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Stable flies on the Swan Coastal Plain

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Natalie Keals
Bob Paulin

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STABLE FLIES on the Swan Coastal Plain

Growers associations are developing best management practices (BMPs) to minimise fly breeding in horticulture and turf production. These BMPs draw on the research of David Cook, Ian Dadour, Natalie Keals and Bob Paulin into preferred fly breeding sites and three types of insecticide controls.

The stable fly (Stomoxys calcitrans) was first recorded in eastern Australia in 1881 and had reached Western Australia by 1912. The adult flies (both males and females) feed several times a day, generally in the early morning and late afternoon. Their main hosts are cattle and horses, with lesser hosts including man, dogs and pigs.

Stable flies bite animals mainly on the lower limbs and belly. When present in high numbers (more than five flies per foreleg), the constant biting can reduce weight gain and feed conversion in livestock, making the stable fly an economically important pest.

Female flies require blood in order to lay eggs. The larvae or maggots of stable flies breed mostly in moist and rotting organic matter, especially when combined with animal manure or urine.

Based on complaints to local government authorities, the stable fly problem has steadily increased on the Swan Coastal Plain since the late 1980s. Its prevalence has increased with the encroachment of urban development into rural areas. The stable fly has seriously disrupted cattle finishing and forced cattle and horse owners to either agist stock, relocate or close down. It has also affected the lifestyle of local residents in Wanneroo, Gingin, Kwinana and Serpentine.

Because the stable fly affects numerous agricultural industries (livestock, poultry, horticulture), Agriculture Western Australia in conjunction with the Health Department has taken a lead role in identifying breeding sites and developing BMPs for horticultural and livestock industries to minimise fly breeding.

**Stable fly breeding sites**

Identifying exactly where stable flies are breeding is done by using emergence traps and emergence tubes. Emergence traps consist of one square metre of shadecloth placed on the ground over a potential fly breeding site with clear canisters on top to trap the emerging adult flies. Emergence tubes are large grab samples of fly breeding material (one square metre) from which the flies are reared in the laboratory under optimal conditions.

The traps and tubes have given a much clearer picture of where stable flies are actually breeding.

Although these data are not complete, high numbers of stable flies have been found in:

- wet poultry manure stacks (Photo 1)
- spilled, wet animal feed;
- vegetable refuse pits;
- vegetables fed to livestock, where dung and urine are trampled into rotting vegetable matter (Photo 2); and
- preplant and side dressing applications of poultry manure (Table 1 and Photo 3).

![Photo 1: Poultry manure stacks](image-url)
we must take into account the total area of each type of material. For example, an average of 11,500 stable flies (and 300,000 house flies) can be produced from each hectare of a side banded crop. As many as 60,000 stable flies can be produced on average from every hectare of preplanted beds.

Conversely, from livestock, an average of 80 to 100 stable flies per hectare can be produced from horse and cattle dung (assuming two animals per hectare which produce 64 litres of cow dung and 40 litres of horse dung per day, and are viable for fly breeding for five days).

Although poultry manure heaps can produce large numbers of stable flies if delivered wet, or if wet by sprinklers or rain, they are not an important source when delivered dry and kept dry (Photo 4).

An intensive survey of rural, rural-residential and special rural properties in Wanneroo was conducted in February 1997. The owners were interviewed about the stable fly problem and all properties were inspected for evidence of fly breeding. Where fly larvae were found, a sample was collected and reared in the laboratory for species identification.

Figure 1 gives a breakdown of where all fly species were breeding and Figure 2 shows where stable flies were found breeding. Flies were breeding in association with the use of poultry manure and the breakdown of rotting vegetable matter from pits and trashed crops. Stable flies were breeding predominantly from wet poultry manure stacks, side band applications, rotting vegetable matter and horse manure.

Best management practices

- Cover manure stacks, especially during winter and when the manure is delivered wet.
- Follow recommendations for using manures in turf production.
- Avoid side banding or surface applications of manure that cannot be incorporated between October and April, which is the main period of stable fly breeding.
- Replace side banding with fertigation.
- Use insecticides effectively to control fly larvae.

Best management practices

Best management practices to minimise fly breeding in horticulture and turf production have been developed by the Cropping Industries Fly Management Working Group and were outlined to growers at meetings over January-February 1997.

A Livestock Industries Fly Management Group was recently formed and will develop Livestock Production BMPs. A Poultry Industry Group is dealing with poultry manure quality and possible processes to reduce or prevent fly breeding when manure is delivered to growers. Some possibilities include:

- delivering manure from poultry sheds that is dry and free of clumps; and
Photo 4: Dry poultry manure stacks
- partial or full composting of poultry manure.

Fly breeding in poultry manure stacks
Some 200,000 tonnes of poultry manure is produced annually from broiler sheds in and around the Perth metropolitan area. The manure is mixed with jarrah sawdust or a similar organic bedding material and is an ideal breeding medium for stable flies if it becomes wet.

This manure is removed rapidly from poultry sheds and delivered to horticultural properties, where it is widely used as a fertiliser and soil conditioner in vegetable and turf production. It is mixed into the soil prior to planting (preplant) or applied in strips, as a side band (Photo 5) or top dressing, alongside the growing crop.

Moist manure from poultry sheds can be struck by flies:
- as soon as the poultry are removed from the sheds;
- in transit to horticultural properties;
- while stored in a heap on a property; and
- after application to crops or turf as a preplant or side band.

Tunnel houses made of fine mesh were erected over delivered poultry manure immediately on delivery, or seven days after delivery, to determine the extent of fly breeding occurring before and after delivery. All flies emerging from the manure were trapped.

The study showed that manure is delivered to growers already struck with flies (mainly house flies but also stable flies). Large numbers of house flies are breeding in the manure heaps after delivery, with one heap generating 64 stable flies post-delivery (Table 2).

Growers test insecticides
The effectiveness of chemicals that were applied by growers to side dressing applications of poultry manure infested with fly larvae was assessed. Counts of fly larvae were done immediately before spraying and on at least two dates post-application.

Dominex® (40-50 millilitres per 100 litres) at between 400-800
litres per hectare was used to control fly larvae in poultry manure side band applications. The growers applied the insecticide according to their usual practice and assessments were made on the number of fly larvae and/or pupae at various dates post-spraying (Table 3).

Table 2. The number of stable flies and house flies emerging from poultry manure heaps (10 cubic metres)

<table>
<thead>
<tr>
<th>Time</th>
<th>Upon delivery</th>
<th>7 days after delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stable fly</td>
<td>House fly</td>
</tr>
<tr>
<td>Sep/Oct</td>
<td>133</td>
<td>64</td>
</tr>
<tr>
<td>Oct</td>
<td>44</td>
<td>31</td>
</tr>
<tr>
<td>Nov</td>
<td>4</td>
<td>1254</td>
</tr>
<tr>
<td>Jan</td>
<td>74</td>
<td>354</td>
</tr>
<tr>
<td>Feb</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td>March</td>
<td>0</td>
<td>58</td>
</tr>
<tr>
<td>Average</td>
<td>20.3</td>
<td>153.3</td>
</tr>
</tbody>
</table>

Trials on common horticultural insecticides

A range of commonly used horticultural insecticides were applied at recommended rates to replicated plots (within brassica crops) of poultry manure side band applications that had become struck with fly larvae. Six chemicals were used in each trial: methamidophos (Nitofol®), chlorpyrifos (Lorsban®), fluvalinate (Mavrik®), alpha-cypermethrin (Dominex®), mevinphos (Phosdrin®) and carbaryl (Bugmaster®).

Trial results showed that insecticides do not have a significant impact on the number of fly larvae (Table 4), because the larvae can survive in large clumps of poultry manure. Occasionally, however, chemicals such as Nitofol® and Bugmaster® were able to considerably reduce the number of fly larvae.

Photo 5: Side banding

photo impact of clumpy poultry manure on fly breeding

Impact of clumpy poultry manure on fly breeding

Numerous observations confirm that fly larvae will breed in clumps of poultry manure that are exposed at the soil surface (Photo 6). Flies lay eggs on the edges of the manure clump and the larvae then move under the clump and between layers in the clump. Within these water repellent clumps, the larvae are virtually safe from insecticide contact.

Both house fly and stable fly larvae were prevalent in obvious clumps of poultry manure, as distinct from fine, powdery manure that was thinly spread and mixed with the soil. The number of fly larvae found in each situation are summarised in Table 5.

Table 3. Mean numbers of fly larvae in sideband applications of poultry manure by growers using Dominex®

<table>
<thead>
<tr>
<th>Time</th>
<th>Trial 1</th>
<th>800 L/ha</th>
<th>Trial 3</th>
<th>800 L/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-spray</td>
<td>9.6 (0)</td>
<td>13.3 (0)</td>
<td>1.5 (0)</td>
<td>1.5 (0)</td>
</tr>
<tr>
<td>1 dose</td>
<td>10.8 (0)</td>
<td>22.2 (69)</td>
<td>- (0)</td>
<td>0.3 (0)</td>
</tr>
<tr>
<td>3 doses</td>
<td>33.5 (0)</td>
<td>15.0 (85)</td>
<td>10.9 (15)</td>
<td>10.9 (15)</td>
</tr>
<tr>
<td>6 doses</td>
<td>15.9 (20)</td>
<td>15.2 (20)</td>
<td>- (0)</td>
<td>- (0)</td>
</tr>
<tr>
<td>9 doses</td>
<td>7.4 (92)</td>
<td>N=15</td>
<td>N=15</td>
<td>N=15</td>
</tr>
</tbody>
</table>

Values in parentheses are % pupae. 3 doses post-spraying.

Counts of stable flies were made daily from day 1 to day 7, twice weekly from day 8 to day 28 and weekly from day 29 to day 101 after ear tag application. On each assessment day, stable flies were counted, using binoculars, on one side of 10 cattle.

In both trials, there were significantly less stable flies on cattle with Python® ear tags. There was no difference in the number of stable flies on untreated cattle or cattle with Optimizer® ear tags.

The variation in fly numbers on untreated cattle was four to eight times greater than on cattle with Python® ear tags. On days when stable flies were at high densities, cattle with Python® ear tags were less effected. Optimizer® had a similar but a lesser effect.

Table 4. The effect of a range of horticultural insecticides against fly larvae in poultry manure side band applications

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitofol®</td>
<td>80</td>
<td>12</td>
<td>23</td>
<td>39</td>
</tr>
<tr>
<td>Dominex®</td>
<td>2</td>
<td>35</td>
<td>41</td>
<td>26</td>
</tr>
<tr>
<td>Mavrik®</td>
<td>38</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Phosdrin®</td>
<td>35</td>
<td>2</td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>Lorsaban®</td>
<td>29</td>
<td>22</td>
<td>41</td>
<td>36</td>
</tr>
<tr>
<td>Bugmaster®</td>
<td>44</td>
<td>24</td>
<td>64</td>
<td>44</td>
</tr>
</tbody>
</table>

*According to the Henderson-Tilton formula.

Table 5. Mean number of fly larvae in poultry manure clumps or in fine poultry manure and preplant applications of poultry manure

<table>
<thead>
<tr>
<th>Clumps/Manure/sand</th>
<th>3 days post application</th>
<th>6 days post application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side dress</td>
<td>77.8</td>
<td>18.8</td>
</tr>
<tr>
<td>Lorsaban®</td>
<td>16.9</td>
<td>17.0</td>
</tr>
<tr>
<td>Phosdrin®</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Bugmaster®</td>
<td>0.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Note: The values are the mean of assessments at day 3 and day 6 post-spraying.

Can cattle ear tags repel stable flies?

A preliminary trial tested the ability of Optimizer® and Python® insecticidal ear tags to repel stable flies from cattle in the Gingin Shire during 1996/97. The Optimizer® tags contain 200 grams per kilogram of diazinon and Python® tags contain 100 grams per kilogram of zeta-cypermethrin and 200 grams per kilogram of PBO.

Six properties were used to conduct two preliminary trials in the Gingin brook area and around the Gingin townsite. At each location, at least 50 cattle were used in three treatments (Optimizer®, Python® and no ear tags). Ear tags were inserted with an applicator into both ears of all cattle in the trials.

For further information, contact

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Photo 6: Flies breeding in poultry manure clumps

Photographs courtesy of Natalie Keals