# PERFORMANCE OF DIFFERENT GROUND SPRAYING EQUIPMENT FOR CONTROLLING WHITEFLY, *BEMISIA TABACI* (GENN.) IN COTTON FIELDS OF EGYPT.

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***Abstract***

The performance of conventional ground motor sprayer, Motorized knapsack sprayer "Solo", and lever-operated sprayer "Solo" were compared for controlling adults and nymphs of the whitefly Bemisia tabaci (Gennadius). A mixture of Lambdacyhalothrin at 187.5 ml + Diafenthiuron (500 SC) 60 ml/fed. was applied in cotton fields at Gharbia Governorate during the growing season of 1995. The conventional ground motor sprayer showed high initial efficacy against the whitefly adults while achieved moderate effect against nymphs. Motorized knapsack sprayer and lever operated sprayer proved less initial effect against the adult stage and no effect on nymphs. The three tested machines showed nearly the same average of bio-residual efficiency against both adults and nymphs.

## INTRODUCTION

Whitefly, Bemisia tabaci (Gennadius) has become one of the most economic insect pests in Egypt not only on cotton but also on vegetables (El-Sayed *et al.*, 1989). The damage caused to cotton results in significant losses. Chemical control of whitefly is difficult because the adults and the immature stages inhabit the lower surface of plant leaves and the insect has high reproductive potential and the sweet potato whitefly is resistant to most classes of insecticides currently available (Prabhaker *et al.*, 1985). Pesticide application is a vital factor in the process of making contact between insecticide and whitefly on cotton plants. The amidines, represented by amitraz were used in the Sudan and elswhere (Heijne and Peregrine, 1984). Best control was achieved when 500 g/ha were applied at high volume and with large droplet size. Bache and UK (1975), UK (1987), Ernst et al. (1984) and Scopes (1981) carried out several experiments with ULV spraying either by hand-held equipment or by aircraft, produced a similar trend of vertical deposit distribution. Another difficulty encountered in spraying against whiteflies is that droplet deposition takes place mainly on the upper side of the leaves. UK and Courshee (1982) found that, the de-

posits on the underside of the leaves rarely exceed 40 to 50% of those on the upperside for the top leaves and can be as low as 5 % or less for the botton leaves. Such deposits on the wrong side of the leaves result in an insufficient amount of the insecticide needed to achieve acceptable control. Therefore, the present investigation aimed to evaluate the efficacy of three different spray equipments against whiteflies on cotton plants .

## MATERIALS AND METHODS

An area of three feddans cultivated with cotton, variety "Giza 75" were chosen in Bassion Province, Gharbia Governorate on July 15, 1995. The area was divided into three plots, one feddan each. Each plot was sprayed with Lambdacyhalothrin a.i. 5% (w/v) (Kendo) at 187.5 ml and Diafenthiuron 500 SC (Polo) 60 ml/fed., using conventional ground motor sprayer, motorized knapsack sprayer and lever opertated Solo sprayer. This mixture of insecticides agree with recent literature owing to increasing difficulty in controlling whiteflies as time progresses. Increasing resistance to organophosphorus or pyrethroid insecticides are thought to be responsible for this phenomenon. Table 1 illustrated the technical data, and spray parmeters of the tested ground equipment.

Table 1. Technical data and spray parameters of the tested ground spraying machines equipments.

| Type of atomizer / Spray parameters | Lever operated (Solo) sprayer | Conventional motor Genar | Motorized knapsack Solo |
|---|---|---|---|
| | Hydraulic | | Pneumatic |
| | TXVS-6 | Spray gun | Water flow No. 4 * 100 m/sec. |
| No. of units | 3 | 1 | 1 |
| Spacing (m.) | 0.45 | - | - |
| Spray height (m.) | 0.70 | 0.50 | 0.50 |
| Effective swath width (m.) | 5.0 | 3.0 | 5.0 |
| Spray volume (L/fed.) | 20.0 | 600.0 | 144.0 |
| Flow rate (L/min.) | 0.960 | 17.14 | 6.85 |
| Tank capacity (L.) | 20.0 | 600.0 | 12.0 |
| Pressure P.S.I. | 15.0 | 25.0 | - |

* Air velocity (m/sec.)
Working speed 2.4 km/h. for all treatments.

Inspection was made before spraying and at 2,5 and 7 days after insecticide application. Four leaves were picked from the different levels of each cotton plant. Twenty five plants were chosen at random for each plot in each inspection. The number of adults per 100 plants and the number of nymphs per inch/100 plants were recorded. The percentage reduction in insect population after spray was calculated for each plant level as follows :

$$\% \text{ Reduction} = \frac{\text{No. of adults (nymphs) after spray - No. of adults (nymphs) before spray}}{\text{No. of adults (nymphs) before spray}} \times 100$$

The percentage reduction after two days from spraying is considered as initial efficacy, while the means of reduction at 5 and 7 days after spraying represent the residual effect.

## RESULTS AND DISCUSSION

Results in Table 2 indicate that, the total of the adults population on the different plant levels were approximately equal in selected plots before spray. Also, the upper and the middle levels of cotton plants contained more adults than the bottom. Two days after spraying with the conventional ground motor, there was obvious difference in the percentage reduction between the upper level and the lowest one. The differences were reduced with motorized knapsack sprayer and lever operated solo. This may be due to the mechanical effect of the spraying process on the upper levels as they received larger portion of spray solution than the lowest one. Five and seven days after spray, data show gradual increase in the percentage reduction of insect population among the four plant levels. This was pronounced with the three tested sprayers, the upper plant level showed the least reduction, while the bottom recorded the highest one. This may be attributed to the more persistence of insecticide residues on the leaves of the lower levels.

Two days after spray, the highest overall percentage reduction in the insect population occurred with ground motor (92.3%) compared with 82% and 63.8% for the knapsack motor and lever operated solo sprayer, respectively. The prolongation of pest spray time to 5 and 7 days indicated that, while the percentage reduction in population is gradually decreased with conventional ground motor to 75.4 after 7 days, it slightly increased in the same period in case of the motorized knapsack and lever operated Solo sprayer, respectively. Data in Table 3 indicate that population

differed greatly among the four plant levels. The highest population appeared on the middle and bottom levels before spray. Two days after insecticide spray, the highest percentage reduction was recorded on the upper half of treated cotton plants. This was more pronounced with ground motor followed by lever operated solo sprayer, while the motorized knapsack sprayer showed the least reduction. After five days, the percentage reduction in insect population decreased gradually on the upper half and sharply decreased after seven days with the ground motor. On the other hand, both the knapsack motor and lever operated solo sprayer showed that the percentage reduction in whitefly increased after five days and slightly decreased after seven days. For the lower half of cotton plant, the percentage reduction increased gradually after five and seven days with those two equipments. As for the total number of nymphs, it was found that the percentage reduction two days after spraying (initial kill) was moderate for the conventional ground motor (61.3 %), no reduction occurred with knapsack motor and lever operated solo sprayer. After five days, the percentage reduction increased, especially with the ground motor (91.5 %). Again, it sharply increased to reach approximately 80 % for the other machines. After seven days, the reduction declined with the ground motor (76 %), while increased to 87.8% and 85.1% for knapsack motor solo and lever operated solo sprayer, respectively. These results are in agreement with El-Metwally (1995) and Hindy et al. (1996).

Table 2. Number of whitefly adults and their percentage reduction by different ground machines.

| Kind of machine | Level | No. of adults and % reduction in every inspection | | | | | | | Av. of % reduction 5 & 7 days |
|---|---|---|---|---|---|---|---|---|---|
| | | Before spray | 2 days A.S.* | | 5 days A.S.* | | 7 days A.S.* | | |
| | | | No. of adults | % Reduction | No. of adults | % Reduction | No. of adults | % Reduction | |
| Ground motor sprayer "Genar" | Upper | 623 | 34 | 94.5 | 229 | 63.2 | 213 | 65.8 | 64.5 |
| | Mid.(1) | 712 | 50 | 93.0 | 126 | 82.3 | 234 | 67.1 | 74.7 |
| | Mid.(2) | 600 | 28 | 95.3 | 27 | 95.5 | 53 | 91.2 | 93.4 |
| | Lower | 159 | 49- | 69.2 | 1 | 99.4 | 15 | 90.6 | 95.0 |
| Average | | 524 | 40 | 88.0 | 96 | 85.1 | 129 | 78.6 | 81.9 |
| Knapsack motor sprayer (solo) | Upper | 754 | 78 | 89.7 | 176 | 76.7 | 176 | 76.7 | 76.7 |
| | Mid.(1) | 769 | 137 | 82.2 | 163 | 78.8 | 109 | 85.8 | 82.3 |
| | Mid.(2) | 790 | 172 | 78.2 | 54 | 93.2 | 37 | 95.3 | 94.3 |
| | Lower | 277 | 78 | 71.8 | 19 | 93.1 | 10 | 96.4 | 94.8 |
| Average | | 648 | 116 | 80.4 | 103 | 85.4 | 83 | 88.5 | 87.0 |
| Lever operated sprayer (Solo) | Upper | 701 | 292 | 58.3 | 231 | 67.0 | 199 | 71.6 | 69.3 |
| | Mid.(1) | 692 | 302 | 56.4 | 152 | 78.0 | 134 | 80.6 | 79.3 |
| | Mid.(2) | 287 | 155 | 77.4 | 70 | 89.8 | 51 | 92.6 | 91.2 |
| | Lower | 83 | 34 | 59.0 | 2 | 97.6 | 6 | 92.8 | 95.2 |
| Average | | 541 | 196 | 62.7 | 114 | 83.1 | 98 | 84.4 | 83.7 |

* A.S. : After spraying.

Therefore, the afore-mentioned results indicate that the initial efficacy of the tested insecticides against the whitefly may be attributed to the mechanical damage, while the residual effect is related to the type of the used insecticide as well as its stability on plant surface. As a conclusion, the ground motor proved high initial effect against the adult whitefly and moderate influence on nymphal stage. On the other hand, knapsack motor solo and lever operated "Solo" sprayer showed less initial effect against the adult stage i.e. 82.1% and 63.8%. They have no initial effect against nymphs. All the tested machines have nearly the same average of residual effect against adults and nymphal stages of whitefly, i.e. 78.6%, 85.8%, 80.5% and 83.8%, 84.2%, 82.1% for conventional ground motor, knapsack motor solo, and lever operated solo sprayer, respectively.

Table 3. Number of nymphs of whitefly, and their percentage reduction by different ground machines .

| Kind of machine | Level | No. of adults and % reduction in every inspection | | | | | | | Av. of % reduction 5 & 7 days |
|---|---|---|---|---|---|---|---|---|---|
| | | Before spray | 2 days A.S.* | | 5 days A.S.* | | 7 days A.S.* | | |
| | | | No. of adults | % Reduction | No. of adults | % Reduction | No. of adults | % Reduction | |
| Ground motor sprayer "Genar" | Upper | 13 | 1 | 92.3 | 5 | 61.5 | 24 | 0 | 30.8 |
| | Mid.(1) | 113 | 5 | 95.6 | 9 | 92.0 | 66 | 41.6 | 66.8 |
| | Mid.(2) | 398 | 113 | 71.6 | 28 | 93.0 | 36 | 91.0 | 92.0 |
| | Lower | 44 | 101 | 0 | 6 | 86.4 | 10 | 77.3 | 81.9 |
| Average | | 142 | 55 | 64.8 | 12 | 83.2 | 34 | 52.4 | 67.8 |
| Knapsack motor sprayer (solo) | Upper | 34 | 22 | 35.3 | 6 | 82.4 | 20 | 41.2 | 61.8 |
| | Mid.(1) | 240 | 109 | 45.6 | 27 | 88.8 | 49 | 79.6 | 84.2 |
| | Mid.(2) | 450 | 659 | 0 | 64 | 80.8 | 31 | 93.1 | 87.0 |
| | Lower | 129 | 747 | 0 | 69 | 46.6 | 4 | 96.9 | 71.7 |
| Average | | 213 | 384 | 20.2 | 42 | 74.6 | 26 | 77.7 | 76.2 |
| Lever operated sprayer (Solo) | Upper | 46 | 6 | 87.0 | 0 | 100 | 10 | 78.3 | 89.2 |
| | Mid.(1) | 159 | 31 | 80.5 | 19 | 88.0 | 51 | 67.9 | 78.0 |
| | Mid.(2) | 470 | 313 | 33.4 | 16 | 8.70 | 34 | 92.8 | 89.9 |
| | Lower | 17 | 438 | 0 | 65 | 0 | 8 | 52.9 | 26.5 |
| Average | | 173 | 197 | 50.2 | 36 | 68.7 | 26 | 72.9 | 70.9 |

* A.S. : After spraying.

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# كفاءة معاملات الرش بوسائل أرضية مختلفة لمكافحة الذبابة البيضاء فى حقول القطن بمصر

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تم مقارنة كفاءة كل من موتور الرش العادى جينار ، وموتور الرش الظهرى صولو والرشاشة اليدوية صولو ذات حامل الرش الرمحى لمكافحة الحشرات الكاملة وحوريات الذبابة البيضاء وذلك باستخدام مخلوط من مبيدى لامبداسيهالوثرين (كيندو) بمعدل ١٨٧,٥ سم٣ / فدان + مبيد ديافينثيورون بمعدل ٦٠سم٣ / فدان (بولو ٥٠٠) فى حقول القطن بمحافظة الغربية أثناء موسم القطن ١٩٩٥. أعطى استخدام الموتور الأرضى التقليدى فعالية ابادية عالية فورية ضد الحشرات الكاملة للذبابة البيضاء ، بينما حدث تأثير معتدل ضد الحوريات. ومن ناحية أخرى كان لاستعمال كل من الموتور الظهرى صولو والرشاشة اليدوية صولو تأثيرا ابادية فوريا أقل ضد طور الحشرة الكاملة ولم يؤثرا على طور الحورية كابادة فورية.

أظهرت الثلاث آلات نفس المتوسط تقريبا فى الفاعلية الابادية ذات الأثر المتبقى على كل من الحشرات الكاملة والحوريات.