8 in 1965 and 1966, and 7 in 1968. All treatments were replicated 4 times and randomized in a block design. Maneb fungicide, at 1.5 pounds per acre, was applied to all plots following insecticide treatment for disease control.

For measurement of insecticidal effectiveness, cabbage aphid numbers were rated one week after the last application of pesticides by a system as follows: 1 = 0, 2 = 1-2, 3 = 3-10, 4 = 11-25, 5 = 26-50, 6 = 51-100, and 7 = over 100 aphids per plant. Aphid numbers were rated on 10 plants each of brussels sprouts and rutabaga per replicate. Numbers on cabbage were too low and erratic to warrant rating.

Results

Large numbers of cabbage aphids were present on brussels sprouts and rutabaga each year for testing of insecticides. Control differences between the two crops were not significant in 1965, were highly significant in 1966, and were significant in 1968. Brussels sprouts had more aphids in 1966 while rutabaga had more in 1968. Aphid ratings showed that Azodrin, diazinon, Di-Syston, Furadan, and Meta-Sistox-R gave the best control at the dosages used (Tables 1-3).

LITERATURE CITED


PROSPECTIVE SUBSTITUTES FOR DDT DUST FOR CONTROL OF CORN EARWORMS IN FLORIDA SWEET CORN

G. L. GREENE
Central Florida Experiment Station
Sanford

M. J. JANES
Everglades Experiment Station
Belle Glade

ABSTRACT

The proposed lowering of the DDT tolerance from seven to one ppm on most crops has created the need for an insecticide other than DDT to protect Florida sweet corn from injury by corn earworms. Gardona at 0.75 lb., Sevin at 2 lb., and Niran 6-3 (6 lb. of ethyl parathion + 3 lb. of methyl parathion per gallon) at 0.75 lb. active ingredient per acre gave good protection to sweet corn ears from corn earworm larvae [Heliothis zea (Boddie)]. Aerial sprays using five gallons of water and one lb. of active ingredient per acre gave good control, but low volume dusts of eight lb. or less (2 lb. of active Sevin) per acre did not result in earworm control.

INTRODUCTION

The tolerance of DDT residues will probably be lowered from seven ppm to one ppm on most vegetable commodities by January 1, 1969. These lowered tolerances affect the Florida recommendations (1) of DDT for corn earworm control on sweet corn not because of excessive residues on fresh market ears, but because of residues on crops growing near sweet corn fields being dusted. Information is needed on the effectiveness and reliability of the materials which will replace DDT because of the grower commitment to produce U. S. Fancy sweet corn (7).

The dosage of DDT used for earworm control has increased from the recommended two pounds per acre and the application interval has decreased from three to one day since DDT was first used for earworm control in the late 1940s (3, 5, 9, and 10). For many years para-
thion has been added to the DDT to achieve satisfactory control (1 and 11). In view of the reduced effectiveness of DDT and the anticipated residue problems facing growers, several promising insecticides have been examined at Belle Glade and Zellwood for corn earworm control. More detailed research data on several experimental insecticides is being presented in another paper (6).

**Materials and Methods**

Experiments at Belle Glade and Zellwood were conducted during 1967 and 1968 using plots replicated 4 times and large commercial fields of 10 or more acres of sweet corn. Small plots of three rows at Zellwood and four rows at Belle Glade, 50 ft long were used for all replicated experiments. Treatments were applied when silks appeared and continued until harvest. At Belle Glade a 48 hour application interval was used while at Zellwood applications were made every 24 hours. At both locations 80 to 110 gallons of water were applied per acre at 200 to 300 psi traveling 2.5 to 3 mph.

Dust applications at Oviedo, Sanford, and Zellwood were made with a ground duster or airplane. The dust equipment was calibrated to deliver the indicated rate per acre.

**Results**

Gardona, developed by Shell Chemical Co., label has been applied for, has looked promising in tests conducted throughout the world (2, 12, and unpublished reports at the Heliothis conference held November 29, 1967 in conjunction with the Entomological Society of America annual meeting). This insecticide is relatively safe to handle and has a short residual life on the plant. It is effective in extremely small amounts on corn earworm adults (J. R. Young, personal communication).²

Gardona at various rates of active ingredient per acre was more effective than the recommended materials in all cases (Table 1). The 0.75 lb. per acre rate appeared to be adequate, even though in two cases 0.5 lb. gave very good control. We believe 0.5 lb. of Gardona per acre properly applied will control a light to moderate population of earworms when a treatment interval of 24 hours is maintained.

During the fall of 1967 a tractor mounted duster was used at Sanford to apply Gardona at three rates (0.5, 0.75, and 1.0 lb. per acre). All three rates produced good control when applied every 24 hours, but were inadequate on a 48-hour schedule (Table 1). Gardona dust applied at 0.5 lb. active per acre by airplane to a three acre block of sweet corn near Oviedo resulted in control comparable to an adjoining field dusted with DDT + parathion at 3.6 and 0.4 lb. per acre (Table 1). Control at Oviedo was poorer than at Sanford because of tropical storm Abby which prevented dusting for three days.

In other tests Niran 6-3 (6 lb. of ethyl parathion + 3 lb. of methyl parathion per gallon) was applied at the rate of 0.75 or 1.0 lb. active per acre on several commercial fields in Central Florida. From 700 ears sampled in three fields only one ear showed earworm damage. During the same period untreated samples ranged from 5 to 100% damaged ears and one field treated with a tractor mounted sprayer was free of earworm damage while in untreated plots every ear was damaged. One field being sprayed with Niran 6-3 for earworm control was not sprayed for three days because of tropical storm Abby and a harvest sample showed 17% of the ears infested. This percentage was higher than on blocks dusted with 40 lb. per acre of 10% DDT + 1% parathion possibly due to the more rapid break down of Niran 6-3 than DDT during the heavy rain.

Sevin is a good insecticide to replace DDT + parathion mixtures for corn earworm control. During 1968 earworm control in several commercial fields was examined and in 20 acre blocks, growers were getting good control using 5 and 10% Sevin dust. However, sprays of 1.5 or 2.0 lb. of technical Sevin per acre did not provide adequate earworm control (98% worm free ears).

Three experimental insecticides which have shown promise for earworm control in recent tests are DuPont's Lannate, Niagara's Furadan, and Allied's GC 6506. These materials all have systemic activity making them very desirable materials where good coverage and insect contact are difficult. By using a systemic insecticide, use of dust formulations may become unnecessary.

The method of application is related to earworm control. In the Zellwood area nearly 100% of the sweet corn was dusted for earworm control prior to the 1968 season. Dusts were used

² Dr. J. R. Young, Entomologist located at The Southeast Grain Insects Res. Lab., Coastal Plain Exp. Sta., Ent. Res. Div. ARS USDA, Tifton, Georgia.
Table -- Percentage of worm free ears of sweet corn after treatment with Gardona and recommended insecticides for prevention of corn earworm feeding in Florida.

<table>
<thead>
<tr>
<th>Location</th>
<th>Spray Interval hours</th>
<th>Non treated</th>
<th>Recommended Materials</th>
<th>Pounds of Gardona per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5  0.75  1.0  1.5  3.0</td>
<td></td>
</tr>
<tr>
<td>Sanford 1967</td>
<td>24</td>
<td>22</td>
<td>56</td>
<td>67</td>
</tr>
<tr>
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<td>100</td>
</tr>
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<td>24</td>
<td>29</td>
<td>77</td>
<td>98</td>
</tr>
<tr>
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<td>48</td>
<td>36</td>
<td>98</td>
<td></td>
</tr>
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<td>77</td>
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<td>98</td>
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<td>48</td>
<td>5</td>
<td>68</td>
<td></td>
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</table>

**Dusts**

<table>
<thead>
<tr>
<th>Location</th>
<th>Spray Interval hours</th>
<th>Non treated</th>
<th>Recommended Materials</th>
<th>Pounds of Gardona per acre</th>
</tr>
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<td>Oviedo 1968</td>
<td>24</td>
<td>20</td>
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<td>94</td>
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</tbody>
</table>

1 The recommended materials were Sevin, DDT or DDT + parathion at recommended rates.

Because growers had previously experienced good control with dusts, and Harris (4) found dust formulations superior to wetable powders. During recent years in the Belle Glade area sprays have been used.

Advantages of using sprays rather than dusts, include lower cost, easier handling, better stability, smaller particle size and decreased hazard of drift or atmospheric contamination. Aerial application of Niran 6-8 at 0.75 lb. per acre in five gallons of water per acre gave adequate control in 20 acre blocks even though it gave only 94% worm free ears in small plot tests. ULV (Ultra Low Volume) was used on one field, but adequate control was not obtained.

With results reported by other researchers (2) it appears the use of low volume applications merit further research.

Low volumes of 25 and 50% Sevin dust were tried twice, but control was inadequate. Rates of four and eight lb. of total material, two lb. technical per acre in both cases, were used. The four lb. rate was applied by airplane and with a tractor duster. A rate of eight lb. of dust/acre or less apparently is not enough to insure adequate coverage. Lincoln and Dean (8) reported low volumes of dust did control Heliothis on cotton, but with cotton the degree of control needed is much less than with fresh market sweet corn. It appears that 20 lb. by ground and 30 to 40
lb. by air are the minimum amounts of dust which will give adequate earworm control. The Florida recommendation gives 25 to 30 lb. per acre as the amount of dust to use, which is in agreement with these observations.

LITERATURE CITED