Control of the red-legged earth mite and lucerne flea: treatment of seed with systemic insecticides

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TREATMENT OF SEED WITH SYSTEMIC INSECTICIDES

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The red-legged earth mite, *Halotydeus destructor* (Tuck.), and the lucerne flea, *Sminthurus viridis* (L.), are at present controlled effectively, cheaply and safely by a combined DDT/malathion spray (Jenkins, 1956, 1957) and this continues to be the general recommendation for farmers. However, this combination has some disadvantages. The DDT in the spray ensures some residual control of the earth mite but has the unfortunate property of toxicity to the bdellid mites which are useful predators of the lucerne flea. The malathion in the spray assists the DDT to control the earth mite and provides a good, quick kill of the lucerne flea, but it has no residual action. As a consequence, lucerne flea populations tend to build up again rapidly after treatment, unless a second treatment is applied.

There are, therefore, two weaknesses in the present DDT malathion mixture, viz. lack of residual toxicity to the lucerne flea and some toxicity to the useful bdellid mites.

Recent laboratory and small-scale field tests at the C.S.I.R.O. W.A. Regional Laboratory, Nedlands, have shown that the new systemic insecticides may help to overcome these difficulties.

Systemic insecticides are materials which can be taken up by the plant, either from seed, from the soil, or through the leaves. The insecticide becomes distributed throughout the plant in varying proportions, so that an insect, when feeding, takes some into its system. Mites and small insects, such as aphides, thrips, leafhoppers, etc., may absorb enough to cause death. Results have been more erratic with larger insects, although good control has been achieved in some cases.

Seed treatment, that is the coating of the seed with a layer of insecticide dust prior to sowing, was tried as a means of protecting subterranean clover and other plants, such as pea and vetch, against attack by the red-legged earth mite and lucerne flea. The results of these small-scale tests were very encouraging and a brief account of them is given here so that, should any of the materials become available, farmers may try them out for themselves in small areas. It should be emphasised however, that further tests must be carried out before precise recom-
mendations on dosage rates, methods of application, etc., can be given.

MATERIALS TESTED
1. Demeton ("Systox") and methyl demeton ("Metasystox"), obtained as a 50 per cent. material on active charcoal.
2. "Thimet," obtained as a 44 per cent. material on active charcoal.
3. "Sayfos," obtained as an 80 per cent. wettable powder.

"Systox" and "Thimet" are highly poisonous materials and must be handled with great care. "Metasystox" is less poisonous and "Sayfos" is reported to have a very low mammalian toxicity. Nevertheless, care must be exercised when these chemicals are handled. It is important that users should adhere strictly to the precautions advised by the manufacturers.

METHODS
The best method of adding the insecticide to the seed is not yet known but good results have been obtained by simply tumbling the seed in a suitable container with the required amount of insecticide dust. Water can be added to the seed, if desired, and this has the advantage of reducing slightly the amount of free dust in the atmosphere. About two pints per 100 lb. subterranean clover seed seems to be quite satisfactory. Another method is to make up a slurry of the insecticide in water and add this to the seed in the container.

In the experiments so far conducted the seed was planted within a few hours of treatment. However, there is some evidence to suggest that treated seed could be stored for some time, if necessary.

QUANTITIES
In the early experiments the damp seed was simply tumbled in an excess of insecticide dust. Later on quantities ranged from ½ to 4 lb. insecticide dust per 100 lb. seed.

RESULTS
The results indicate that all materials tested gave at least some control of both the red-legged earth mite and lucerne flea.

In a pot trial, subterranean clover seedlings arising from seed tumbled in an excess of "Systox" and "Metasystox" proved toxic to both these pests for periods of up to eleven weeks after sowing in the case of "Systox," and seven weeks in the case of "Metasystox." The latter appeared to lose toxicity to the lucerne flea more quickly than to the earth mite.

A small field trial comparing the effects of seed treatment of subterranean clover (Dwalganup), common vetch, *Vicia sativa* L. and field pea, *Pisum arvense* L. with "Systox," "Metasystox" and "Thimet," was commenced in the autumn of 1959. The seed after treatment with an excess of insecticide, was sown out in rows with areas of natural mite-infested pasture between the rows. This ensured a continuous invasion of earth mites on to the seedlings. The results are summarised in Table 1.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Subclover</th>
<th>Vetch</th>
<th>Pea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control—no treatment</td>
<td>...</td>
<td>...</td>
<td>1</td>
</tr>
<tr>
<td>&quot;Systox&quot;</td>
<td>...</td>
<td>5</td>
<td>423</td>
</tr>
<tr>
<td>&quot;Metasystox&quot;</td>
<td>...</td>
<td>1</td>
<td>216</td>
</tr>
<tr>
<td>&quot;Thimet&quot;</td>
<td>...</td>
<td>639</td>
<td>1,904</td>
</tr>
</tbody>
</table>

All treatments produced at least some kill of the earth mite up to twelve days after sowing, but "Thimet" was clearly the most effective of the three. Detailed observations were discontinued at this stage, but subsequent casual inspections indicated that mites were still being killed up to six weeks after sowing in the "Thimet" treatment. Although the plants arising from the treated seed suffered some damage as a result of the continuous mite attack, they obtained a good deal of protection and grew much more vigorously than the untreated series. Under normal conditions this type of continuous attack would not occur, except perhaps at the edge of crops, and the plants would receive almost complete protection for an extended period.
Photographs showing (right) the increased growth of peas where the seed had been treated with "Thimet" prior to sowing. Compare with plants grown from untreated seed (left). The increased growth is due principally to protection from earth mite attack.

The other insecticide tested, namely "Sayfos," did not become available until late in 1959, so that the tests with this insecticide were restricted to a few pot trials.

The results of one such trial with subterranean clover are shown in Table 2. The mites and fleas were counted after feeding upon the plants for from five to eight days.

**TABLE 2.**

The influence of treatment of subterranean clover seed with "Sayfos" on earth mites and lucerne flea feeding upon the resulting seedlings. Table shows percentage mortality after from 5-8 days of feeding.

<table>
<thead>
<tr>
<th>Dosage Rate lb. &quot;Sayfos&quot; per 100 lb. Seed</th>
<th>14 days after Sowing</th>
<th>34 days after Sowing</th>
<th>55 days after Sowing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Earth Mite</td>
<td>Lucerne Flea</td>
<td>Earth Mite</td>
</tr>
<tr>
<td>Control—No treatment</td>
<td>26-1</td>
<td>6-7</td>
<td>33-3</td>
</tr>
<tr>
<td>½ lb.</td>
<td>96-1</td>
<td>90-0</td>
<td>81-7</td>
</tr>
<tr>
<td>1 lb.</td>
<td>100-0</td>
<td>98-0</td>
<td>100-0</td>
</tr>
<tr>
<td>4 lb.</td>
<td>98-2</td>
<td>98-1</td>
<td>100-0</td>
</tr>
</tbody>
</table>

* No mites available for testing.

The toxic action was fairly rapid when the seedlings were only young (14 days after sowing) but three weeks later (34 days after sowing) the time required to produce the same kill increased from two to six days. However, there was clear evidence of residual action of at least one month in all treatments. Fifty-five days after sowing, only the heaviest dosage (4 lb. "Sayfos" per 100 lb. seed) appeared to have any substantial residual influence.

**EFFECT OF EMERGENCE AND GROWTH OF SEEDLINGS**

Germination rate and seedling emergence were depressed to a greater or lesser degree by all treatments. At the lower rates of application, ½ to 1 lb. per 100 lb. seed, the depression was only very slight and would probably be of little or no significance in practice. "Metasystox" was the most highly toxic to the seed and in one instance reduced emergence of subterranean clover to 22 per cent.

"Sayfos" was less toxic, and even at 4 lb. insecticide per 100 lb. seed, the depression in clover emergence was only about 10 per cent. At this dosage, however, many of the seedlings which did emerge were very pale in colour and subsequent growth was severely retarded.
Some loss of colour and stunting in early growth occurred at the 1 lb. dosage, but recovery was usually good, and in fact, there was evidence of substantially increased growth in the later stages even where insect attack appeared to be non-existent. Other workers, e.g., Guyer, Brown and Wells, 1958, and Brown, 1957, have reported similar increases in weight in treated seedlings, in the absence of any apparent insect attack. It seems probable that the systemic insecticide treatment of the seed boosted seedling growth by means other than protection from direct damage by insects.

"Thimet" was relatively non-phytotoxic and appeared to be fairly safe to use up to about 4 lb. per 100 lb. seed. It should be noted that there is some variation in the response of different plant species.

EFFECT OF NODULATING BACTERIA

Both "Thimet" and "Sayfos" at high concentrations can inhibit growth of these bacteria. On the other hand, at lower concentrations growth is not seriously affected and may even be enhanced. The practical implications of the influence of these treatments on nodule formation have yet to be examined. It is likely that the problem will be a serious one only in certain special circumstances, for example, where the only possible source of the bacteria is from the inoculated seed.

CONCLUSIONS

Treatment of legume seed with systemic insecticides may provide an effective means of protecting young seedlings from attack by the red-legged earth mite and lucerne flea. Quantities of insecticide required have yet to be determined accurately, but about 1 lb. active ingredient per 100 lb. seed appears to be satisfactory. The advantages of this treatment are (1) rapid initial kill of both pests; (2) prolonged residual action; (3) lack of toxicity to useful predators, such as the bdellid mite, and (4) ease of handling, especially in the case of "Sayfos" where the mammalian toxicity is low.

Experiments on the use of these insecticides in established pastures will be carried out in 1960. Until these results are obtained the present control methods with malathion and DDT should be used where necessary.

SUMMARY

Treatment of the seed of subterranean clover and other legumes with the new systemic insecticides prior to sowing, may provide an effective means of protecting the seedlings from attack by the red-legged earth mite and the lucerne flea. "Sayfos," applied at from ½ to 1 lb. insecticide active ingredient per 100 lb. seed was effective for several weeks in small-scale tests. "Thimet" may require slightly higher dosages. For trial purposes about 1 lb. insecticide per 100 lb. seed is recommended.

REFERENCES


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