2010 Maximum Residue Level (MRL) Workshop –
Global Regulations
Residue Decline Curves Related to MRLs
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Structure of Presentation

- MRLs, Residue Data and Label Directions
- Declines Curves
- Secondary Residue Standards vs. MRLs
- Value of Decline Curve Data
Regulatory Definition of MRL

- **Maximum Residue Level (MRL)** legally allowed in/on food, or animal feedstuff, after use of crop protection chemical according to **Good Agricultural Practice (GAP)**
How are MRLs set?

- Calculated on basis of residue data generated according to a specific use pattern (worst-case conditions)
  - Max application rate
  - Timing of application
  - Max number of applications
  - Min spray interval between applications
  - **Shortest Pre-Harvest Interval (PHI)**

Residue data → MRL setting
### Residue Data set for MRL setting

**Tomato-Insecticide X**

<table>
<thead>
<tr>
<th>Location</th>
<th>Trial #</th>
<th>kg as/ha</th>
<th>PHI (days)</th>
<th>Residues (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gard, France</td>
<td>L070378</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.62</td>
</tr>
<tr>
<td>Heasaloniki, Greece</td>
<td>L070379</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.49</td>
</tr>
<tr>
<td>Milano, Italy</td>
<td>L070380</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.22</td>
</tr>
<tr>
<td>Sevilla, Spain</td>
<td>L070381</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.66</td>
</tr>
<tr>
<td>Gard, France</td>
<td>L080001</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>Thessaloniki, Greece</td>
<td>L080002</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.78</td>
</tr>
<tr>
<td>Teramo, Italy</td>
<td>L080003</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.30</td>
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<td>Sevilla, Spain</td>
<td>L080004</td>
<td>2 x 0.24</td>
<td>1</td>
<td>0.31</td>
</tr>
</tbody>
</table>
### GAP, PHI, MRL & Product Label relationship

#### Table 1. Crop-Specific Restrictions and Limitations

<table>
<thead>
<tr>
<th>Crop Group¹</th>
<th>Crop Group²</th>
<th>Minimum Time from Application to Harvest (PHI) (days)</th>
<th>Maximum Rate per Acre per Application (oz product)</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Acre per Season (oz product)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berries Group¹:</td>
<td></td>
<td>0</td>
<td>23</td>
<td>4</td>
<td>92</td>
</tr>
<tr>
<td>Blueberry, Caneberry, Raspberry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulb Vegetables Group¹:</td>
<td></td>
<td>7</td>
<td>18.5</td>
<td>6</td>
<td>111</td>
</tr>
<tr>
<td>Onion, Garlic, Leeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td></td>
<td>0</td>
<td>10.5</td>
<td>6</td>
<td>63</td>
</tr>
<tr>
<td>Celery</td>
<td></td>
<td>0</td>
<td>25</td>
<td>2</td>
<td>50</td>
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<tr>
<td>Dry Beans¹</td>
<td></td>
<td>21</td>
<td>25</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Grapes²</td>
<td></td>
<td>14</td>
<td>23</td>
<td>3</td>
<td>69</td>
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<tr>
<td>Hops</td>
<td></td>
<td>14</td>
<td>28</td>
<td>3</td>
<td>84</td>
</tr>
<tr>
<td>Peanut</td>
<td></td>
<td>14</td>
<td>28</td>
<td>3</td>
<td>84</td>
</tr>
</tbody>
</table>

MRL is based on residue values which reflect specific GAP (incl. PHI) different PHI → different residues → different MRL!
What is a Residue Decline Curve?

Determines residues at a range of PHIs according to a particular GAP.
Lettuce Decline Curve

Lettuce DC of Fungicide

mg/kg

PHI

0 5 10 15 20 25

mg/kg

0 1 2 3 4 5 6 7 8 9
Apple Decline Curve with Parent and Metabolite

Apple DC of Fungicide

PHI (days)

Parent
Metabolite

mg/kg
mg/kg
Apple Decline Curve with Parent and Metabolite

Residue definition includes parent + metabolite
Design of Residue Decline Curve

- Include 3 to 5 sampling intervals in addition to the target PHI
- Include 0 day sampling (can be target PHI)
- Set sampling intervals at shorter and longer time points relative to the target PHI
- For multiple applications, set a sampling point immediately prior to the final application – determines contribution of earlier applications
- DCs are generally run alongside “At Harvest” trials, i.e. commercial PHI target interval for label
Residue Decline Curves for Bell Pepper
MRLs vs. Secondary Residue Standards

- MRLs are trading standards; they have been established by Regulators using strict, scientific-based, dietary intake evaluations
- Secondary standards are private, arbitrary standards established by Retailers and Food Processors

- Pesticide lists
- Standards less than MRL
- Maximum number pesticides
- No detectable residues
Secondary Standards: pressure for growers

- 2ndary Std Compliance Pressure
- Pressure
- Pressure
- 2ndary Std Proliferation
- External Pressure
- DISEASES
- INSECTS
- WEEDS
- Registered CPCs
- Regulatory MRLs
- Regulatory Import Tolerances
- National/Regional Regulators
- CPI
- Foods/Feeds
- Domestic Production Exports/Imports
- Food Processors
- Retailers
- Consumers 6.8 billion
- External Pressure
- Emotive Messages
- Pesticide scare - don’t eat apples or pears!
Secondary Standards

Secondary Residue Standards, which undercut and undermine regulatory MRLs, are becoming commonplace around the world because the major food retailers are sourcing and expanding globally.

- **Aldi**: max 1/3 MRL, max 100% ARfD (sum)
- **Coca-Cola**:
- **Fresh & Easy**
- **Tesco**
- **Rewe**
- **Lidl**
- **Carrefour**
- **Norma**
- **Metro Group**
- **Edeka**: max 70% MRL, max 50% MRL (for own brands)
- **Max. 3-5 actives**
- **Max. 5 actives**
- **Max. 80% MRL (sum)**
- **Max. 80% ARfD (sum)**
- **Max. 70% MRL (sum)**
- **Max. 70% ARfD (sum)**
Value of DC from Regulatory perspective

- Provides information on rate of disappearance of parent residue
- Provides information on rate of increase/decrease of metabolites
- Aids decision-making for inclusion/exclusion of metabolites in residue definition for both dietary assessment and MRL setting
- Predicts residues at an alternative PHI in case dietary risk concerns are encountered with target PHI
- Determines time to reach maximum residue level for systemic compound
- Useful data for assessing agricultural worker re-entry periods
Value of DC from Grower/Exporter perspective

- Provides information on total residues at different harvest intervals compared to worst-case minimum PHI on label, which was used for MRL setting

- Shows importance of adhering to label instructions with respect to PHI in order to stay within domestic MRL

- Information can be used to estimate a later harvest interval in order to comply with a lower foreign market MRL, or a customer’s Secondary Residue Standard
Residue Decline Curves for Bell Pepper

Residue in Peppers vs PHI

Label PHI
MRL = 1 mg/kg

Foreign Market
MRL = 0.4 mg/kg
Residue DC data are required for registration purposes by Regulatory Authorities.

DC data are helpful for estimating residues at range of PHI intervals.

DC data are collected for harvested commodities at the farm gate; residues decline during transit/shelf-life period.

Caution must be exercised in use of DC data since residue data tend to show lots of variability!

Analytical testing is always best to confirm residue level.
…..and please support Globally Harmonized MRLs, they make a world of difference!
BACK-UP
Strawberry Decline Curve

Strawberry-fungicide A

mg/kg
Apple Decline Curve – more stable compound

Apple-fungicide B

mg/kg

0 0.5 1 1.5 2 2.5 3

0 5 10 15 20 25 30 35 40

PHI
(vi) Residue decline studies. (A) Residue decline studies are required. Such data will be needed for uses where the pesticide is applied when the edible portion of the crop has formed or it is clear that quantifiable residues may occur on the food or feed commodities at, or close to, the earliest harvest time. The primary purpose of these studies is to determine if residues are higher at longer PHIs than requested and the approximate half-life of the residues. In addition, such studies are frequently of great value for determining an appropriate tolerance when a use pattern is changed. The number of decline studies needed is one for crops requiring 5 to 12 total trials and two for crops requiring 16 to 20 total trials. These studies are included in the 5 to 12 or 16 to 20 trials (i.e. not in addition to these numbers of trials). Decline studies will not be required for crops needing three or fewer total trials.

(B) The design of the decline studies should include 3 to 5 sampling times in addition to the requested PHI. The sampling times should all fall within the crop stage when harvesting could reasonably be expected to occur. The time points should be approximately equally spaced and, where possible, represent both shorter and longer PHIs than that requested. Of course, shorter PHIs cannot be examined in the case of a use with a zeroday PHI. In addition, for an at-plant/preplant use, the PHI is usually predetermined by the length of the growing season of the crop. Therefore, for such uses that result in quantifiable residues, petitioners should attempt to stretch the harvest period by sampling immature fruit, tubers, etc. if necessary.