Orchard spraying: Opportunities to reduce rates

Peter Walklate, Silsoe Research Institute and Jerry Cross, East Malling Research

Do you want to:
• Reduce pesticide residues on fruit?
• Reduce environmental and bystander contamination?
• Reduce operational costs by more efficient use of pesticide?
• Reduce aquatic buffer zones under a Local Environmental Risk Assessment for Pesticide (LERAP)?

This factsheet provides a step-by-step guide to help you achieve these aims by determining the appropriate dose and making the right sprayer adjustments to suit different apple orchards at different stages of the season.

Background

Did you know that there can be a greater than five fold variation in average pesticide spray deposits in the tree canopy, due to the variability of tree size and canopy density? Current pesticide label dose recommendations stating the amount of product applied per hectare of ground area contribute to this problem. You may already have taken the opportunity to reduce the recommended dose of some products in particular orchards at certain stages. Many have already done so, based on successful practice and on ad hoc trials with different orchard/product combinations.

In some other countries, the ‘tree row volume’ method of dose adjustment has been adopted to improve dose optimisation. This method considers only the effects of different tree height, tree crown width and tree row width and ignores some important effects of foliar development and branching density at different growth stages. Pesticide Adjustment to the Crop Environment (PACE) is a dose adjustment system that additionally takes account of the increasing density of the canopy during the growing season. Research and grower trials have shown that there is the potential to apply pesticides from full-dose down to 1/4 full-dose during the pre-blossom growth stages depending on certain factors. Note that 1/4 full-dose applications reduce the risk of non-target contamination from drift by 75% and can be used to reduce the aquatic buffer zones according to the Defra LERAP guide for broadcast air-assisted sprayers.

What should you do to optimise the dose?

Take these steps to optimise dose and reduce the variability of spray deposits:

1. Establish your standard orchard sprayer settings
2. Assess the need to spray
3. Select the pesticide(s) and assess whether dose reduction is appropriate
4. Reduce the dose for lower canopy density
5. Reduce the spray plume height for lower tree height.
Step 1. Establish standard orchard sprayer settings
As a once only exercise, at the full-leaf stage, set the sprayer so that the top of the spray plume hits the top of the tallest trees (maximum height 2.5m). Adjust the airflow and nozzle number and position to match the height of the spray plume to the tallest trees. Increase the ground speed of the sprayer (by up to 50%) without significantly reducing spray deposit and distribution.

Step 2. Assess the need to spray
Monitor your orchards fortnightly for levels of pests and diseases and assess the potential risk of infection or infestation. Use the schedule in The Defra Best Practice Guides for Apple and Pear Production or the HDC Orchard Monitoring Calendar. Take into account predictions from pest or disease models and weather forecasts.

Step 3. Select the pesticide(s) and assess whether dose reduction is appropriate
Check the product label for the dose recommendation in relation to growth stage and use Step 4 below to determine the appropriate dose reduction. Dose reduction may be appropriate for low to medium pest or disease risk situations. Note that if you reduce the dose the manufacturer’s warranty on the efficacy of the product may no longer apply. Check if your target water volumes are achievable using the standard sprayer settings and that any additional requirements do not compromise these settings.

Step 4. Reduce the dose for lower tree area density
Check the canopy density in relation to growth stage and use the pictograms below to determine the appropriate dose reduction.

Pre-blossom dose adjustments

<table>
<thead>
<tr>
<th>Product label does not give specific pre-blossom dose</th>
<th>1/4</th>
<th>1/2</th>
<th>3/4</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product label does give specific pre-blossom dose</td>
<td>1/4</td>
<td>1/2</td>
<td>3/4</td>
<td>1</td>
</tr>
</tbody>
</table>

Product label gives specific pre-blossom dose rate

Post-blossom dose adjustments

<table>
<thead>
<tr>
<th>Product label does not give specific post-blossom dose</th>
<th>1/4</th>
<th>1/2</th>
<th>3/4</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product label gives specific post-blossom dose rate</td>
<td>1/4</td>
<td>1/2</td>
<td>3/4</td>
<td>1</td>
</tr>
</tbody>
</table>

Product label gives specific post-blossom dose rate

<table>
<thead>
<tr>
<th>Reduce dose for earlier growth stages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce dose for lower density of planting, branching &amp; foliage</td>
</tr>
</tbody>
</table>

Step 5. Reduce spray plume height for lower tree height
Turn off the upper-most nozzles to reduce the spray plume height for pro rata dose reduction (eg turning off the upper 25% of nozzles when the tree height is 25% smaller than the tallest trees will achieve a dose reduction of 25%).
**Water volume rate and spray cover**

Remember the relationship between dose, volume and concentration. For instance, if a volume of 200 l/ha is recommended for the full dose, then applying a 1/2 dose at a volume of 100 l/ha will maintain the concentration. However, pro rata lower volumes such as 50 l/ha may compromise spray cover. Pro rata reductions beyond the minimum on the label for the dose being applied (thereby increasing the concentration of pesticide above the maximum prescribed by the label) can be made under some circumstances within the Defra Code of Practice for the Safe Use of Pesticides on Farms and Holdings, but not where they are specifically prohibited on the label.

**Worked examples**

**Dithionon 750 g/l SC (Dithionon Flowable)**
This scab fungicide is recommended to be applied from bud burst at a dose of 1.1 l/ha in a minimum water volume of 200 l/ha for low volume application or between 0.5 and 0.75 l/1000 l of water at high volume and repeated every 10 days until the danger of scab infection ceases. Because it is crucial to control scab between bud burst and bloom specific pre-blossom dose adjustments from full-dose down to 1/2 dose would be appropriate depending on the canopy density, whereas below 1/2 dose would be too risky.

**Chlorpyrifos 480 g/l EC (eg Equity)**
These insecticide products have different dose recommendations for pre-blossom (1.0 l/ha) and post-blossom (2 l/ha) use. The minimum spray volume is 250 l/ha. The specific pre-blossom dose columns of dose adjustments are appropriate (canopy density dose adjustment factor 1/2–1). For pre-blossom applications, the greatest reduction for canopy density is by 1/2, which reduces the dose from 1.0 down to 0.5 l/ha. For post-blossom applications the greatest reduction for canopy density at full leaf is by 1/2, which reduces the dose from 2.0 to 1.0 l/ha.

**Dimilin Flo**

Diflubenzuron 480 g/l SC (Dimilin Flo)
The dose rate recommendation is 0.3 l/ha in a minimum of 500 l/ha. The non-growth stage specific dose columns of dose adjustment for these product recommendations for canopy density are appropriate (canopy density dose adjustment factor 1/4 – 1/2 pre-blossom and 1/2–1 at full leaf).

3 Reduced dose, and reduced volume, result in reduced drift, reduced pollution and reduced costs

**Please note**

- Any decision to apply reduced rates and/or volumes outside the label recommendation is at grower’s own risk.
- Always read the product label before applying pesticides and use pesticides safely.
- Take wind speed and direction into account.
- The PACE concept outlined in this factsheet is based on research funded by the Pesticide Safety Directorate.