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EFFECT OF DEFOLIANTS ON SOME AGRONOMIC CHARACTERISTICS AND ON CONTROL OF COTTON INSECT PESTS IN MINIA GOVERNORATE

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Abstract: Two field experiments were carried out at Mallawi Agricultural Research Station Farm Minia, during 2005 and 2006 cotton growing seasons to evaluate the effect of defoliants dropp (Thidiazuron), ethrel (ethephon) and calcium superphosphate on the leaf shedding, earliness and the yield of Giza 83 cotton cultivar, as well as their effects in controlling some insect pests and natural enemies in cotton. Results of this study could be summarized as follows:

1. In both seasons, dropp and ethrel gave a significant pronounced increase in leaf *abscission%*, *earliness%* and the number of bolls opening per plant as compared with the control. Also, dropp and ethrel tended to Increase *lint %* but to decrease boll weight and seed index. In contrast control and calcium superphosphate showed no significant effect on all agronomic characters in both seasons. Seed cotton yield was not significantly affected by any treatment in both seasons.

2. Dropp caused a significant reduction in the aphids and the spider mite infestations.

3. The calcium superphosphate caused a significant reduction in jassids and whitefly infestations.

4. Defoliants caused a significant effect on immature stages population of whitefly and increased the parasitism percentage to (86.15%) as compared with 62% in control.

5. Defoliants reduction of the bollworms infestation and the number of larvae was 14% and 10 larvae when calcium superphosphate was used 6^{th} weeks after spraying.

6. Dropp caused the highest reduction in the bollworm infestation rates (94.12%).

7. Dropp caused a significant effect in reducing the loss of the cotton yield of 17.07% compared with 27.39% in control.

Key words: defoliation, agronomic characteristics, insect pests, cotton.

Introduction

Defoliation is a standard management practice in many cotton areas worldwide not only because of its agronomic benefits but also because it is considered as apart of integrated pest management strategy at the same time. The possible agronomic benefits of cotton defoliation include accelerating boll

opening with advancing crop harvest, facilitating mechanical or hand picking, improving lint grade by reducing its trash and green stain, and in some cases increasing seed cotton yield (Robinson *et al.,* 2001). Numerous studies have shown that cotton treatment with various defoliants, including dropp and ethrel, increased leaf loss, accelerated boll opening and enhanced earliness (Eid *et al.*,1990; Liu *et al.,* 2001 and Stewart *et al.,* 2000). However response of cotton yield to the defoliation process was inconsistent (Abdel-Al,1990; Eid *et al.*,1990 and Holman *et al.*,1998).

The cotton is considered to be an economic crop with along and favorable growing season that stimulate the pest problems, in the late season as well as Aphids, *Aphis gossypii* (Glover); Jassid, *Empoasca lybica* (deberg); white fly, *Bemisia tabaci* (Genn.) and the red spider mite *Tetranychus spp*. may cause injury to the bolls and quality, the pink bollworm, *Pectinophora gossypiella* (saund.) and the spiny bollworm, *Earias insulana* (Boisd.) are actually the main cotton pests in Egypt, Both pests usually produce tremendous loss in quantity and quality of the cotton yield, as well as in lint quality (Scavone *et al.*,1955; Adkission, *et al.*,1963; Abul-Nasr, *et al.*,1971; El-Saadany *et al.,* 1975; Abul-Naga and Ghanim, 1979; Cai *et al.*,1985; Ismail, 1998; Abdel-Galil *et al.*, 2002 and Ismail *et al.*, 2005). Another investigators observed that the activity of pests and their Natural enemies on cotton (Abbas and El-Deeb,1993; Abdel-Galil,1971 and Gerling,1990). The effect of chemical termination and relationship to reduce the loss of cotton yield by bollworms and other pests in the late season was studied by Bailey, 1947; Addicott and Walhood,1954; Addicott *et al.*,1959; Anonymous, 1960; Addkisson,1962; Abdurakh manov, 1971; Bariola *et al.*,1976; Bariola *et al.*, 1979; Ismail *et al.*,1986 and Bariola *et al.*,1987.

The main purpose of this work is investigate the role of defoliants and their relationship with the main pests and associated of the natural enemies for reducing the loss of the yield of cotton in the late season, and the effect on some agronomic characteristics and the possibility addition to integrated pest management strategy.

Materials and Methods

The present study was carried out at Mallawi agricultural Research, Station, Farm Minia, Egypt, in 2005 and 2006 cotton growing seasons to shed light on the efficiency of dropp, ethrel and calcium superphosphate as harvest-aid chemicals on leaf abscission, earliness, yield and some yield components of cotton cultivar Giza 83, as well as their effects on the population growth of pest and associated of natural enemies the loss of cotton yield by bollworms,

and the reduction and infestation percentages.

The defoliants were applied at 40% boll opening stage at the recommended rates of 20 g/fed. for dropp, 250 cm/fed. for ethrel and 15kg/fed. for calcium superphosphate.

***Chemical structure* of defoliants were used :**

1. Dropp (N-phenyl Nl, 2,3-thiadiazol-5-yl urea)
2. Ethrel (2-chloroethyl phosphoric acid)
3. Superphosphates ($Ca(H_2PO_4)_2$ H_2O).

The collected data were as follows:-

A- Agronomic traits:

Five guarded plants were randomly chosen from the control row of each plot, and their leaves were counted and recorded on the day of defoliants application and 15 days later to calculate leaf abscission %. At harvest,15 days after defoliants application, all open bolls of the selected plants were counted and collected and later they were ginned to determine number of open boll per plant, boll weight (g), lint% and seed index earliness% was determined by dividing *ist*. Pick yield by total yield. Seed cotton yield in kentar per feddan was estimated on the basis of the yield per plot.

B- Entomological trials:

1.The effect of defoliants on the population density of pests and associated natural enemies:

Ten plants for every plot were randomized chosen to count the pests and the natural enemies every week. The pests were *Aphids gossypii* Glover, *Empoasca lybica* deberg., *Bemisia tabaci* Lind., and the two spotted mite (*tetranychus arabicus* Koch., *Tetranychus cucurbeta*). The natural enemies were (lady bird, *Coccinella chrysoperla carnea* Stephen, the rove beetle, *Paederus alfierii* Koch., and the true spiders mites. True spiders (or: Araneae): Families: Theridiidae (*Steatoda* spp.), Thomisidae (*Thomisus citrinellus*), Corinnidae (*Castianeira antinorii*), Lycosidae (*Erigone* spp.), Gnaphosidae (*Zelotes* spp.), Clubiondae (*Chircanthum* spp.) and Salticidae (*Neathe oculata*).

2. The effect of defoliants on the parasoited on *Bemisia tabaci* (Genn.).

Ten plants were chosen randomly, three leaves from three levels (Middle – upper, lower). Each group from leaves were put in paper bags and directly taken to the laboratory, where carefully examined by the aid of stereomicroscope. Third and fourth instars were inspected to determine parasitism of each species. The two parasities were (*Encarsia lutea*,

Masi.) and *Eretmocerus munds* Merect. (Fam: Aphelinidae). Parasitism % by the total were estimated by calculating the proposition of the parasitizes third and fourth instars from the sum total of the third and fourth instars. Also, parasitized nymphs were put on wetted filter paper in Petri dishes till the emergence of parasitoid/adults, which were counted and identified.

3. Effect of the chemical termination on the bollworms infestation, and the larvae numbers:

The defoliants used were (dropp, ethrel, and superphosphate), 100 green bolls were randomly taken from each plot treated with defoliants and the untreated plot (one sampling every week), and examined in the laboratory and counted the percentage of infestation and number, for the larvae of bollworms. *Effect of the chemical termination on the reduction of the number of bolls remained, bolls infestation and the loss percentage in the cotton yield after picking.* Examined 100 plants randomly for every treatments and calculated the loss of cotton yields. This trend about meaned sampling (one sample weekly, from 17th of August to 14th of September.

The experiment design:

The experimented design was randomized complete block with four replicates. Plot area was 13m^2 including 5 ridges; 4m^2 long and 65cm. apart. Sowing dates was during the last week of March in both seasons. All agricultural practices were done as recommended for cotton production.

Statistical analysis :

T. test of pairs were used to emphasize the differences between the number of pests and a the species of predacious arthropods (Sendecor and Cochran, 1967).

Results and Discussion

1- Agronomic characteristics:

1-1: Leaf abscission and earliness %:

It can be seen in Table (1) that the application of dropp and ethrel markedly increased leaf shedding% and earliness% as compared with the control in both seasons. However, calcium superphosphate showed no significant effects on leaf shedding or earliness in both seasons. It is thought that dropp or ethrel increases leaf shedding and crop earliness through enhancing ethylene production. It has been shown that hormonal defoliants such as dropp (thidiazuron) and ethrel (ethephon) increase the production of ethylene, the hormone known to stimulate leaf abscission and Fruit ripening. Ethylene promotes leaf abscission via reducing auxin transport to the abscission layer located at the base of leaf petiole, and increasing the activities of

various cell wall degrading enzymes such as pectinase and cellulose which breakdown the middle lamella and the primary cell wall in cells of abscission zone and eventually separate and drop the leaf (Cothren and Witten, 2001). Likewise, increasing ethylene release leads to splitting of carpel (boll) walls, a subsequent drying or dehiscing of the carpals, and opening of the boll (Stewart *et al*, 2000). Furthermore, enhancing leaf shedding by dropp or ethrel may provide within – canopy conditions suitable for forcing bolls to faster opening which accelerate boll opening and advancing crop earliness. Several studies demonstrated similar results; Eid *et al*, (1990), Abdel-Al (1990) and Stewart *et al*, (2000).

1-2 : Yield and yield components :

Data presented in Table (1) show that, in comparison with the control, dropp and ethrel generally increased number of open bolls / plant and lint% and reduced boll weight and seed index in both seasons, but the significant level was not always reached. Seed cotton yield was not significantly affected by the defoliants application in both seasons. In comparison with the control, calcium superphosphate exerted no significant effect on yield and its components in the two studied seasons. It could be said that higher leaf abscission associated with dropp or ethrel application may create external and enternal conditions that promote boll opening and increase number of open bolls per plant. However, such conditions may force some upper canopy bolls to premature opening which resulted in lower boll weight and seed index but higher lint %. Seed cotton yield was not significantly affected by dropp or ethrel because the reduction in average boll weight was compensated by the increase in boll number. These results are in agreement with those of Abdel-Al (1990), Eid *et al*. (1990), Holman *et al.* (1998) and Stewart *et al*. (2000).

2- Effect of spraying certain chemical termination :

A- Population dynamics of pests and predators during cotton growing season, 2005 and 2006:

Data presented in Table (2) showed that, the lowest mean number of Aphids. *Aphis gossypii* (Glover) was 574.90 individuals at dropp, while in superphosphate and ethrel it were 606.70 and 739.70 individuals. Superphosphate recorded the lowest mean number of Jassids, *Empoasca lybica* 155.60 individuals, in dropp and ethrel it were 174.40 and 192.20 individuals, respectively. The used of superphosphate recorded the lowest mean number for white fly, *Bemesia tabaci* (Genn.), (141.20 individuals), while dropp and ethrel it were 143.90 and 165.70 individuals. The dropp recorded the lowest mean number of the red spider mite,

Tetryanchus spp. (24.40 individuals), while the two defoliants were 28.20 and 33.60 individuals, respectively, and the untreated plots the mean number of pests for aphids, jassids, white fly and red spider mite were 1328.90, 332.40, 279.10 and 51.70 individuals, respectively.

B- The number of immature stages for B. *tabaci* and their parasitism percentages :

Data Table (3) showed that the number of immature stages for *B. tabaci* and parasitism percentages before spraying the chemical termination and weekly until the end of taking samples (8^{th} week). It could be observed that dropp was higher Parasitism percentage (75.67) than other defoliants were (69.81, 60.75 and 70.15), respectively.

The dropp recorded a highest number of parasitism percentage was (75.86), while ethrel, superphosphate and untreated plants were (73.91, 69.74 and 67.92), respectively. The used of superphosphate as a defoliant recorded a highest Parasitism percentage was (86.15), while dropp, ethrel and untreated plants were (72.10, 69.23 and 80.45), respectively. The ethrel recorded highest number of Parasitism percentage was (66.67), while dropp, superphosphate and untreated plants were (65.85, 66.15 and 72.92), respectively .The ethrel noticed highest number of parasitism percentage was (78.08), while dropp, superphosphate and untreated plants were (76.92, 73.33 and 77.22), respectively. The used of superphosphate recorded a highest number of Parasitism percentage was (77.50), while dropp, ethrel and untreated were (72.88, 71.05, 70.59), respectively. The dropp recorded a highest number of Parasitism percentage was (80.00) while anothers were (79.36, 74.29 and 74.39), respectively . The ethrel recorded highest number of Parasitism percentage was (77.17 and 75.68) for 7 and 8 weeks after applications. The population density of parasite, *Encarsia Lutea* was higher *Eretomocerus munds*. Results revealed that most of the identified commonly on cotton plants.

Results revealed that most of the identified species in this survey were well known and exist commonly on cotton plants. This finding is in agreement with those of many investigators who have studied these piercing sucking pests (Aphids, Jassids, White fly and two species of spider mites belonging to order Acarina were recorded. Also unidentified complex of the true spiders represented order Araneae on cotton plants during all its growth stages. Such records have been reported previously by Abbas and El-Deeb (1990); Ismail (1998) and Ismail *et al.* (2005).

C- Bollworm infestations and the effects of chemical termination :

Data Table (4) showed the infestation percent and the number of larvae for bollworms after using defoliants. Using of superphosphate caused the lowest number of infestation and number of larvae (14% and 10 larvae), while dropp, ethryl and untreated plants were 21%, 17; 17%, 13 and 22%, 19 larvae, respectively.

D- The reduction Percentage for the remained bolls, infestation the loss for yield after using chemical termination :

Data Table (5) recorded the reduction percent of the number of green bolls remained, the infestation of bolls and the loss for the yield by bollworms after using chemical. Dropp caused higher reduction in bollworm infestations (94.12%), while ethrel and superphosphate gave 85.06 and 64.25%. Dropp caused reduction in the loss of cotton yield by 17.07% as compared with 18.5, 23.3 and 27.39 in ethrel, superphosphate and control.

It is important to point out herein that more studies in the f*uture* are greatly in need to evaluate the effect of chemical termination as a methods for monitoring the pests and associated predators and *parasites* in the cotton fields.

Conclusion:

The conclusions achieved from the conducted study could be summarized in the following points:-

1. The most agronomic benefits of using dropp and ethrel is enhancing crop earliness of maturity without reduction in seed cotton yield.

2. A significant reduction in the infestation by the aphids, jassids, whitefly and red mite.

3. A significant increase in the predaceous arthropods, population increase in the parasitism on whitefly.

4. A reduction in the green bolls and the number of larvae of bollworms remained after picking the cotton yield, and decrease in the number of overwintering larvae.

5. A reduction in percentage of the loss in the cotton yield.

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تأثير مسقطات الأوراق على بعض الصفات المحصولية ومكافحة الآفات الحشرية فى القطن بمحافظة المنيا

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أجريت تجربتان حقليتان فى مزرعة محطة البحوث الزراعية بملوى فى محافظة المنيا خلال موسمى قطن 2005، 2006 لتقييم تأثير مسقطات الأوراق الدروبوب ، والأثيريل ، والسوبر فوسفات على تساقط الأوراق والتبكير فى النضج لمحصول القطن صنف جيزة 83 ، وتأثيرها على تعداد بعض الآفات الحشرية والأعداء الطبيعية فى القطن : -

وقد أوضحت النتائج المتحصل عليها ما يلى :

1- أعطى استخدام الدروبوب والأثيريل زيادة معنوية فى كلاً من النسبة المئوية لتساقط الأوراق والتبكير فى النضج وعدد اللوز المتفتح للنبات فى كلاً من موسمى الدراسة ، وتصافى الحليج فى موسم 2005 فقط ، ولكن أدى إلى نقص معنوى فى وزن اللوزة ومعامل البذرة فى كلاً من موسمى الدراسة 2005 ، 2006 .

2- لم يؤد سوبر فوسفات الكالسيوم أى تأثير معنوى على كل الصفات المحصولية التى تمت دراستها مقارنة بالغير معامل خلال موسمى الدراسة .

3- لم تكن هناك فروق معنوية فى محصول القطن الزهر نتيجة الرش بالمسقطات خلال موسمى الدراسة .

4- وجود تأثير معنوى للدروبوب فى خفض نسبة الإصابة بالمن والعنكبوت الأحمر ..

5- كان لسوبر فوسفات الكالسيوم تأثيراً معنوياً فى خفض الإصابة بالجاسيد والذبابة البيضاء .

6- أدى استخدام المسقطات إلى زيادة معنوية فى تعداد الأعداء الطبيعية فى نهاية موسم القطن .

7- وجدت زيادة معنوية فى تعداد الأطوار الغير كاملة من الذبابة البيضاء .

- زيادة معنوية فى النسبة المئوية للتطفل حيث وصلت إلى (86.15٪) فى المعامل وغير المعامل (62٪) .
- أدى استخدام المسقطات إلى خفض الإصابة بديدان اللوز وعدد اليرقات حيث أصبح (14٪ ، 10 يرقة) عند استخدام سوبر فوسفات الكالسيوم فى الأسبوع السادس من المعاملة .
- أدى استخدام الدروبوب إلى اعلى نسبة خفض فى الإصابة بديدان اللوز حيث وصلت (94.12٪).
- أدى الدروبوب إلى خفض الخسارة فى الناتج النهائى لمحصول القطن إلى (17.07٪) مقارنة بالغير معامل حيث وصلت إلى (27.39٪) .