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Barley heads on the ground as a result of severe armyworm attack.

Armyworm control in coarse grain crops

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Senior Entomologist

Investigations of armyworm infestations carried out in Western Australia during 1976 have shown that a complex of three species is involved in the spasmodic outbreaks that may cause severe damage to coarse grain crops. These have been identified as Persectania ewingii (Westw), P. dyscrita Common and Pseudaletia convecta (Walker).

Armyworm populations may reach high levels before apparent crop damage is detected by the grower. The grubs first attack the lower flag leaves and sheaths of the tiller and can be found in the inter-row weeds such as cape-weed and ryegrass.

Ryegrass is a good population indicator and is generally severely attacked in cereal crops although it is undamaged in pastures adjoining the crop. As the crop matures and lower portions of the cereal wither, the caterpillars begin their “head lopping” phase, which causes the obvious damage and crop loss.*

During an outbreak at Jerramungup in November, 1976, further trials were undertaken to evaluate new materials and formulations for control of this complex. The dominant pest species found in the crop was Pseudaletia convecta, al-

though *Persectania dyscrita* was present in the area. *P. convecta* is well known as a pest of cereals and grasses in the eastern States, where several generations a year may occur, the insect oversummering on native grasses. From laboratory studies carried out locally it appears that this is the case in Western Australia, the districts affected being in the southern portions of the State where native grasses survive to varying degrees through the summer.

The trial was carried out in part of a 2-row barley crop nearing maturity, with the flag leaves withering. The treatments shown in Table 1 were applied with a Terra Mister spray machine, calibrated to distribute the chemical mixed with water, at the rate of 20 litres per hectare.

Treatments were applied to 2 hectare plots on November 25, after pre-treatment sampling, and subsequently sampled on November 26 and December 2. Barley heads obviously lopped by armyworms were sampled on December 3. Although the insecticide rates actually applied differed slightly from those the trial set out to evaluate, the departures were insignificant and are normal in small plot applications.

### Results

The pre-sampling figures in Table 1 indicate a population capable of inflicting severe economic crop loss and are sufficiently uniform to ensure valid comparisons of the test materials.

Chlorpyrifos gave some rapid kills on day one and complete control by day seven. Trichlorphon was slower in action but achieved similar control by day seven. Chlorfenvinphos at the rates tested achieved an initial kill, but survivors on day seven were still causing head lopping of economic significance. This material will be evaluated at higher application rates, as soon as possible.

The barley head counts per square metre taken on day eight corroborate the insecticidal efficiency of the test materials and clearly demonstrate the damage that was being caused by armyworms in the trial site.

### Aerial Trial

Sufficient commercial ultra low volume chlorpyrifos formulation was available (courtesy Dow Chemical Co.) to treat 20 hectares by aircraft, and the remainder of the trial site was treated at the rate of 700 ml 50 per cent U.L.V. per hectare. Aerial application gave similar results to those obtained with the 50 per cent e.c. ground application, armyworm populations being reduced to an average 0.4 per square metre in two days. The cost benefit of this formulation becomes obvious if aerial application over a large area is being considered.

### Discussion

The high count of barley heads on the ground in the untreated areas (88-75 per sq. metre) indicates an approximate loss of $39 per hectare at on-farm barley prices. This figure would undoubtedly have been exceeded by harvest time if the crop had not been treated. A comparison with the head counts of the trichlorphon and chlorpyrifos plots (12-25 and 7-25 per sq. metre respectively) indicate the economics of the insecticidal treatments when populations of armyworm such as those in the trial site begin their destructive head-lopping phase. With insecticide costs of $4.50 per hectare for trichlorphon and $5.60 for chlorpyrifos the financial return is considerable.

### Biological control

The decline in armyworm numbers in the control plots was due to natural biological control.

A high percentage of the caterpillars collected during the trial from untreated plots died from parasitism in their final instar. A small parasitic encyrtid wasp was responsible, the female laying its eggs in the armyworm which subsequently dies as the wasp larvae develop. The armyworm becomes distorted as the wasp larvae approach pupation and it assumes a mummified appearance as several hundred pupae mature.

Wasps of this family exhibit a polylombronic habit, the original eggs laid by the female subsequently dividing until a sufficient number are obtained to give rise to larvae that will occupy the available food space within the caterpillar. The parasite has been identified as *Lito-mastix* sp.

Two predators were also active in the crop during the trial period, an ichneumonid wasp, *Mesostenus* sp. and the pentatomid bug, *Cermatulus nasalis* (Westwood), being collected. *Mesostenus* was sub-
sequently bred out in the laboratory from armyworm pupae collected in the field.

The detection of the encyrtid wasp parasite may make integrated control economically feasible. The use of ovicides, bacteria, virus and short residual insecticides as support mechanisms to parasites is common practise in other industries and will be investigated in the future.

The persistent organo-chlorine insecticides, such as DDT, eradicate beneficial insects and may have removed controlling mechanisms that keep the pest complex in check during most years.

**CONTROL RECOMMENDATIONS**

**DETECTION**
- Examine inter-row weeds, especially cape weed and ryegrass, for caterpillars.
- Check crop for heads on the ground. If greater numbers are present than can be attributed to wind damage, examine soil surface for armyworm.
- Shake plant vigorously and examine soil surface, especially at the base of the plant, where grubs can shelter below general surface level. Threshold level for spraying is four to five grubs per square meter.
- Watch out for caterpillars just below heads. Danger sign.

**CHEMICAL CONTROL**
- Assess harvest date against the possible damage that may occur in the remaining maturation period. Note that five heads on ground per square metre is equivalent to about $2.20 per hectare crop loss.
- Recommended chemicals
  - Trichlorphon—1 litre 62.5 per cent per hectare.
  - Chlorpyrifos—700 mils 50 per cent e.c. per hectare or U.L.V. equivalent.
  - Endosulfan—1 litre 35 per cent e.c. per hectare.

**THE VALUE OF CHEMICAL CONTROL OF ARMYWORM**

*Jerramungup trial site—November, 1976*

- Barley heads on the ground in untreated plots 90 per sq. metre.
- Each barley head contains 20 grains.
- Loss per square metre 90 x 20 = 1 800 grains.
- At on-farm barley prices 100 grains per sq. metre represents $2.2 per hectare.
- Therefore 1 800 grains per sq. metre represents a loss of $39.60 per hectare.
- Insecticide cost per hectare:
  - Lorsban—$5.60 per hectare
  - Dipterex—$4.30 per hectare

A good barley crop in this area may yield 2 to 3 tonnes per hectare.

*Estimates of crop loss by A. Stock, Agricultural Adviser, Jerramungup.*

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- Note: Recent amendments to the Aerial Spraying Control Act have made it illegal to apply DDT from the air for armyworm control. Similarly, removal of registration for armyworm control and recent gazettals under the pesticide regulations of the Health Act (1911-1973) make it an offence to apply DDT for armyworm control from ground rigs.
<table>
<thead>
<tr>
<th>Treatments</th>
<th>Trial rate</th>
<th>Live worms per sq metre</th>
<th>Fallen barley heads per sq. metre</th>
<th>Pupae per sq. metre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre-spray</td>
<td>Day 1</td>
<td>Day 7</td>
</tr>
<tr>
<td>Control</td>
<td>Nil treatment</td>
<td>19·8</td>
<td>19·0</td>
<td>10·6</td>
</tr>
<tr>
<td>Trichlorphon 62·5 per cent w.v. e.c.</td>
<td>1 l/ha.</td>
<td>16·6</td>
<td>10·0</td>
<td>...</td>
</tr>
<tr>
<td>Chlorpyrifos 50 per cent w.v. e.c.</td>
<td>660 ml/ha.</td>
<td>18·2</td>
<td>2·8</td>
<td>...</td>
</tr>
<tr>
<td>Chlorfenvinphos 50 per cent w.v. e.c.</td>
<td>465 ml/ha.</td>
<td>22·4</td>
<td>7·6</td>
<td>6·2</td>
</tr>
</tbody>
</table>

Armyworm parasites, highly magnified