Background

Weeds often occur in patches so selective herbicide application can in principle result in significant reductions in chemical use, giving both economic and environmental benefits. Technological advances, based on a recently completed MAFF LINK project with 50% HGCA funding and led by Dr Peter Lutman, IACR-Rothamsted and Professor Paul Miller, Silsoe Research Institute, are described.

First principles

A practical system for spraying weed patches is being developed using:

- a weed map,
- a sprayer capable of applying herbicides on a spatially selective basis,
- an electronic system that uses the weed map to control the sprayer.

Weed mapping

The Global Positioning System (GPS) used to map yield has also proved suitable for weeds. This was done by assessing weed incidence on either side of tram-lines and inputting the information into a computer. This forms the basis of the weed map (Figure 1).

The project concentrated on black-grass and brome in mid-summer and wild-oats and couch just before harvest.

Areas of fields not infested with grass weeds do not require treatment (Table 1). Some broad-leaved weeds, such as creeping thistle and cleavers, may also have patchy distribution.

If weed patches are stable then a map can be used for several years. If they are not, then re-mapping is needed more often. Black-grass patches are relatively stable, but the level of infestation may change between years.

<table>
<thead>
<tr>
<th>Weed species</th>
<th>Percentage areas of fields infested</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-grass</td>
<td>4 20 34 45 40 46 54 59 69 72 84 85</td>
<td>52</td>
</tr>
<tr>
<td>Wild-oats</td>
<td>2 14 18 15</td>
<td>12</td>
</tr>
<tr>
<td>Common couch-grass</td>
<td>3 10 27 48 57 79</td>
<td>37</td>
</tr>
<tr>
<td>Barren brome</td>
<td>51</td>
<td>51</td>
</tr>
</tbody>
</table>
Sprayer design and electronic control

The prototype patch sprayer for this project was developed by Silsoe Research Institute. Using injection metering, this responded to the weed map to treat areas 2m x 4m with different herbicide doses.

The field was divided into small areas or cells. The weed map controlled the sprayer and the GPS system ensured the right herbicide dose was applied to each cell. Much of the potential benefit may be lost if cells are too large.

It is probably best to treat the non-infested areas with a low dose of herbicide and the weedy areas with a higher one. This should ensure that isolated plants do not form a focus for future infestations.

Economic justification

Patch spraying will only be worthwhile if herbicide savings exceed the additional costs of new equipment and of weed mapping. Based on work with grass weeds it is estimated that the cost of herbicides would be reduced by £5 to £15 a hectare each year. Herbicide savings should be greater than the cost of mapping as long as fields are mapped no more frequently than one year in three. As environmental constraints on pesticide use increase, patch treatment may be given increased priority. An important finding from the weed patch spraying strategies examined in this and associated project work is that the use of variable dose and/or mixture treatments rather than on/off control is likely to be a more robust and cost-effective approach taken over an extended period of a number of seasons.

The future

A new LINK project with HGCA funding has recently started to fully develop practical on-farm weed patch spraying, involving several new elements:

- a commercial ‘patch sprayer’ being developed by Micron Sprayers in collaboration with Silsoe Research Institute is undergoing farmer trials in the 1998 season;
- techniques for efficient weed mapping;
- satellite navigation, mapping and sprayer control systems currently under development by AGCO UK.

The project will supply records of spray application to meet future ‘traceability’ requirements.

Further companies are importing injection metering systems from the USA and are looking at ‘patch spraying’ weeds.

Developing a weed patch spraying system

Topic Sheet No. 13
Spring 1998

Action:

- Identify areas of fields where weeds are abundant or absent. Record this information in relation to tram-lines for future use.
- If appropriate, manually patch spray some weeds, e.g. wild-oats.
- When purchasing electronic navigation and control systems that can be used for yield mapping and spatially variable fertiliser application, ensure that they can also be used for weed mapping and spatially variable herbicide application.
- When purchasing a new sprayer consider machines that have the potential to apply spatially variable treatments.

Further Information:
Project Report 158
Ongoing project 0088/1/97

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