Residues on plants as surrogates for insects

Assessment of pesticide risks to birds and mammals from dietary exposure requires estimates of the concentration of pesticides in their food.

Current approaches rely upon estimates of the residues likely to be found in various types of plant matter immediately after pesticide application. These estimates were originally derived by Hoerger and Kenaga (1972). They collated data from field studies with a number of pesticides and derived estimates of the 'Residue per Unit Dose' (RUD), which entered general use in the form of the 'Kenaga nomogram'.

Neither of these studies included any data on residues in insects. Kenaga (1973) suggested that "residues deposited on insects might be equivalent to those on plant parts of similar surface area to volume ratio". This suggestion was adopted as standard practice in North America and Europe (Table 1). Until recently, the assumptions it implied were untested.

Table 1. Use of field data on initial pesticide residues in plant materials to estimate residues in insects. All the values are expressed as the ppm of residues expected per unit of pesticide applied (in lb/acre). To estimate the residue for any pesticide use, the dose rate (lb/acre) is multiplied by the relevant RUD.

<table>
<thead>
<tr>
<th>Residue measured in:</th>
<th>Kenaga (1972)</th>
<th>Fletcher et al. (1994)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Typical mean RUD</td>
<td>Typical limit RUD</td>
</tr>
<tr>
<td>Forage crops</td>
<td>33</td>
<td>58</td>
</tr>
<tr>
<td>Pods/seeds</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Country</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crops</td>
<td></td>
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<td></td>
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<tr>
<td>Dose rates:</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Pesticide type:</td>
<td></td>
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<td>Methods of application:</td>
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</tbody>
</table>

Some margin of safety is appropriate to allow for these uncertainties, but it is not easy to judge how large this should be.

Conclusion

Until the factors affecting insect residues are better understood, no firm basis can be given for revising the standard RUDs. Pending further research, it may be best to retain current approaches for screening assessments. Where these indicate a potential risk, field studies could be conducted to obtain more reliable data.

Research needs

1. Field experiments to test the influence of key factors including application rate, insect type and size, time after application, to develop improved RUDs and distributions for probabilistic assessment.
2. Statistical methods for combining pesticide-specific data with generic RUD information, to reduce the need for large numbers of field sites.
3. A practical process for sharing data and updating RUDs as new data becomes available.
4. Re-examination of existing RUDs for plant material to check for similar problems.

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