Lecture 2

Pesticide Technology

Use of pesticides on grapes
Regulatory control of pesticides
Human & Ecological Toxicity
Testing for Registration

Instructor: Allan Felsot (afelsot@tricity.wsu.edu)
Use of Pesticides in Grape Production

Products Registered

Intensity of Product Use & Trends
Washington State Pest Management Resource Service

Connecting the people of Washington State with research-based information on pest management choices for home and commercial use.

Search WSPRS

PNW Issues Conference
Click here for information on the Pacific Northwest Agricultural Safety, Health and Medicine Conference, February 19, 2004
Welcome to Washington State University's Label and Tolerance Databases. These databases are operated by WSU with funding from the Washington State Department of Agriculture, the Oregon Department of Agriculture, Oregon State University, and WSU. This web site requires version IE 4+ or Netscape 4+.

This database contains information on Oregon and Washington pesticide labels*, 24(c)'s, and federal supplemental labels. It does not contain any information on Section 18's and EUPs. Section 18 information may be found on the PNN Web site at www.pnn.wsu.edu. Information in the PICOL label database is updated daily.

This database contains information on tolerances relevant to agricultural commodities in the Pacific Northwest. PICOL tolerance information is updated monthly. Please advise Catherine Daniels (cdaniels@tricity.wsu.edu) of any errors in either database.

* The PICOL label database is not a substitute for obtaining and reading pesticide labels. PICOL label information has no legal status, whereas the label is a legal document.
Pesticide Nomenclature

• Chemical name & common chemical name (approved by Int’l. Union Pure & Applied Chemistry)
  – Carbaryl (common name of an active ingredient)
    • Chemical name is 1-naphthyl methyl carbamate

• Product name
  – Name given to a formulation of the active ingredient
  – Contains other chemicals in addition to the active ingredient
    • Solvents
    • Adjuvants
    • Emulsifiers
See Handout of Herbicides, Insecticides, Fungicides, Nematicides, and Plant Growth Regulators Registered in WA State

Data obtained from the PICOL (Pesticide Information Center On-Line Database)
http://wsprs.wsu.edu
Pounds/Acre Per Year Use of Pesticides in California (CA) and Washington (WA) Grape Production

Note More Insecticides Used on Table Grapes than Wine Grapes in CA; “WA All” Includes wine and processing grapes

USDA NASS Database
Trends in Percentage of Grape Acres Treated with Pesticides

- **Herbicides**
- **Insecticides**
- **Fungicides**

**Year**
- 1991
- 1995
- 1999
- 2001
- CA 2001

**States**
- Washington State
- California

**Source**
USDA NASS
## Trends in Total Pounds of Pesticides Used In Grapes (lbs x 1000)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Herbicides</td>
<td>15</td>
<td>66</td>
<td>69</td>
<td>66</td>
<td>1016</td>
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<tr>
<td>Insecticides</td>
<td>42</td>
<td>24</td>
<td>47</td>
<td>87</td>
<td>2881</td>
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<tr>
<td>Fungicides</td>
<td>26</td>
<td>127</td>
<td>269</td>
<td>213</td>
<td>40,574</td>
</tr>
<tr>
<td>Other (PGRs)</td>
<td></td>
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<td>580</td>
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</table>
Pesticide Use on Grapes: Pounds/Acre/Crop Year

- Herbicides
- Insecticides
- Fungicides


Washington State

California

USDA NASS
Usage of Specific Herbicide AI in WA Grapes, 2001

- Simazine
- Paraquat
- Oryzalin
- Glyphosate

Graph showing the usage of specific herbicides in WA grapes in 2001, with the axes labeled as "% Area Appl" and "lbs x 1000". The graph is sourced from USDA NASS.
Usage of Specific Insecticide AI in WA Grapes, 2001

- **Propargite**
- **Petroleum distillate**
- **Dimethoate**
- **Chlorpyrifos**
- **Carbaryl**
- **Abamectin**

- **Ibs x 1000**
- **% Area Appl**

The chart shows the usage of specific insecticide AI in WA grapes in 2001, with **Petroleum distillate** having the highest usage.
Usage of Specific Fungicide AI in WA Grapes, 2001

- Calcium polysulfide
- Cyprodinil
- Fenhexamid
- Kresoxim-methyl
- Myclobutanil
- Sulfur
- Tebuconazole
- Trifloxystrobin
- Triflumizole
- Triflumizole

0.1 1 10 100 1000 % Area Appl  
lbs x 1000

USDA NASS
What Pesticide Use Statistics Cannot Tell Us

- Nothing about hazard nor risk
- Nothing about implementation of IPM nor sustainable agricultural systems

What Pesticide Use Statistics Can Tell Us

- Trends in use of particular products
- Adoption of new products
- Trends in outbreaks of certain pests
Are Grape Growers Adopting IPM? What Are the Economic & Environmental Consequences?

- Study by Fernandez-Cornejo (1998)
  - “Environmental and economic consequences of technology adoption: IPM in viticulture”
  - Agricultural Economics 18:145-155
USDA IPM Definition

• “IPM is a management approach that encourages natural control of pest populations by anticipating pest problems and preventing pests from reaching economically damaging levels.”

• “All appropriate techniques are used such as enhancing natural enemies, planting pest-resistant crops, adapting cultural management, and using pesticides judiciously.”
Data Gathering

• Agricultural Chemical Use Survey (1994)
• Economic Follow-On (to the Ag Chemical Use Survey (1994))
• Grower surveys (all types of grapes)
  – Represented 743,000 acres
  – Pest management surveys completed by 691 grape producers (1993)
  – Most producers grew wine grapes (~80%)
• Estimated an environmental quotient index
  – Takes in to account pesticide toxicity to humans
  – Variables to describe “environmental” quality
  – Lower the number, the “better”
Criteria for IPM Adopter Classification

- Farmer reports having used both scouting for insects &/or diseases and economic thresholds in making pesticide treatment decisions
- Farmer reports the use of one or more additional pest management practice among those considered to be IPM techniques
IPM Techniques Considered

- Pheromone use
- Resistant varieties
- Alternating pesticides to slow resistance
- Adjusting planting dates to lessen pest problems
- Soil testing for pests
- Pruning
- Purchasing biocontrol organisms
- Adjusting application rates, riming, and frequency to protect beneficial organisms
- Use of insecticides less harmful to beneficial insects
## Survey of IPM Adopters Among Grape Producers, USA

<table>
<thead>
<tr>
<th>State</th>
<th>Respondents (N)</th>
<th>% Insect IPM Adopters</th>
<th>% Disease IPM Adopters</th>
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<tbody>
<tr>
<td>CA</td>
<td>131</td>
<td>32</td>
<td>30</td>
</tr>
<tr>
<td>MI</td>
<td>124</td>
<td>40</td>
<td>44</td>
</tr>
<tr>
<td>NY</td>
<td>133</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>OR</td>
<td>110</td>
<td>na</td>
<td>20</td>
</tr>
<tr>
<td>PA</td>
<td>107</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>WA</td>
<td>107</td>
<td>35</td>
<td>28</td>
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<tr>
<td>Total/Avg</td>
<td>691</td>
<td>30</td>
<td>26</td>
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Fernandez-Cornejo 1998
### Averaged Results for Econometric Variables (Fernandez-Cornejo 1998)

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<tbody>
<tr>
<td>Yield (lbs x 1000)</td>
<td>8.12</td>
<td>9.44</td>
<td>9.93</td>
<td>7.15</td>
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<tr>
<td>Price of grapes ($/lb)</td>
<td>0.33</td>
<td>0.34</td>
<td>0.24</td>
<td>0.32</td>
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<tr>
<td>Insecticide price ($/acre/application)</td>
<td>29.5</td>
<td>29.86</td>
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<tr>
<td>Fungicide Price ($/acre/application)</td>
<td></td>
<td></td>
<td>9.84</td>
<td>10.48</td>
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<tr>
<td>Profits ($ x 1000/acre/yr)</td>
<td>2.00</td>
<td>1.93</td>
<td>1.88</td>
<td>1.86</td>
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### Averaged Results for “Environmental Variables” (Fernandez-Cornejo 1998)

<table>
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<th>No</th>
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<tbody>
<tr>
<td>Farm Size (0 - 1 scale; 1 = &gt;300 acres)</td>
<td>0.28</td>
<td>0.13</td>
<td>0.32</td>
<td>0.11</td>
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<tr>
<td>Infestation Level Insects (0-1 scale; 1 = worse than normal)</td>
<td>0.09</td>
<td>0.18</td>
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<tr>
<td>Infestation Level Disease (0-1 scale; 1 = worse than normal)</td>
<td></td>
<td></td>
<td>0.12</td>
<td>0.21</td>
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<tr>
<td>Number insecticides appl/yr</td>
<td>1.34</td>
<td>1.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number fungicides appl/yr</td>
<td></td>
<td></td>
<td>2.67</td>
<td>4.43</td>
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<tr>
<td>Environmental Index Quotient</td>
<td>24.69</td>
<td>25.24</td>
<td>45.6</td>
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Regulatory Control of Pesticides

Federal Law
State Law
Federal Law: Applicable Acronyms

- FIFRA (Federal Insecticide Fungicide & Rodenticide Act)
- FFDCA (Federal Food Drug & Cosmetic Act)
- FEPCA (Federal Environmental Pesticide Control Act)
- FQPA (Food Quality Protection Act)
U.S. Pesticide Law 101

FIFRA (1947)
  ↓ FEPCA (1972)
  ↓ Risk Assessment
  ↓ Labeling
  ↓ Registration

FFDCA (1938)
  ↓ Delaney (1958)
  ↓ Tolerance ("MRL")

FQPA (1996)
FEPCA (Federal Environmental Pesticide Control Act)

- Registrant had to show that a pesticide could perform its intended function without unreasonable adverse effects on the environment
  - Use in violation of product label becomes a crime

- Classification of Pesticides
  - Restricted Use
    - Pesticide could cause unreasonable adverse effects to environment or applicator if additional regulatory restrictions were not imposed
    - Must be certified to buy
      - Initiated training and certification programs by the states
  - General Use (no license required; available to public)
U.S. Pesticide Law 101

FIFRA (1947)

FEPCA (1972)

Risk Assessment

Labeling

FFDCA (1938)

Miller (1954)

Delaney (1958)

Tolerance ("MRL")

Registration

FQPA (1996)
New & Improved FFDCA
Tolerance before registration

- Manufacturer petitions for tolerance
  - Name & chemical composition
  - Application procedures
  - Safety data
  - Residue tests
  - Method for removing excess residue
  - Proposed tolerance
- Manufacturer obtains certificate of usefulness from USDA or exemption
- Food sold with residues above tolerance considered adulterated
U.S. Pesticide Law 101

FIFRA (1947)
FEPCA (1972)
Risk Assessment
Labeling

FFDCA (1938)
Miller (1954)
Delaney (1958)
Tolerance ("MRL")
Registration

FQPA (1996)
• All registered active ingredients formulated into commercial products
  – All individual products must be registered, but registration not given until label developed and approved

• The label is the governing law
  – Identification of active ingredient and contents
  – Legal uses (crops, maybe specific pests)
  – Rates of application; application methods
  – Personal protective equipment
  – Restrictions on use (no drift; no application near water; sometimes region-restricted)
  – Directions for disposal
U.S. Pesticide Law 101


Risk Assessment → Tolerance (“MRL”) → Registration

Labeling → FQPA (1996)
Mandate of the FQPA

• Tolerances will be “safe,” i.e., “a reasonable certainty that no harm will result from aggregate exposure”

• All tolerances will be reassessed by 2006
Significance of the FQPA

• Changed the “standards” of proof for safety and thus registration
• The registration process relies on risk assessment
  – Hazard & Dose-Response Assessment
  – Dietary, Drinking Water, Residential & Worker Exposure
  – Nontarget Organism Exposure
  – Risk Characterization
What Is a Safe Tolerance?

Factors To Consider As Mandated by FQPA

- Infants & Children
- Threshold vs. Non-threshold Effect
- Endocrine Disruption
- Aggregate Exposure Assessment
- Cumulative Exposure Assessment
WA State Dept. of Agriculture (WSDA) Legal Responsibility

- Enforce FIFRA under a mandate from EPA
- Enforce requirements for applicator training
  - FEPCA mandated that commercial and private pesticide applicators & handlers (mixers/loaders) pass certification/licensing if using restricted use pesticides
  - Pesticides classified as restricted use when deemed risky to environment and/or humans
- State registration of pesticides (must approve labels of products sold in states)
- Inspections for record keeping, proper pesticide use, etc.
- Can impose pesticide use restrictions in local areas