Efficacy of mineral oil with insecticides against CMB

J. Agric. Res., 2012, 50(1) 103

Efficacy of Mineral Oil in Combination With Lower Doses of Insecticides Against Cotton Mealy Bug, Phenacoccus solenopsis

Riaz Ahmed*, Jawwad Yousaf**, Muhammad Saleem*** and Tariq Niaz****

ABSTRACT

In a study conducted at Entomological Research Institute, AARI, Faisalabad, Pakistan during the year 2007 and 2008, six mineral oil combinations with recommended doses of insecticides and check were tested under field conditions against cotton mealy bug (Phenacoccus solenopsis) (Pseudococcidae; Homoptera). The treatments were; DCtron Plus (mineral oil) @ 1000 ml, DCtron Plus + Supracide 40 EC @ 500 + 300 ml and 500 + 250 ml, DCtron Plus + Lannate 40 SP @ 500 ml + 250 g and 150 g, DCtron Plus + Curacron 50 EC @ 500 + 600 ml and 500 + 500 ml and check. All insecticides and mineral oil combinations proved effective against the pest upto 7 days after treatment. Their percent mortality ranged from 44.29 - 58.78, 85.81 - 94.74, 80.89 - 94.60, 84.71 - 94.96, 80.56 - 92.31, 86.91 - 95.15, and 86.56 - 92.86, respectively as compared with check (0.0%) during 2007 and 2008. However, DCtron Plus + Curacron @ 500+600 ml proved as the best among all treatments giving the highest mortality (93.87%) of the pest after 7 days of application.

KEYWORDS: Phenacoccus solenopsis; mineral oils; insecticides; mixing; Pakistan.

INTRODUCTION

Cotton (Gossypium hirsutum L.) is one of the most important cash crops of Pakistan. The country is the 4th largest lint producer in the world after China, USA and India (14). Cotton is a big source of foreign exchange, earnings contributing about 8.6 percent of value added to agriculture and about 1.9 percent to GDP (4). The mealy bug, Phenacoccus solenopsis has recently emerged as a serious pest of cotton in Pakistan (1, 2). This insect pest caused 14 percent loss to cotton crop in the year 2005 (5) and 17 percent in 2008 (4). About 35-70 percent cotton fields in Sanghar district were harvested due to severe attack of cotton mealy bug (5).

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The mealy bug feeds on phloem tissue, removing plant sap and causing the leaves to distort, yellow and even drop. The severely affected plants may die. The cotton mealy bug also produces large amount of honeydew similar to that produced by other sucking insect pests of cotton (14). Growing of sooty mold on honeydew interferes with photosynthesis. The efficacy of mineral spray oils against mealy bugs has been earlier assessed in field trials on persimmon (12) where repeated applications of oil and adjuvant-enhanced oil in three months prior to harvest had no deleterious effects on fruit size or quality. Fortnightly applications of such oils in a commercial orchard maintained the fruit insect free. Oil sprays enhanced with alkylsilicone adjuvant, provided significant control of mealy bugs and mites, in a persimmon orchard subjected to intensive pest pressure close to harvest. Moreover, addition of oil to insecticide used at half recommended rate gave equivalent insect control to full-rate insecticide regime (12).

The biological control of this pest on citrus and avocado has given good results (6) in different parts with parasitoids of the world, but its outbreak requires the use of insecticides due to their rapid action as compared to predators and parasitoids. Danne et al. (7) observed that insect growth regulators and nicotine-based insecticides were good alternative pesticides for use in some vineyards. Muthukrishnan et al. (9) compared buprofezin as a foliar spray with carbosulfan and chlorpyrifos. They found that buprofezin reduced the nymph and adult populations and bunch infestation (9).

Chemical control measures included petroleum spray oils and soap spray (10) andcrop protection with chemicals is an unavoidable part of the integrated pest management (8).

The most outstanding property of spray-oils is that these address multiple targets in the insect body (16). So these oils do not elicit resistance responses in insects as chemical insecticides do. Mineral oils act primarily as ovicides by depressing the respiratory rate when applied directly to codling moth eggs (13). The length of respiratory depression and dose of oil in contact with the egg are critical for causing mortality (15). Mineral oil proved responsible for the alteration of cuticle hardness of other insect pest species. Moths treated with mineral oil Dapsa-Drv laid less number of eggs than controls (16, 17).

The present study aimed at investigating the better tactics to develop rapid and effective management of cotton mealy bug to minimize its attack.
MATERIALS AND METHODS

Two field experiments were conducted on cotton (cv. CIM-446) at Entomological Research Institute, AARI, Faisalabad, Pakistan during 2007 and 2008. The layout system was RCBD with three replications, in 9 x 7m plot size and 75 cm row to row distance. Ten infested cotton plants per repeat were tagged and sprayed thoroughly with a knapsack hand-sprayer. Ten topical and middle stem portions (15cm) including leaves were observed for presence of the mealy bug from each plot. Pre-treatment data were recorded one day before spray, while the post-treatment data were recorded after 3, 5 and 7 days in each test plot. Data were compiled and analyzed statistically.

In plots, the pest population was maintained below economic injury level from June to August by hand-picking and destruction of adults and nymphs by putting them in tin containing kerosene oil. After month of August, eradication with hand-picking became difficult.

Plots were kept free from weeds. Pesticides were applied on 27th August, 2007 and 11th July, 2008. The different doses of insecticides and mineral oil (DCtron Plus @ 500 ml) using 100 litre of water were sprayed against the cotton mealy bug as given below.

<table>
<thead>
<tr>
<th>Trade name of insecticides</th>
<th>Common name</th>
<th>Dose/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DCtron Plus</td>
<td>Mineral oil</td>
<td>1000 ml</td>
</tr>
<tr>
<td>2. DCtron Plus + Supracide 40EC</td>
<td>Mineral oil + Methidathion</td>
<td>500+300 ml</td>
</tr>
<tr>
<td>3. DCtron Plus + Supracide 40EC</td>
<td>Mineral oil + Methidathion</td>
<td>500+250 ml</td>
</tr>
<tr>
<td>4. DCtron Plus + Lannate 40 SP</td>
<td>Mineral oil + Methomyl</td>
<td>500ml+250 g</td>
</tr>
<tr>
<td>5. DCtron Plus + Lannate 40 SP</td>
<td>Mineral oil + Methomyl</td>
<td>500ml+150 g</td>
</tr>
<tr>
<td>6. DCtron Plus + Curacron 50 EC</td>
<td>Mineral oil + Profenofos</td>
<td>500+600 ml</td>
</tr>
<tr>
<td>7. DCtron Plus + Curacron 50 EC</td>
<td>Mineral oil + Profenofos</td>
<td>500+500 ml</td>
</tr>
<tr>
<td>8. Check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data on percent adult mortality were calculated and subjected to analysis of variance using MS Excel and LSD test at 5 percent level of significance.

RESULTS AND DISCUSSION

The date (Table) showed that percent mortality of cotton mealy bug was very high in all treatments during both years with combination of DCtron Plus at 3, 5 and 7 days after treatment (DAT). The check plots showed no mortality while alone DCtron Plus gave the lowest mortality which significantly differed from other treatments upto one week of spray during both years. During 2007, the highest mortality was recorded in case of DCtron Plus + Curacron
50EC (500+600ml) at 3 DAT (86.91 and 86.56%). It was statistically at par with other combinations which gave more than 84 percent pest mortality. At 5 DAT, percent mortality in DCtron Plus + Curacron 50 EC (91.69 and 89.91%) was maximum followed by DCtron Plus + Supracide 40 EC (90.50 and 88.53%) and DCtron Plus + Lannate 40 SP (89.03 and 85.83%). However, these treatments were statistically at par with each other. At 7 DAT, DCtron Plus + Supracide 40 EC @ 300ml gave highest pest mortality (94.74%), followed by DCtron Plus combined with Curacron 50EC (94.40 and 87.72%), Lannate 40SP (90.44 and 80.56%) and Supracide 40EC @ 250ml (80.89%).

Table. Mortality of cotton mealy bug with mineral oil and its combinations with different insecticides.

<table>
<thead>
<tr>
<th>Insecticides</th>
<th>Mealy bug mortality (%) in 2007</th>
<th>Mealy bug mortality (%) in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 days</td>
<td>5 days</td>
</tr>
<tr>
<td>1. DCtron Plus</td>
<td>58.78b</td>
<td>54.07f</td>
</tr>
<tr>
<td>2. DCtron Plus +</td>
<td>85.81a</td>
<td>90.50ab</td>
</tr>
<tr>
<td>Supracide 40EC (300 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. DCtron Plus +</td>
<td>85.51a</td>
<td>88.53abc</td>
</tr>
<tr>
<td>Supracide 40EC (250 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. DCtron Plus +</td>
<td>84.71a</td>
<td>89.03abc</td>
</tr>
<tr>
<td>Lannate 40 SP (250 g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. DCtron Plus +</td>
<td>84.77a</td>
<td>85.83abc</td>
</tr>
<tr>
<td>Lannate 40 SP (150 g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. DCtron Plus +</td>
<td>86.91a</td>
<td>91.69a</td>
</tr>
<tr>
<td>Curacron 50 EC (600 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. DCtron Plus +</td>
<td>86.56a</td>
<td>89.91a</td>
</tr>
<tr>
<td>Curacron 50 EC (500 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Check</td>
<td>0.0 c</td>
<td>0.0 g</td>
</tr>
</tbody>
</table>

During 2008, Curacron 50EC @ 600 ml combination with DCtron Plus again proved most effective with maximum mortality (95.15%) at 3 DAT which was statistically at par with DCtron Plus combined with Supracide 40EC (94.60 and 90.08%) and Lannate 40SP @ 250g (94.26%). Mineral oil mixture with Curacron 50EC @ 500ml and Lannate 40SP @ 150g also gave more than 82 percent pest mortality.

At 5 DAT, pest mortality in DCtron Plus + Curacron 50 EC plots was maximum (94.25 and 92.64%) and was at par with DCtron Plus combined
with Lannate @ 250 g (93.44%) and Supracide 40EC @300ml (90.08%).
Mineral oil combinations with Lannate 40SP @ 150g and Supracide 40EC @
250ml also gave more than 81 percent mortality.

At 7 DAT, maximum pest mortality (94.96%) was recorded in plots treated
with DCtron Plus + Lannate 40SP @ 250g followed by DCtron Plus
combinations with Curacron 50EC (93.87 and 92.86%), Lannate 40SP @
150g (92.31%) and Supracide 40EC (88.46 and 88.34%).

The results indicated that alone DCtron Plus (mineral oil) @ 1000ml/100 liter
of water depressed the mealy bug population from 44.30 to 58.80 percent.
Also its combinations with full and reduced doses of Supracide 40EC,
Lannate 40SP and Curacron 50EC proved equally effective with 80-95
percent pest mortality up to one week of spray.

These results are supported by Gaskini et al. (12), where all treatments gave
highly significant control of mealy bugs (0.2 mealy bug/fruit) compared with
untreated control (2.0 mealy bug/fruit). They found that half-rate insecticide +
enhanced oil (mineral oil) provided control equal to full-rate (0.4 mealy
bug/fruit) insecticide and was better than half-rate (0.3 mealy bug/fruit)
insecticide or enhanced oil treatment alone (0.8 mealy bug/fruit). Number of
mealy bugs on randomly sampled fruit was too low to be analyzed. Aheer et
al. (3) proved that Supracide, Curacron, Lorsban and Lannate were cheaper
and effective up to 3, 5 and 7 days after treatment with 85.74 to 95.69 percent
and 83.17 to 93.72 percent mortality of mealy bug during 2006 and 2007,
respectively.

Cariac et al. (11) proved that effectiveness of tested extracts and mineral oil
in reducing fecundity was: D. tenuifolia > G. hirsutum > Dapsa-DRV > G.
max, yielding 29, 41, 45 and 65 percent of fecundity, respectively relative to
controls.

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