

EFFICIENCY OF SOME SYSTEMIC INSECTICIDES FOR CONTROLLING BEAN SEEDLING PESTS WHEN USED AS SEED TREATMENT

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Abstract

The efficiency of three systemic insecticides Gaucho 70% SP (Imidaclopride), Agrinate 90% SP (Methomyl) and Cartan 10% GR (carbofuran), were tested alone and in combination with mineral oil (lubrication cut of petroleum oil) as anti-releasing agent at the rate of 50% oil/insecticide against the bean seedling pests. Insecticides alone and when mixed with anti-releasing agent were used as seed treatment for bean seeds at the rate of 8g/kg seeds. Infestation of bean seedlings with sucking piercing pests was determined weekly after 3 up to 11 weeks of planting bean seeds obtained result: indicated that all tested insecticides were effective in reducing infestation of the present pests on bean seedlings: aphid, whitefly and spider mite up to the 11th week after planting. The addition of anti-releasing agent increased the efficacy of the tested insecticides. According to the critical economic limitation of infestation level, it could be said that the tested insecticides when used as seed treatment for bean seeds caused more protection for bean seedlings up to 8 weeks of planting date.

INTRODUCTION

Seed treatment method is a preferred method for controlling seedling plant pests for its easy of application, economic, effective and safe on food crop. This method is successful for controlling fungi diseases infesting seedling, therefore efforts should be directed towards application of this method for controlling insects infesting seedling. Many researchers proved success of systemic insecticides as seed treatment for controlling sucking piercing pests infested seedlings (Adkinson, 1958, Hopkins *et al.*, 1958, 1959, Parencia, *et.al.*, 1957 a and b, and Reynolds, *et al.* 1957). Recent researchs proved that Imidacloprid (Gaucho) the systemic insecticide proved success in controlling sucking insects infested cotton seedlings such as aphid, thrips and whiteflies when used as seed treatment (Saba, 1991, Diehr *et al/* 1991, Anonymous 1992 and El-Hamady & Abu-Sholoa, 1999), therefore Gaucho is recommended in Egypt for controlling aphid and thrips on cotton plants as seed treatment (Anonymous 2003).

The aim of the present work is to evaluate the efficiency of three systemic insecticides: Imidacloprid, Methomyl and carbofuran when used alone and in

combination with lubrication as bean seed dressing against sucking piercing pests infesting bean seedlings.

MATERIALS AND METHODS

The following systemic insecticides were used in this study:

- 1- Imidacloprid (Gaucho 70% SP).
- 2- Methomyl (Agrinate 90% SP).
- 3- Carbofuran (Cartan 10% GR).

Carbofuran 10% GR was reformulated to dust powder formulation by well grinding of granulated carbofuran using grinder.

All insecticides were used alone and in combination with lubrication cut of petroleum oil as anti-releasing agent at rate of 50 % of insecticide, as a result of decreasing solubility of insecticide in water.

Seed treatments:

The bean seeds were treated in small container after moistened with 5ml water/50 g seeds at the rate of 8 g insecticide/kg bean seeds, (as recommended for gaucho). Then the seeds were air-dried through spreading on clean plastic sheets and then directly planted in the field.

Field experiment:

Treated bean seeds were planted in hills each have 2-3 seeds, 30 cm were left between each two hills. Cultivation was done at the 6th of May 2007 in the farm of Plant Protection Research Institute, Dokki, Giza. The area was divided into seven plots each plot have 7 rows of 3 meter long. Three replicates were used for each treatment.

The plots were used as follows:

- 1- Gaucho
- 2- Gaucho + anti-release
- 3- Agrinate
- 4- Agrinate + anti-release
- 5- Cartan
- 6- Cartan + anti-release
- 7- Untreated seeds (check)

Population densities of the tested pests, i.e., cowpea aphid, *Aphis craccivora*, tomato whitefly, *Bemisia tabaci* and spider mite, *Tetranychus urtica* were evaluated on the bean seedlings by the examination of 10 leaves taken from each plot using a binocular microscope. Pest populations were determined weekly after 3 weeks of planting and continued up to the eleventh week. Mean of infestation for pests was

calculated for each inspection date then % reduction of infestation was calculated according to the following equation:

$$\% R = \frac{C-T}{C} \times 100$$

Where

%R= Percentage of reduction

C= Mean alive number of pest in the control.

T= Mean alive number of pest in the treatment.

RESULTS AND DISCUSSION

According to the Egyptian ministry of agriculture recommendations (Anonymous, 2003), the critical economic limitation for the pests infested bean plants are : 7 living individuals/leaf for aphid, 7 living individuals/leaf for whitefly and 5 living individuals/leaf for spider mite, it means that when the infestation reaches this level, control should be carried out.

1-Against aphid:

According to the critical economic limitation rule, results presented in Table (1) clearly indicated that seedlings of the untreated seeds required application control after 4 weeks of planting while those of other treatments required an application after 8 weeks of planting except Cartan which required an application after 7 weeks.

Data also showed the high efficiency of all treatments as indicated by percentage of reduction up to 11 weeks of planting date. Agrinate and Cartan show already the same result as Gaucho (the recommended insecticide). Results also indicated that the addition of anti-releasing agent lead to increase in pesticidal efficiency (%R) for the tested insecticide. After 3 weeks of planting Gaucho alone or when mixed with anti-releasing agent gave the highest effect (100%) followed by [(Agrinate + antirealising) (92.6) or (Cartan + anti-releasing) (92.6) and (Agrinate or Cartan) (85.2)]. After 11 weeks of planting % R ranged between 75.9 and 82.0. Agrinate + anti-release gave the highest effect (82%) followed by Cartan+anti-release (80.4), Gaucho + anti-release (78.4), Agrinate (78.1), Gaucho (77.3) and Cartan (75.9).

2- Against whitefly:

Data shown in Table (2) clearly indicated the high pesticidal efficiency of the tested pesticides and increasing their activity by addition the anti-releaseng agent. According to the level of critical economic limitation of infestation, seedlings of the un-

treated seeds reached this level after 5 weeks of planting. After 3 weeks of planting (Gaucho + anti-release) and (Cartan + anti-release) showed the highest effect (86.1%), followed by (Agrinate + anti-release), Gaucho, Agrinate and Cartan. Reduction percentages after 11 weeks of planting recorded 89.5% for Gaucho + anti-release followed by (Agrinate + anti-releas (88.4 %), Cartan + anti-release (88.4%)), Cartan (88.0%), Agrinate (87.7%) and Gaucho (85.5 %).

3-Against spider mite:

Data presented in Table (3) indicated that all treatments are effective in controlling spider mite *T. urticae* up to the eleventh week of planting as expressed by both infestation and reduction percentages. Data also indicated that the addition of anti-releasing agent to the tested pesticide increased its efficiency. According to the critical economic limitation, seedlings of untreated seeds required application control after 4 weeks of planting. All the pesticides treatments increased reduction percentages than in the un-treated plots up to the eleventh week of planting. After the eleventh week of planting, reduction percentage ranged between 60.6 for Arginate and 92.0% for Cartan + anti-release. Cartan + anti-release gave the highest effect followed by Agrinate + anti-release (82.9%), Gaucho, Gaucho + anti-release, Cartan, and Agrinate.

The obtained results are in general in agreement with those of Saba, (1991), Diehr *et al* (1991), Anonymous, (1992) and El-Hamady and Abu-Sholooa, (1999), who found that Gaucho when used as seed treatment against sucking insects infested cotton seedlings, aphid, thrips and whitefly gave a good results

As a general conclusion, it could be said that all the tested pesticides proved its high pesticidal efficiency in controlling sucking piercing pests, aphid, whitefly, and spider mite infested bean seedlings when they used as seed treatment. The study also proved that the addition of anti-releasing agent increased the pesticidal efficiency for the same pesticides. This effect may be due to reducing the solubility of the pesticide then reducing loss in pesticide as a result of leaching by irrigation water.

Table 1. Efficiency of the tested pesticides against cowpea aphid, *Aphis craccivora*, (2007).

| Treatments | Mean number of the pest/leaf and % R after the weeks of planting | | | | | | | | | | | | | | | | | |
|-------------------------|--|------|----------------------|------|----------------------|------|--------------------------|------|--------------------------|------|--------------------------|------|--------------------------|------|--------------------------|------|----------------------|------|
| | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 weeks | |
| | Mean no./ leaf* | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mea n no./ leaf | %R** | Mea n no./ leaf | %R** | Mea n no./ leaf | %R** | Mea n no./ leaf | %R** | Mea n no./ leaf | %R** | Mean no./ leaf | %R** |
| Gaucho | 0 | 100 | 05 | 92.9 | 1.1 | 93.0 | 2.9 | 84.8 | 4.8 | 88.0 | 10.6 | 75.7 | 12.2 | 71.4 | 14.8 | 75.7 | 18.1 | 77.3 |
| Gaucho + anti-release | 0 | 100 | 0.2 | 97.1 | 1.0 | 93.6 | 2.8 | 85.3 | 4.3 | 89.2 | 8.0 | 81.7 | 10.4 | 75.6 | 12.6 | 79.3 | 17.2 | 78.4 |
| Agrinate | 0.4 | 85.2 | 0.8 | 88.6 | 1.9 | 87.9 | 2.4 | 87.4 | 6.2 | 84.5 | 8.9 | 79.6 | 11.2 | 73.3 | 12.4 | 79.6 | 17.4 | 78.1 |
| Agrinate + anti-release | 0.2 | 92.6 | 0.4 | 94.3 | 1.6 | 89.8 | 2.3 | 88.0 | 5.0 | 87.5 | 8.6 | 80.3 | 10.4 | 75.6 | 11.4 | 81.3 | 14.4 | 82.0 |
| Cartan | 0.4 | 85.2 | 1.0 | 85.7 | 2.4 | 84.7 | 3.5 | 81.7 | 7.9 | 80.2 | 11.4 | 73.9 | 12.9 | 69.8 | 15.4 | 74.7 | 19.2 | 75.9 |
| Cartan + anti-release | 0.2 | 92.6 | 0.4 | 94.3 | 1.5 | 90.4 | 2.3 | 88.0 | 4.5 | 88.7 | 7.8 | 82.1 | 11.4 | 73.3 | 13.5 | 77.8 | 15.6 | 80.4 |
| Untreated seeds | 2.7 | | 7.0 | | 15.7 | | 19.1 | | 39.9 | | 43.6 | | 42.7 | | 60.8 | | 79.6 | |

* No./leaf =mean alive pest/leaf

** % R = %Reduction of a live pest according to Henderson and Tilton equation (1955).

Table 2. Efficiency of the tested pesticides against white fly, *Bemisia tabaci* (2007).

| Treatments | Number of the pest/leaf and % R after the weeks of planting | | | | | | | | | | | | | | | | | |
|-------------------------|---|------|----------------------|------|----------------------|------|----------------------|------|----------------------|------|----------------------|------|----------------------|------|----------------------|------|----------------------|------|
| | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 weeks | |
| | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** | Mean no./ leaf | %R** |
| Gaucho | 0.9 | 75 | 1.0 | 84.8 | 1.3 | 89.7 | 3.1 | 85.0 | 4.0 | 88.3 | 9.7 | 77.2 | 11.4 | 82.5 | 16.8 | 72.5 | 21.4 | 85.5 |
| Gaucho + anti-release | 0.5 | 86.1 | 0.4 | 93.9 | 1.0 | 92.1 | 1.9 | 90.8 | 3.8 | 88.9 | 5.7 | 86.6 | 9.6 | 85.3 | 11.6 | 81.0 | 15.6 | 89.5 |
| Agrinate | 101 | 69.1 | 1.3 | 80.3 | 2.7 | 78.6 | 4.9 | 76.3 | 7.8 | 77.3 | 10.2 | 76.1 | 11.1 | 83.0 | 14.8 | 75.7 | 18.2 | 87.7 |
| Agrinate + anti-release | 0.7 | 80.6 | 0.7 | 89.4 | 1.8 | 85.7 | 4.3 | 79.2 | 5.9 | 82.8 | 9.4 | 77.9 | 9.8 | 85.3 | 13.4 | 78.0 | 17.2 | 88.4 |
| Cartan | 1.3 | 63.9 | 1.9 | 71.2 | 3.1 | 75.4 | 4.9 | 76.3 | 9.0 | 73.8 | 12.8 | 70.0 | 14.4 | 77.9 | 19.2 | 68.5 | 17.8 | 88.0 |
| Cartan + anti-release | 0.5 | 86.1 | 1.0 | 84.8 | 2.1 | 83.3 | 3.1 | 85.0 | 4.9 | 85.7 | 8.4 | 80.3 | 11.7 | 82.1 | 14.7 | 75.8 | 17.2 | 88.4 |
| Untreated seeds | 3.6 | | .6 | | 12.6 | | 20.7 | | 34.3 | | 42.6 | | 65.2 | | 61.0 | | 148 | |

Table 3. Efficiency of the tested pesticides against spider mite, *Tetranychus urticae* (2007)

| Treatments | Number of the pest/leaf and % R after the weeks of planting | | | | | | | | | | | | | | | | | |
|----------------------------|---|------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|
| | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 weeks | |
| | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' | Mean no./ leaf' | %R'' |
| Gaucho | 1.6 | 63.6 | 1.8 | 81.1 | 2.4 | 84.3 | 3.9 | 86.6 | 5.7 | 84.4 | 9.1 | 86.2 | 12.2 | 83.7 | 15.0 | 83.6 | 20.3 | 82.5 |
| Gaucho + anti-release | 0.6 | 86.4 | 1.1 | 88.4 | 1.5 | 90.2 | 2.8 | 90.4 | 5.0 | 86.3 | 7.0 | 89.4 | 10.2 | 86.0 | 12.2 | 86.7 | 21.7 | 81.3 |
| Agrinate | 1.6 | 63.6 | 2.9 | 69.5 | 4.8 | 68.6 | 8.2 | 71.9 | 10.7 | 70.7 | 14.2 | 78.5 | 18.4 | 75.5 | 19.7 | 86.9 | 45.7 | 60.6 |
| Agrinate + anti-release | 1.5 | 65.9 | 1.2 | 87.4 | 2.4 | 84.3 | 5.4 | 81.5 | 7.6 | 79.2 | 8.7 | 86.8 | 13.9 | 81.5 | 15.5 | 83.0 | 19.8 | 82.9 |
| Cartan | 1.5 | 65.9 | 2.4 | 74.7 | 3.5 | 77.1 | 5.6 | 80.8 | 9.7 | 73.4 | 14.5 | 78.1 | 18.2 | 75.7 | 21.3 | 76.7 | 23.8 | 79.5 |
| Cartan + anti-release | 0.6 | 86.4 | 0.8 | 91.6 | 2.1 | 86.3 | 4.9 | 83.2 | 5.9 | 83.8 | 8.8 | 86.7 | 12.3 | 83.6 | 15.4 | 83.2 | 9.3 | 92.0 |
| Untreated seeds | 4.4 | | 9.5 | | 15.3 | | 29.2 | | 36.5 | | 66.1 | | 75.0 | | 91.4 | | 116.0 | |

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كفاءة بعض المبيدات الحشرية الجهازية لمكافحة آفات بادرات الفاصوليا عند استخدامها كمعاملة بذور

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تم اختبار كفاءة ثلاثة مبيدات جهازية هي : جاوشو ٧٠% قابل للذوبان (ايميداكلوبرايد)، اجرنيت ٩٠% قابل للذوبان (ميثوميل)، كارتان ١٠% مسحوق (كاربوفينوران). منفردة وبعد خلطها بالزيت المعدنى (قطفة التشحيم الزيت البترول) كماده مانعه للانسياب حيث تم خلطها بالمبيد بنسبة ٠,٥% زيت : ١ مبيد وذلك ضد آفات بادرات الفاصوليا.

تم استخدام المبيدات المنفردة والمخلوطة مع المادة المانعة للانسياب لمعاملة بذور الفاصوليا بمعدل ٨ جرام لكل كيلو جرام بذور. وتم تقدير شدة الإصابة بالآفات الثاقبة الماصة اسبوعيا من الاسبوع الثالث بعد زراعة البذور وحتى الاسبوع الحادى عشر.

تشير النتائج المتحصل عليها على أن كل المبيدات المختبرة كانت فعالة في خفض الإصابة بالآفات الموجودة على البادرات وهى : المن ، الذبابة البيضاء ، العنكبوت الاحمر وذلك حتى الأسبوع الحادى عشر، كذلك دلت الدراسة على أن إضافة المادة المانعة للانسياب الى المبيدات ادت الى زياده فعاليتها. وطبقا للحد الاقتصادي الحرج لشدة الإصابة بهذه الآفات يمكن القول بان معاملة بذور الفاصوليا بهذه المبيدات ادى الى حماية البادرات حتى ٨ اسابيع تقريبا من الزراعة.