – time.

These results agree with that obtained by Shaaban and Mourad (1994) who studied the effect of the insect growth inhibitor, flufenoxuron on consumption of food by 4th instar larvae of *S. littoralis* (Bosid). Larvae were fed on flufenoxuron – treated leaves for 48 hours. Food consumption were decreased on the treated leaves as compared with that on the untreated check at all periods of the experiment. Data also indicated that flufenoxuron decreased the values of consumption index (c.i.). Gomaa *et al.* (1995) studied feeding response, biological and toxicological potential of some IGR 's on *S. littoralis*. The new insect growth regulators namely,

diafenthiuron, buprofezin and pyriproxyfen were evaluated against 4th instar larvae of *S. littoralis*. Larvae were fed on castar bean leaves treated with 500 ppm solution of the IGR 's using dipping technique. Results obtained indicated that pyriproxyfen increased the feeding activity (18.5 %). Diafenthiuron revealed great reduction in areas consumed (33.3 %) and buprofezin treatment showed a slight reduction for the feeding response (7.4 %).

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Table (1): Effect of lufenuron and flufenoxuron sprayed onto cotton leafworm, *S. littoralis* expressed in percent reduction of infestation under field conditions at 1998 growing season.

| Treatments | Rate of application g.a.i. / fed. | No. of larvae before spray | % reduction in infestation at indicated days after application | | | | Mean of residual activity % (3-7 days) |
|---|---|---|---|---|---|---|---|
| | | | Initial after 24 hours | Residual | | | |
| | | | | 3 | 5 | 7 | |
| Lufenuron | 6 | 2001 | 60.12 | 89.999 | 100 | 100 | 96.66 |
| Flufenoxuron | 12.5 | 2048 | 33.74 | 54.25 | 79 | 100 | 77.75 |
| No. of larvae in check control | | 2151 | 2213 | 2126 | 2028 | 1931 | |

Table (2): Effect of lufenuron and flufenoxuron sprayed onto cotton leafworm *S. littoralis* expressed in percent reduction of infestation under field conditions at 1999 growing season.

| Treatments | Rate of application g.a.i. / fed. | No. of larvae before spray | % reduction in infestation at indicated days after application | | | | Mean of residual activity % (3-7 days) |
|---|---|---|---|---|---|---|---|
| | | | Initial after 24 hours | Residual | | | |
| | | | | 3 | 5 | 7 | |
| Lufenuron | 6 | 2080 | 63.77 | 92.32 | 100 | 100 | 97.44 |
| Flufenoxuron | 12.5 | 2150 | 41.87 | 61.65 | 82.65 | 100 | 81.43 |
| No. of larvae in check control | | 2130 | 2267 | 2189 | 2125 | 1940 | |

Table (3): Latent toxicities of lufenuren and flufenoxuron against CLW 2nd instar larvae, percent pupation and adult emergance during 1998 season.

| Days of collecting samples after spraying | Insecticides tested | % mortality at the indicated days after feeding on: | | | | | | % pupation | % Adult emergance |
|---|---|---|---|---|---|---|---|---|---|
| | | Sprayed leaves | Unsprayed leaves | | | | | | |
| | | 2 | 5 | 7 | 9 | 11 | 13 | | |
| 0 (2 hours) | Lufenuron | 60.52 | 100 | - | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 50.00 | 72.22 | 78.78 | 78.78 | 81.25 | 81.25 | 17.5 | 7.5 |
| 7 | Lufenuron | 55.00 | 94.59 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 45.00 | 72.97 | 76.47 | 76.47 | 100 | - | 0.0 | 0.0 |
| 14 | Lufenuron | 7.50 | 77.5 | 88.88 | 88.88 | 90.62 | 90.62 | 5 | 0.0 |
| | Flufenoxuron | 25.00 | 70.00 | 72.22 | 72.22 | 90.62 | 90.62 | 7.5 | 0.0 |
| 21 | Lufenuron | 5.00 | 74.35 | 86.11 | 86.11 | 100 | - | 0.0 | 0.0 |
| | Flufenoxuron | 17.50 | 66.60 | 69.44 | 69.44 | 100 | - | 0.0 | 0.0 |

Table (4): Latent toxicities of lufenuren and flufenoxuron against CLW 2nd instar larvae, percent pupation and adult emergance during 1999 season.

| Days of collecting samples after spraying | Insecticides tested | % mortality at the indicated days after feeding on: | | | | | | % pupation | % Adult emergance |
|---|---|---|---|---|---|---|---|---|---|
| | | Sprayed leaves | Unsprayed leaves | | | | | | |
| | | 2 | 5 | 7 | 9 | 11 | 13 | | |
| 0 (2 hours) | Lufenuron | 94.28 | 100 | - | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 75.67 | 94.59 | 94.28 | 96.87 | 96.87 | 96.87 | 2.5 | 0.0 |
| 7 | Lufenuron | 90.00 | 97.36 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 67.50 | 92.10 | 92.10 | 97.75 | 97.75 | 97.75 | 5 | 5 |
| 14 | Lufenuron | 82.50 | 90.62 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 40.00 | 43.75 | 59.37 | 75.0 | 78.12 | 87.5 | 12.5 | 5 |
| 21 | Lufenuron | 42.50 | 72.22 | 72.22 | 100 | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 22.50 | 40.00 | 54.54 | 68.75 | 71.87 | 84.37 | 12.5 | 12.5 |

Table (5): Latent toxicities of lufenuren and flufenoxuron against CLW 4th instar larvae, percent pupation and adult emergance during 1998 season.

| Days of collecting samples after spraying | Insecticides tested | % mortality at the indicated days after feeding on: | | | | | | % pupation | % Adult emergance |
|---|---|---|---|---|---|---|---|---|---|
| | | Sprayed leaves | Unsprayed leaves | | | | | | |
| | | 2 | 5 | 7 | 9 | 11 | 13 | | |
| 0 (2 hours) | Lufenuron | 50.00 | 91.42 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 40.00 | 77.14 | 100 | - | - | - | 0.0 | 0.0 |
| 7 | Lufenuron | 47.22 | 86.48 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 33.33 | 75.00 | 84.37 | 84.37 | 84.37 | 84.37 | 10 | 0.0 |
| 14 | Lufenuron | 47.36 | 72.72 | 87.50 | 87.50 | 87.50 | 87.50 | 12.5 | 0.0 |
| | Flufenoxuron | 28.94 | 72.72 | 87.50 | 87.50 | 87.50 | 87.50 | 12.5 | 5 |
| 21 | Lufenuron | 10.52 | 68.75 | 75.00 | 75.00 | 75.00 | 75.00 | 20.0 | 0.0 |
| | Flufenoxuron | 2.63 | 68.75 | 75.0 | 75.00 | 75.00 | 75.00 | 20.0 | 0.0 |

Table (6): Latent toxicities of lufenuren and flufenoxuron against CLW 4th instar larvae, percent pupation and adult emergance during 1999 season.

| Days of collecting samples after spraying | Insecticides tested | % mortality at the indicated days after feeding on: | | | | | | % pupation | % Adult emergance |
|---|---|---|---|---|---|---|---|---|---|
| | | Sprayed leaves | Unsprayed leaves | | | | | | |
| | | 2 | 5 | 7 | 9 | 11 | 13 | | |
| 0 (2 hours) | Lufenuron | 65.71 | 100 | - | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 75.69 | 100 | - | - | - | - | 0.0 | 0.0 |
| 7 | Lufenuron | 62.50 | 97.36 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 57.5 | 94.73 | 97.36 | 97.36 | 97.36 | 97.36 | 2.50 | 0.0 |
| 14 | Lufenuron | 52.50 | 93.75 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 40.0 | 87.50 | 87.50 | 100 | - | - | 0.0 | 0.0 |
| 21 | Lufenuron | 47.89 | 87.87 | 100 | - | - | - | 0.0 | 0.0 |
| | Flufenoxuron | 36.84 | 81.81 | 84.37 | 96.87 | 96.87 | 96.87 | 2.5 | 2.5 |

Table (7): Effect of lufenuron and flufenoxuron on food consumption (g / larva / day) of 2nd and 4th larval instars of *S. littoralis* after periods of IGI 's application during 1998 season.

| Day of sampling after spray | Laval stage | Treatments | Consumption mean (g / L / d)* |
|---|---|---|---|
| 0 | 2nd | Lufenuron | 0.0095 |
| | | flufenoxuron | 0.0254 |
| | | control | 0.0336 |
| | 4th | Lufenuron | 0.0218 |
| | | flufenoxuron | 0.0338 |
| | | control | 0.0429 |
| 7 | 2nd | Lufenuron | 0.0334 |
| | | flufenoxuron | 0.0324 |
| | | control | 0.0341 |
| | 4th | Lufenuron | 0.0458 |
| | | flufenoxuron | 0.0478 |
| | | control | 0.0545 |
| 14 | 2nd | Lufenuron | 0.0491 |
| | | flufenoxuron | 0.0521 |
| | | control | 0.1057 |
| | 4th | Lufenuron | 0.0223 |
| | | flufenoxuron | 0.0234 |
| | | control | 0.0281 |
| 21 | 2nd | Lufenuron | 0.0264 |
| | | flufenoxuron | 0.0208 |
| | | control | 0.0275 |
| | 4th | Lufenuron | 0.0135 |
| | | flufenoxuron | 0.0222 |
| | | control | 0.0367 |

Figures are the average of food consumption per 40 larvae during lifetime. (g / L /d)* = gram food / larva / day.

Table (8): Effect of lufenuron and flufenoxuron on food consumption (g / larva / day) of 2nd and 4th larval instars of *S. littoralis* after periods of IGI 's application during 1999 season.

| Day of sampling after spray | Laval stage | Treatments | Consumption mean (g / L / d)* |
|---|---|---|---|
| 0 | 2nd | Lufenuron | 0.0063 |
| | | flufenoxuron | 0.0405 |
| | | control | 0.0551 |
| | 4th | Lufenuron | 0.00068 |
| | | flufenoxuron | 0.0337 |
| | | control | 0.0742 |
| 7 | 2nd | Lufenuron | 0.0112 |
| | | flufenoxuron | 0.0587 |
| | | control | 0.0375 |
| | 4th | Lufenuron | 0.0201 |
| | | flufenoxuron | 0.0350 |
| | | control | 0.0439 |
| 14 | 2nd | Lufenuron | 0.0310 |
| | | flufenoxuron | 0.0350 |
| | | control | 0.0368 |
| | 4th | Lufenuron | 0.0185 |
| | | flufenoxuron | 0.0162 |
| | | control | 0.0395 |
| 21 | 2nd | Lufenuron | 0.0247 |
| | | flufenoxuron | 0.0323 |
| | | control | 0.0353 |
| | 4th | Lufenuron | 0.0364 |
| | | flufenoxuron | 0.0423 |
| | | control | 0.0532 |

Figures are the average of food consumption per 40 larvae during lifetime. (g / L /d)* = gram food / larva / day.

# تأثير بعض مناهضات النمو الحشرية على دودة ورق القطن

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أجـريت تجارب حقليه بمركز منيا القمح - شرقية خلال عامى ١٩٩٨، ١٩٩٩ حيث تم رش مـبيدات ليوفينيورون (مانتش) و فلوفينوكسيورون (كاسكيد) بالمعدلات الموصى بها على نباتات القطن فى وجود يرقات دودة ورق القطن وذلك بهدف دراسة سمية المبيدين لدودة ورق القطـن تحت الظروف الحقليه. كما تمت دراسة تأثير المبيدين على موت يرقات العمر اليرقى الـثانى والرابع وكذلك على التعذير وخروج الحشرات الكاملة وأيضاً تأثير هذه المبيدات على الإستهلاك الغذائى للعمرين اليرقى الثانى والرابع لدودة ورق القطن من خلال تجارب حقليه - معمليه وأوضحت الدراسة النتائج التاليه:

١) وجـد أن مثبط النمو ليوفينيورون كان أسرع تأثيراً ضد يرقات دودة ورق القطن من فلوفينوكسـيورون حيث سبب إرتفاع معدل إنخفاض الإصابة بدودة ورق القطن إلى ١٠٠ % بعد خمسة أيام بينما كانت بعد سبعة أيام فى حالة فلوفينوكسيورون.

٢) وجـد أن المركـبين لهما تأثيراً حتى ٢١ يوماً بعد التطبيق على العمر اليرقى الثانى ليـرقات دودة ورق القطـن وأنهمـا يـتميزان بـتأثير طويـل المدى وكانت سمية ليوفينيورون أعلى وأسرع من تلك لمثبط النمو فلوفينوكسيورون. وكان التأثير الأولى والأثـر الباقى لمثبط النمو ليوفينيورون أعلى من تلك المقدرة للفلوفينوكسيورون ولم تخـرج أى حشـرات كامـلة مـن اليرقات التى تغذت على أوراق معاملة بالمثبط ليوفيـنيورون خـلال فـترة التجربة. وعلى العكس من ذلك تمكنت بعض الحشرات الكاملة (٧,٥ %) من الخروج من معاملات فلوفينوكسيورون خلال عام ١٩٩٨م عند

الـتغذية عـلى ورق معـامل بعـد الرش بساعتين وخلال عام ١٩٩٩م كانت نسبة الحشـرات التى خرجت من التعذير ٥ %، ٥ %، ١٢,٥ % بعد ٢١ ، ١٤، ٧ يوماً من المعاملة على التوالى.

٣) أوضـحت نتائج المعاملات على العمر اليرقى الرابع بعد إنقضاء ساعتين بعد الرش، ٧، ١٤، ٢١ يوماً بعد التطبيق أن ليوفينيورون أعلى فى التأثير الأولى والتأثير الباقى عن فلوفينوكسيورون وكانت نسبة خروج الحشرات الكاملة ٢,٥ % من عدد اليرقات الـتى تغـذت على الأورق المعاملة خلال الفترات ٧ – ٢١ يوم بعد المعاملة خلال ١٩٩٩ وبـلغت نسـبة الـتعذير لليرقات التى تغذت على الأوراق المعاملة بأى من المركبين أقل من ٢٠ %.

٤) إتضح أن متوسط الإستهلاك الغذائى لليرقه الواحدة بالجرام خلال اليوم الواحد للعمر اليـرقى الـرابع أعلى من نظيرة العمر اليرقى الثانى وأن معدل الإستهلاك الغذائى إنخفـض فى حالة المعاملة بمثبطات النمو الحشرية تحت الدراسة عن المعدل المقدر لليرقات الغير معاملة. كما وجد أن معدل الاستهلاك الغذائى لليرقات التى تغذت على ورق معـامل بالمـبيد ليوفيـنيورون أقل من معدل إستهلاك اليرقات المعاملة بالمبيد فلوفينوكسيورون.