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Managing the white grub *Phyllophaga* spp. (Coleoptera: Scarabaeidae) affecting sweet potato, *Ipomoea batatas* L. (Convolulaceae) in St Vincent and the Grenadines

P. Titus¹ y K. Dalip²

**ABSTRACT**

Sweet potato (*Ipomoea batatas* L.) is a major export crop for St Vincent and the Grenadines, with 1,764 metric tonnes (valued at US$783,459.00) exported between 2004 and 2005. However, the production of sweet potato is severely affected by species of the sweet potato grub (*Phyllophaga* spp.) (Coleoptera: Scarabaeidae) which is the major pest of economic importance affecting the crop in St Vincent and the Grenadines. Damage to tubers caused by this pest is estimated to be as high as seventy percent of crop yields. Experiments were conducted at the CARDI Field Station (St Vincent and the Grenadines) using three sweet potato export varieties (Black Vine, Big Red and Lover's Name) to test the efficacy of three chemicals - Neem-X® (azadirachtin), Actara® (thiamethoxam) and Pirate® (chlorfenapyr)- in suppressing the pest population and resultant tuber damage. Treatments were allocated in a complete randomized block design and the insecticides were applied to the soil before and at early planting at the manufacturers' recommended rates. Nine treatments were evaluated and each was replicated three times over two planting seasons (2003 – 2004). Results obtained showed that plots treated with Actara® produced tubers with lower damage than the Neem-X®- and Pirate®-treated plots. These results are very promising as the use of these chemicals can be included as one component in an integrated management programme of the sweet potato grub.

**Key words:** Sweet potato, *Phyllophaga* spp., White grub, Actara, Neem-X and Pirate

**INTRODUCTION**

St Vincent and the Grenadines, is one of the countries of the Windward Islands situated 61°W longitude, 13°N latitude. After bananas, root crops are very important to the agricultural economy of the country. Sweet potato (*Ipomoea batatas* L.) is grown by small farmers for income generation and is also considered an excellent crop for food security. It is a major export crop and markets include Trinidad and Tobago, Barbados, Grenada, St Martin, St Thomas and a small amount to the United Kingdom.

Both production and exports have increased significantly in the last two years (Table 1). Sweet potato exports have contributed significantly to the value of the agricultural sector in St Vincent and the Grenadines with exports valued at US$1,679,852.77 from 2001 to 2005.

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Table 1: Sweet potato production, exports and value for St Vincent and the Grenadines, 2001-2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (kg)</th>
<th>Export (kg)</th>
<th>Value (EC$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1,318,182</td>
<td>622,840</td>
<td>795,543.00</td>
</tr>
<tr>
<td>2002</td>
<td>1,792,727</td>
<td>724,869</td>
<td>1,101,509.00</td>
</tr>
<tr>
<td>2003</td>
<td>1,136,364</td>
<td>430,647</td>
<td>538,278.00</td>
</tr>
<tr>
<td>2004</td>
<td>2,450,000</td>
<td>882,075</td>
<td>1,088,067.00</td>
</tr>
<tr>
<td>2005</td>
<td>2,480,000</td>
<td>881,555</td>
<td>1,040,595.00</td>
</tr>
</tbody>
</table>

Source: Statistical Unit, Ministry of Agriculture, Forestry and Fisheries, St Vincent and the Grenadines

In island wide sweet potato baseline survey conducted by CARDI in 2003, 47% of the growers surveyed identified the sweet potato grub, *Phyllophaga* sp. (Coleoptera: Scarabaeidae) as the major pest. The other pest of lesser importance was the West Indian weevil, *Eucepes postfasciatus* Fairmaire (Coleoptera: Curculionidae) (5.1% of respondents). Yields have been adversely affected by the grub with reported root damage of up to 70% of harvested yields. Proper management of this pest can result in reduced losses in yield, an improvement in the quality of the crop and higher income for sweet potato farmers and foreign exchange for the country. Of the farmers surveyed, 72.7% used some form of chemical to control the pest, but they all indicated that effective control was not achieved. The chemical most used by 83% of the farmers was basudin (active ingredient diazinon®) this organophosphate is no longer imported for use in St Vincent and the Grenadines. The use of appropriate selective insecticides could be considered as a management measure. However, care must be taken in the selection of a suitable insecticide as not only its efficacy, but its persistence in the sweet potato roots and the potential impact on the environment (soil and water) are other important factors that must be considered. This study was, therefore, undertaken to evaluate three commercial insecticides for their effectiveness in suppressing the sweet potato grub population.

**MATERIALS AND METHODS**

The experiments were conducted over two seasons (2003 and 2004) at the Caribbean Agricultural Research and Development Institute (CARDI) Field Station, located in Rabacca. The three commercial insecticides evaluated were Neem-X® (active ingredient azadirachtin), Actara® (active ingredient thiamethoxam) and Pirate® (active ingredient chlorfenapyr). The insecticides were applied to the soil two days before planting, as well as two weeks and six weeks after planting, before vines entirely covered the soil. The rates used were those recommended by the manufacturers: Pirate, 5 cc per four litres, Neem-X, 20 cc per gallon; and Actara, 13 g packet to four litres.
Three sweet potato export varieties which are widely grown in St Vincent and the Grenadines were included in the trial: Black Vine and Big Red are red skinned, white fleshed; and Lover's Name is carrot coloured and high in carotene.

Land preparation included ploughing, rotavating and banking. The trial was planted in a complete randomized block design with three replicates. Plots consisted of twenty-five plants, planted at the top of the ridge; plots were one meter apart. There were sixteen plots in each block and nine plants were sampled per plot. Parameters measured were root damage, sweet potato yield and pesticide residue levels of harvested tubers.

Samples of harvested tubers collected from each experimental plot were sent to the Pesticide Research Group Laboratory at the University of the West Indies Campus, Mona, Jamaica, for pesticide analysis. Samples were liquefied, extracted, cleaned, dried and concentrated before being analysed by Gas Chromatograph with Mass Selective (GCMS) Detector using scanning mode. The samples were compared to standards of the three insecticides used in the experiment.

RESULTS AND DISCUSSION

No significant (P < 0.01) difference was observed in the total yield (weight per ha) obtained from plots treated with the different chemicals during the two planting seasons. However, damage by the white grub differed significantly (P < 0.01) among the treatments in both seasons, with Actara®-treated plots producing roots with the lowest mean grub damage (1.26 ± 0.618 and 0.06 ± 0.351 in Seasons I and II, respectively). Neem-X®-treated plots produced roots which had the second lowest grub damage weight whereas Pirate®-treated plots produced the highest weight of grub-damaged roots (Table 2; Figure 1).

Table 2. The weight of damaged (by *Phyllophaga* spp.) and undamaged sweet potato roots harvested from plots treated with three chemical insecticides (CARDI Field Station, Rabacca).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean total weight (kg) of harvested sweet potato roots</th>
<th>Mean weight (kg) of sweet potato roots damaged by Rat</th>
<th>Mean total weight (kg) of damaged sweet potato roots</th>
<th>Mean total weight (kg) of undamaged sweet potato roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actara®</td>
<td>4.5</td>
<td>0.35</td>
<td>0.66</td>
<td>1.0</td>
</tr>
<tr>
<td>Neem-X®</td>
<td>4.6</td>
<td>0.04</td>
<td>2.73</td>
<td>2.8</td>
</tr>
<tr>
<td>Pirate®</td>
<td>5.2</td>
<td>0.32</td>
<td>3.40</td>
<td>3.7</td>
</tr>
<tr>
<td>Control</td>
<td>4.5</td>
<td>0.34</td>
<td>2.52</td>
<td>2.9</td>
</tr>
<tr>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>

NS – Not significant
An asterisk (*) indicates significance
Figure 1. Overall sweet potato damage (units) in plots treated with Actara, Neem X and Pirate.

Table 3: Varietal comparisons showing rat and grub damage on sweet potato grown at CARDI Field Station, Rabacca.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total weight (kg)</th>
<th>Rat damage weight (kg)</th>
<th>Grub damage weight (kg)</th>
<th>Total of damage (kg)</th>
<th>Undamaged (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lover's Name</td>
<td>5.1</td>
<td>0.05</td>
<td>3.2</td>
<td>3.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Black Vine</td>
<td>5.0</td>
<td>0.15</td>
<td>2.0</td>
<td>2.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Big Red</td>
<td>4.0</td>
<td>0.59</td>
<td>1.8</td>
<td>2.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>

* Denotes significance

In comparing the varieties, the results showed that significantly fewer tubers were harvested from Big Red than from Lover's Name and Black vine. Grub damage to Big Red was significantly more than to the other varieties (See Table 3).

Pesticide residue analysis by Gas Chromatograph Mass Selective Detector (GCMS) indicated that no insecticide residues were detected from harvested roots taken from experimental plots treated with azadirachtin, chlorfenapyr or thiamexotham. This absence of residues implies that either no absorption of the insecticides by the roots
and no translocation to the tissues took place during the growth of the roots or, that if any translocation or absorption did occur, the insecticide residues did not persist to the time of harvesting.

These results are very promising and further consideration can be given to the inclusion of these chemicals in an integrated pest management programme of the sweet potato grub.

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