



SUMMARY

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Field studies were carried out on cotton plants (Giza 85 variety) for three years (2004-2006). Plants received three applications of each of five different treatments, *i.e.*, EM (effective microorganisms), Dipel 2X (bioinsecticide), Mikrofol (foliar fertilizer), Pleo (new chemical insecticide) and Conventional Spray Program. The effect of these treatments on percentages of cotton bolls infestation by *Pectinophora gossypiella* and *Earias insulana* and reductions in larval content, % of opened bolls, seeded cotton yield, fiber quality, some biochemical components on cotton bolls and numbers of predators of bollworms were evaluated.

The obtained results may be summarized as follow:-

I. Field studies:

A. 2004 and 2005 season

1. Effect of application of tested products on the rate of infestation with bollworms:

1.1. Pink bollworm, *Pectinophora gossypiella*:

1.1.1. Infestation percent:

The obtained data indicated marked effect of the tested agrochemicals in reducing the rate of infestation of cotton bolls with the pink bollworm, during the two seasons of study. On the other hand, the time after spraying of agrochemicals showed fluctuated infestation percentages according to the tested compound, but, in general, pink bollworm infestation percentages were lower than in the untreated check. The seasonal

mean percentages of *P. gossypiella* infested bolls were 26.56 and 28.39 % among bolls of the untreated cotton plants in 2004 and 2005 seasons, respectively, opposed to 20.17, 17.20, 18.67, 4.1 and 5.6 % in 2004, and 21.22, 18.67, 19.78, 4.75 and 6.10 % in 2005, respectively, after application of EM, Dipel 2X, Mikrofol, Pleo and C.S. Program, respectively. These results showed that the tested agrochemicals had, almost, the same trend of efficacy in the two seasons where the chemicals insecticide Pleo was the most potent, while the lowest efficacy resulted from microorganisms (EM) treatments.

The efficacies of the tested agrochemicals in reducing infestation with *P. gossypiella* are also clear in the two years' means of reduction percentages of infested bolls with treatments than control. The highest reduction % (83.83 %) occurred among bolls that received sprays with Pleo, followed by C.S.Program treatment which caused 77.47 % reduction in percentages of infested bolls than control. Thus, Pleo and C.S.Program could be, fairly, considered the most efficient against the pink bollworm infestation than the other treatments which caused 36.18, 33.30 and 26.39 % reductions in infestation % than control for treatments with Dipel 2X, Mikrofol and EM, respectively.

1.1.2. Larval content in cotton bolls:

Efficacies of the 5 tested agrochemicals in reducing the number of *P. gossypiella* larvae in cotton bolls took the same trend as that recorded for their effect on percentage of bolls infestation by the same pest species. Mean numbers of 22.33 and 24.20 larvae were the seasonally counted in 2004 and 2005,

respectively/100 bolls after EM sprays, opposed to 27.19 and 26.69 larvae in bolls of the control treatment showing that EM was the least effective product. While, on the contrary, Pleo had the highest efficacy (4.75 and 4.69 larvae/100 bolls), followed by C.S.Program which came the second in efficacy (6.10 and 7.90 larvae/100 bolls in 2004 and 2005, respectively).

1.2. Spiny bollworm, *Earias insulana*

1.2.1. Infestation percent:

The obtained data indicated that the application of each of the 5 tested agrochemicals caused significant reductions in percentages of infested cotton bolls by *Earias insulana*, but the efficacy varied among the different products. As occurred in *P. gossypiella* bolls inspected, the effective microorganisms compound (EM) led to 19.06 and 20.02 % infested bolls with *E. insulana* opposed to 22.56 and 24.23 % in the control treatment in 2004 and 2005 seasons, respectively, indicating 16.33 and 16.79 % reductions in bolls infestation, respectively. On contrary, Pleo had the severest efficacy (4.41 and 4.65 % infested bolls; *i.e.* 80.76 and 80.09 % reductions, respectively). According to the two seasons' mean of reduction percentages in bolls' infestation % with the spiny bollworm, efficacy of the tested agrochemicals could be arranged, descendingly as; Pleo (80.42 % reduction than control), C.S.Program (72.13 %), Dipel 2X (27.77 %), Mikrofol (26.41 %) and EM which proved to be the least effective one showing 16.56 % reduction than control. These results proved that Pleo and Conventional Spray Program had, certainly, superior influence in protecting cotton bolls against the attack by the spiny bollworm, compared with the

other tested agrochemicals. Such finding was pronounced with the three applied sprays. The new insecticide Pleo which contains the active ingredient pyridalyl showed satisfactory protective potential against bollworms infesting cotton bolls. The same trend of results was recorded with the recommended conventional spray program for bollworms control in Egypt.

1.2.2. Larval content in cotton bolls:

The obtained data indicated the same trend of efficacy of the treated agrochemicals against the spiny bollworm infestations. Three sprays on cotton plants with each of the 5 used products caused significant reductions in the number of *E. insulana* larvae counted/100 bolls. Pleo had always the superior efficacy, leading to the lowest number of spiny bollworm larvae in cotton bolls (4.30 and 4.50 larvae/100 bolls in 2004 and 2005, respectively, followed by C.S. Program (10.20 and 8.60 larvae/100 bolls), Mikrofol (20.74 and 22.50 larvae/100 bolls) and Dipel 2X (20.33 and 21.88 larvae/100 bolls). While, effective microorganisms (EM) product had the least effect on *E. insulana* larval counts (27.19 and 26.41 larvae/100 bolls in the two seasons, respectively).

2. Effect of tested agrochemicals on seeded cotton yield and some biochemical compounds of cotton bolls:

At the end of 2004 & 2005 cotton seasons, the seeded cotton produced in each treatment was weighed; data showed that the insecticide Pleo was superior leading to obtaining 2232.5 kg/fed., indicating 90.81 % increase in yield than control (1170.0 kg.). The other agrochemicals may be arranged descendingly according to the resulted yield to C.S.Program (1908.7 kg.; 63.14

% increase), Mikrofol (1662.5 kg; 42.05 %), Dipel 2X (1617.5; 38.25 %) and EM which was the least effective on seeded cotton yield, leading to 1462.5 kg/fed. indicating 25.0 % increase in cotton yield than control.

Data also, indicated significant role of tested agrochemicals in increasing the nitrogen content of bolls than the untreated check. The nitrogen percent were 1.06 (untreated check); 1.75, 1.56, 2.11, 1.35 and 1.37 % in cases of EM, Dipel, Mikrofol, Pleo and Conventional spray program treatments, respectively. Phosphorous content showed different trend, where Mikrofol (0.53 %) only caused significant increase than the check. The phosphorous content expressed as % reached 0.41 % (untreated check), opposed to 0.49, 0.47, 0.53, 0.46 and 0.46 % with EM, Dipel, Mikrofol, Pleo and Conventional spray program treatments, respectively. Data also showed significant increase in potassium content of bolls treated with EM and Mikrofol, while Dipel, Pleo and Conventional Spray Program showed insignificant changes in potassium content than the normal level. Potassium content reached 1.14, 1.83, 1.11, 2.14, 1.11 and 1.09 % in cases of untreated check, EM, Dipel, Mikrofol, Pleo and Conventional Spray Program, respectively.

As for carbohydrates content of cotton bolls, data indicated the significant increase in the amount of this biochemical component because of EM and Mikrofol treatments, while Dipel, Pleo and Conventional Spray Program showed insignificant role in this respect. The carbohydrate content reached 10.1, (untreated check), while it was 11.7, 10.4, 15.4, 10.1 and 9.98 % with the mentioned agrochemical treatments,

respectively. Also, significant increase in total indoles of cotton bolls treated with the tested agrochemicals than the untreated check. The total indoles reached 184.8 mg/100g fresh weight of cotton bolls (untreated check), opposed to 339.0, 336.0, 341.0, 232 and 244 mg/100g fresh weights in cases of EM, Dipel, Mikrofol, Pleo and Conventional spray program, respectively. The contrary was obtained with total phenols of cotton bolls, where agrochemical treatments significantly decreased this biochemical aspect than the untreated check. The total phenols reached 190.0 mg/100g fresh weight (untreated check), while those were 189.0, 171.0, 165.0 mg. in case of EM, Dipel and Mikrofol treatments. On contrary, Pleo and Conventional Spray Program treatments caused increased in total phenols content to reach 207 and 237 mg/100g fresh weight, respectively, indicating 8.95 and 24.74 % increase, respectively, than the check.

Data also, indicated the occurrence of different influences on the photosynthetic pigments (chl.a and chl.b) of cotton bolls by the assayed agrochemicals. The microorganisms complex (EM) and Mikrofol (fertilizers complex) caused significant increase in these pigments, while Dipel, Pleo and Conventional Spray Program treatments showed insignificant differences in chl. a, chl. b than the untreated check. In terms of figures, the chl.a contents were changed from 213.0 mg/100 gm. fresh weight (untreated check) to 323.0 (EM), 232.2 (Dipel), 360.5 (Mikrofol), 221.0 (Pleo) and 220.0 mg/100 fresh weight (Conventional Spray Program). Thus indicating 52.02, 9.01, 69.25, 3.75 and 3.2 % increase by treatments, respectively, than

the check. The same trend of results was recorded with chl.b, which increased by 21.58, 4.33, 40.75, 2.37 and 0.9 % after treatments by EM, Dipel, Mikrofol, Pleo and Conventional Spray Program, respectively than control (207.1 mg./100 g. fresh weight).

3. Effect of tested agrochemicals on total counts of predators in cotton fields:

Data showed that the total populations of insect predators were generally higher in the untreated cotton field compared with treated field. Also, in untreated cotton field the population was, generally, higher during 2005 (477 individuals) than 2004 season (469 individuals).

Regarding, the weekly counts of predators on cotton plants, those were, in general, in high levels during July and August throughout the two seasons. In untreated cotton field, one peak of predators' abundance occurred at the 2nd week of August with 73 and 77 individuals/40 double sweep-net strokes during 2004 and 2005 seasons, respectively. While, in EM treated cotton field, the total seasonal population was higher during 2005 season (482 individuals) than 2004 (460 individuals); weekly counts showed highest number of total predators during the 2nd week of August with 99 individuals/40 double net strokes during 2004 and during last week of July, 2005 (76 individuals). That was followed by fertilizer complex (Mikrofol) treatment which showed total predators' population in 2004 season (456 individuals) than 2005 season (440 individuals); the peak of predators' abundance occurred in the 2nd week of August in 2004 (66 individuals) and 2005 (65 individuals/40 double net strokes).

Also, when the field was treated by the bio insecticide Dipel, the total population of insect predators was higher during 2004 season (474 individuals) than 2005 (450 individuals).

Severest effect on the counts of predators resulted after cotton plants treatments by the chemical pesticide Pleo that led to the lowest total seasonal counts (156 and 142 individuals/2004 & 2005 seasons, respectively) indicating 66.7 & 70.2 % reductions than the control. Treatments by Conventional Spray Program caused also severe effect on the predators' total seasonal counts in 2004 and 2005 (175 individuals in each of the two seasons, respectively indicating 62.7 and 63.3 % reductions in the numbers of total predators than control, respectively).

B. 2006 cotton season.

In this experiment, plots of the cotton field received 4 successive sprays from each of different treatments; a- G1 treatment: Mikrofol, Pleo, Mikrofol and Mikrofol, b- G2: Mikrofol, Pleo, Mikrofol and Pleo, c- G3: Mikrofol, Mikrofol, Pleo and Pleo and d- Conventional Spray Program; i.e. Pestban, Sumigold, Telethon and Pestban. Results were as follows:

1. Effect of treatments on the rate of infestation by bollworms:

1.1. Pink bollworm, *Pectinophora gossypiella*:

1.1.1. Infestation percent:

Data indicated that application of three groups of chosen agrochemicals caused considerable reduction in the rate of infestation of cotton bolls with the pink bollworm. The mean

infestation percentages by pink bollworm reached 30.3 % among bolls of the untreated cotton plants, opposed to 10.27 % (G 1), 6.15 % (G 2), 5.47 % (G 3) and 6.0 % after application of Conventional Spray Program Such figures of infestation percent after treatments are significantly lower than that of the untreated check. These figures indicated 62.5, 76.5, 80.0 and 76.1 % reductions than control in case of G (1), G (2), G (3) and conventional Spray program, respectively.

1.1.2. Larval content in cotton bolls:

Data indicated the superior role of three Groups schemes in protecting cotton bolls from the attack by the pink bollworm. The mean number of larvae/100 bolls within the season reached 40.0 larvae (untreated), opposed to 17.1, 10.6, 10.3, 10.6 larvae in case of G1, G2, G3 and Conventional Spray Program, respectively.

1.2. Spiny bollworm, *E. insulana*:

1. 2.1. Infestation % of cotton bolls:

Infestation percentages of bolls showed fluctuated values by the time elapsed after treatment as well as in comparison with the untreated check. The mean percent of infested bolls reached 31.30 % (untreated check), while those were 12.30, 8.72, 6.30 and 8.01 after treatments of G1, G2, G3 and conventional spray program, respectively. These data confirmed that treatments led to reduction percentages in infested bolls by *E. insulana* than control by 50.5, 65.0, 70.0 and 70.3 % respectively.

1.2.2. Larval content in cotton bolls:

Data indicated the superior role of three Groups schemes in protecting cotton bolls from the attack by the spiny bollworm larvae. The mean seasonal number of *E. insulana* larvae/100 bolls reached 42.0 larvae (untreated) and 21.7, 13.3, 12.6 and 12.8 larvae in case of G1, G2, G3 and Conventional Spray Program, respectively. The highest larval content in untreated bolls was recorded during the 2nd week of September (81.3 larvae). The same trend of results was obtained with G1 (48.0 larvae), G2 (31.0 larvae), G3 (24.5 larvae) and 26.5 larvae for Conventional Spray Program.

2. Effect of tested agrochemicals on seeded cotton yield and some biochemical compounds of cotton bolls:

Data confirmed the significant role of tested agrochemicals schemes in increasing the yield of seed cotton than the untreated check. Such effects were pronounced within the 2006 season. The seeded cotton yield reached 1123.75 kg/fed (untreated check), opposed to 1710.0 kg/fed (G1), 2150.5 kg/fed (G2), 2188.0 kg/fed (G3) and 1805.5 kg/fed (Conventional Spray Program). The increase percent in seed cotton than the untreated check reached 52.1, 91.3, 94.7 and 60.7 % in case of G1, G2, G3 and Conventional spray program, respectively.

Data also, indicated the significant role of tested programs in increasing the nitrogen content of bolls than the untreated check. Percentages of nitrogen were 1.09 (untreated check) and 3.32, 2.1, 2.88 and 1.42 % in case of G1, G2, G3 and Conventional Spray Program treatments, respectively. Phosphorous content was increased by application of the tested

agrochemicals regimes than the untreated check. The phosphorous percent reached 0.62 (untreated check); while those were 0.81, 0.72, 0.74 and 0.59 % in case of G1, G2, G3 and Conventional spray program treatments, respectively. Data also showed the significant increase in potassium content in bolls treated with G1, G2 and G3 spray regimes (3.0, 2.2 and 2.76 %), while Conventional Spray Program showed insignificant increase in potassium content (1.81 %) than the normal level (1.47 %).

As for carbohydrates content of cotton bolls, data indicated the significant increase in the amount of this biochemical component because of G1, G2 and G3 treatments (17.0, 11.6 and 14.6 %), while Conventional Spray Program showed insignificant role in this respect (10.1%, opposed to 9.6 % for the untreated check).

Data also, indicated increases in total indoles in cotton bolls treated with the different regimes of agrochemicals (342, 241, 272 and 199 mg./100 g fresh weight of bolls) than the untreated check (160 mg./100 g.f.w.). Thus indicating 113.0, 50.6, 70.0 and 24.0 % increase with the same treatments, respectively than control. Total phenols were also, increased, significantly with tested agrochemicals than the untreated check. The total phenols reached 158.0 mg/100 g.f.w. (untreated check), and 193.0, 234.0, 240.0 and 221 mg/100 g.f.w. by application of the other 4 regimes, respectively, showing 22.15, 48.10, 51.89 and 39.87 % increase with G1, G2, G3 and Conventional Spray Programs, respectively. Also, data showed the significant role of tested agrochemicals regimes (G1, G2 and G3) in increasing the

carotenoids content of bolls (249, 200 and 209 mg./100 g.f.w., respectively). While, Conventional Spray Program treatments showed insignificant difference (184 mg.) than the untreated check (180 mg/g.f.w. of bolls). Thus indicating 37.5, 10.4, 15.4 and 1.6 % with the same mentioned treatments, respectively than control.

3. Effect of the applied spraying regimes on total counts of predators in cotton fields:

Data confirmed that predaceous insects were found in higher abundance on cotton plants during July and August throughout 2006 season. On untreated cotton plants, higher numbers of predators occurred during the 2nd, 3rd and the last weeks of August with 92, 104 and 113 individuals/ 40 double sweep-net strokes, respectively. While, on treated cotton plants, the highest total seasonal number of predators (484 individuals) was counted after G1 program was applied. This total count was followed by 305, 271 and 227 individuals on cotton plants after treatments by G2, G3 and Conventional Spray Program treatments, respectively. In all cases, these total seasonal counts of predators were lower than those counted from the untreated check (647 individuals).