Keeping Your Team Safe: Reducing Pesticide Exposure
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Are Pesticides Safe?
- **News Headlines** -
  - Pesticide Exposure Linked to Preterm Birth
  - In-Home Pesticide Exposure and Parkinson’s Risk
  - Pesticide Traces Found in Kids Here (Seattle)
  - Pet Flea Collars May Expose Children to Pesticide Harm
  - Living Near Where Pesticides Used May Boost Fetal Death Due To Birth Defects
  - Killing Mosquitoes or Killing Humans?
  - West Nile Spraying to Begin - Worried Marcy Residents Have Many Concerns
  - Are Synthetic Pesticides Sabotaging our Children’s Health, Behavior, and Academic Performance?

Table 5.5
Annual Amount of Pesticides Active Ingredient Used in the United States by Pesticide Type, 1988-2007 Estimates

<table>
<thead>
<tr>
<th>Year</th>
<th>Herbicides</th>
<th>Insecticides</th>
<th>Fungicides</th>
<th>Other Grains</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>22,000</td>
<td>15,000</td>
<td>9,000</td>
<td>3,000</td>
<td>49,000</td>
</tr>
<tr>
<td>2007</td>
<td>10,000</td>
<td>8,000</td>
<td>5,000</td>
<td>2,000</td>
<td>25,000</td>
</tr>
</tbody>
</table>
Are Pesticides Safe?

Pesticides are designed to kill things, but experts agree that you can safely use pesticides!

Hazard (Risk) = Toxicity ⨯ Exposure

Toxicity = How poisonous is the pesticide?

Exposure = Amount ⨯ Duration

RELATIVE TOXICITY CATEGORIES OF PESTICIDES

1. Highly Toxic
   - Acute LD₅₀: 0–50
   - Oral LD₅₀: 0.0001–0.005
   - Eye irritation: Moderate

2. Moderately Toxic
   - Acute LD₅₀: 0.005–0.5
   - Oral LD₅₀: 0.005–0.05
   - Eye irritation: Weak

3. Mildly Toxic
   - Acute LD₅₀: 0.5–5
   - Oral LD₅₀: 0.05–0.5
   - Eye irritation: Mild

4. Relatively non-toxic
   - Acute LD₅₀: 5–50
   - Oral LD₅₀: 0.5–5
   - Eye irritation: Slight

5. Relatively non-toxic
   - Acute LD₅₀: 50–500
   - Oral LD₅₀: 5–50
   - Eye irritation: None

Table 5.8

<table>
<thead>
<tr>
<th>Year</th>
<th>Home and Garden Market Sales</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2011</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2012</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2013</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2014</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2015</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2016</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2017</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2018</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2019</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2020</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2021</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2022</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2023</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2024</td>
<td>151,123</td>
<td>128,152</td>
</tr>
<tr>
<td>2025</td>
<td>151,123</td>
<td>128,152</td>
</tr>
</tbody>
</table>

Note: Herbicides are designed to kill plants, and other non-toxic commodities. See Table 5.8 for more information.
### Rank the fungicides in order of their toxicity:
1. Heritage (azoxystrobin)
2. Daconil (chlorothalonil)
3. Chipco 26GT (iprodione)
4. Compass (trifloxystrobin)

All are equal > 5,000 mg/kg

### LD<sub>50</sub> Values for Common Fungicides

<table>
<thead>
<tr>
<th>Fungicide (Common Name)</th>
<th>Trade Name</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; Oral (mg/kg)</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; Dermal (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azoxystrobin</td>
<td>Heritage</td>
<td>&gt;5,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Bucaral</td>
<td>Emerald</td>
<td>&gt;2,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>Daconil Ultra</td>
<td>&gt;5,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Fludioxonil</td>
<td>Medallion</td>
<td>&gt;5,050</td>
<td>&gt;2,020</td>
</tr>
<tr>
<td>Iprodione</td>
<td>Chipco 26GT</td>
<td>&gt;5,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Polysporin D</td>
<td>Endorse</td>
<td>9,060</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Tridemeton</td>
<td>Bayleton</td>
<td>1,141</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Trifloxystrobin</td>
<td>Compass</td>
<td>&gt;5,050</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Thiophanate methyl</td>
<td>3336</td>
<td>&gt;7,500</td>
<td>&gt;10,000</td>
</tr>
</tbody>
</table>

### Rank the herbicides in order of their toxicity:
1. Buctril (Bromoxynil)
2. RoundUp (glyphosate)
3. Manor (metsulfuron)
4. 2,4-D

Buctril = 250 mg/kg
2,4-D = 300 mg/kg
RoundUp = 4,300 mg/kg
Manor = > 5,000 mg/kg

### LD<sub>50</sub> Values for Common Herbicides

<table>
<thead>
<tr>
<th>Herbicide (Common Name)</th>
<th>Trade Name</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; Oral (mg/kg)</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; Dermal (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metathion</td>
<td>Manor, Bude</td>
<td>&gt;5,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>2,4-D</td>
<td>several</td>
<td>300</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Bromoxynil</td>
<td>Buctril</td>
<td>250</td>
<td>&gt;5,600</td>
</tr>
<tr>
<td>Prechloro-methyl</td>
<td>Fusilade</td>
<td>3,320</td>
<td>&gt;2,420</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>RoundUp</td>
<td>4,300</td>
<td>&gt;5,000</td>
</tr>
<tr>
<td>MCPA</td>
<td>MCPA</td>
<td>800</td>
<td>&gt;4,000</td>
</tr>
<tr>
<td>Pendimethalin</td>
<td>Pre-M, Pendulum</td>
<td>&gt;5,000</td>
<td>&gt;2,000</td>
</tr>
</tbody>
</table>

### Rank the insecticides in order of their toxicity:
1. Distance (pyriproxyfin)
2. Talstar (bifenthrin)
3. Dursban (chlorpyrifos)
4. Orthene (acephate)

Dursban = 270 mg/kg
Talstar = 375 mg/kg
Orthene = 980 mg/kg
Distance = > 5,000 mg/kg

### LD<sub>50</sub> Values for Common Insecticides

<table>
<thead>
<tr>
<th>Insecticide (Common Name)</th>
<th>Trade Name</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; Oral (mg/kg)</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; Dermal (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abamectin</td>
<td>Avid</td>
<td>650</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Acetone</td>
<td>Orthene</td>
<td>980</td>
<td>10,250</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>Taktar</td>
<td>275</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>Sevin</td>
<td>240</td>
<td>&gt;4,000</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>Dursban</td>
<td>270</td>
<td>2,000</td>
</tr>
<tr>
<td>Cyfluthrin</td>
<td>Tempos</td>
<td>0.26</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>Deluthan</td>
<td>125</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Malathion</td>
<td>Miwok</td>
<td>450</td>
<td>2,900</td>
</tr>
<tr>
<td>Riodrin</td>
<td>Offsaul</td>
<td>30</td>
<td>700</td>
</tr>
<tr>
<td>Tebufenoxide</td>
<td>Novabrine</td>
<td>1,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Pyriproxyfin</td>
<td>Distance</td>
<td>&gt;5,000</td>
<td>&gt;2,090</td>
</tr>
<tr>
<td>Trichlorfon</td>
<td>Dylox, Pescal</td>
<td>2,500</td>
<td>&gt;2,100</td>
</tr>
</tbody>
</table>
The Dose Makes the Poison

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Term</th>
<th>Oral LD50</th>
<th>Pounds to Kill a 150 lb. Human</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benomil</td>
<td>Practically Non-Toxic</td>
<td>10,000 mg/kg</td>
<td>1.50 lbs</td>
</tr>
<tr>
<td>Mancozeb</td>
<td>Practically Non-Toxic</td>
<td>8,000</td>
<td>1.40 lbs</td>
</tr>
<tr>
<td>Iprodione</td>
<td>Slightly Toxic</td>
<td>5,000</td>
<td>0.75 lbs</td>
</tr>
<tr>
<td>Baking Soda</td>
<td>Slightly Toxic</td>
<td>4,220</td>
<td>0.63 lbs</td>
</tr>
<tr>
<td>Table Salt</td>
<td>Slightly Toxic</td>
<td>3,000</td>
<td>0.44 lbs</td>
</tr>
<tr>
<td>Propiconizol</td>
<td>Slightly Toxic</td>
<td>1,300</td>
<td>0.20 lbs</td>
</tr>
<tr>
<td>Aspirin</td>
<td>Slightly Toxic</td>
<td>1,250</td>
<td>0.19 lbs</td>
</tr>
<tr>
<td>Orthene</td>
<td>Moderately Toxic</td>
<td>866</td>
<td>0.13 lbs</td>
</tr>
<tr>
<td>Sevin</td>
<td>Moderately Toxic</td>
<td>850</td>
<td>0.12 lbs</td>
</tr>
<tr>
<td>Caffeine</td>
<td>Moderately Toxic</td>
<td>192</td>
<td>0.027 lbs</td>
</tr>
<tr>
<td>Nicotine</td>
<td>Highly Toxic</td>
<td>53</td>
<td>0.008 lbs = 1/8 oz</td>
</tr>
</tbody>
</table>

Hazard (Risk) = Toxicity X Exposure

- Pesticides are potentially dangerous to people if exposure is high.
  - Even a relatively non-toxic pesticide can be dangerous if exposure is high.

- Pesticide Effects:
  - Acute
  - Delayed (Chronic)
  - Allergic

Acute Effects

- Refers to the effects from a single exposure or repeated exposure over a short time, such as an accident during mixing or applying pesticides
- Illnesses or injury that occur within 24 hours.

Acute Effects

- Illnesses or injury that occur within 24 hours.
  - Severe poisoning symptoms:
    - Vomiting, diarrhea, excessive sweating, inability to breathe, convulsions, fever, intense thirst, and coma.

Delayed (Chronic) Effects

- Effects of long-term or repeated lower level exposures to a toxic substance.
  - Do not appear immediately after first exposure - may take years
    - Cancer
    - Injury to Unborn Children
      - Birth Defects, Miscarriage, Still Birth
    - System Problems
      - Anemia, Hard-to-stop bleeding, Paralysis
      - Liver and Kidney disorders
Delayed (Chronic) Effects
• Carcinogenicity - ability to produce cancer or to assist carcinogenic chemicals;
• Mutagenicity - ability to cause genetic changes;
• Teratogenicity - ability to cause birth defects;
• Oncogenicity - ability to induce tumor growth (not necessarily cancers);
• Liver damage;
• Reproductive disorders (reduced sperm count, sterility, miscarriage);
• Nerve damage (including accumulative effects on cholinesterase depression associated with organophosphate insecticides);
• Allergenic sensitization (development of allergies to pesticides or chemicals used in formulation of pesticides).

Allergic Effects
• Asthma
• Shock
• Skin Irritation - chaffing, rashes
• Sneezing, Itchy, watery eyes

1st exposure sensitizes the body.
2nd exposure causes the allergic reaction.

Let’s consider your team. . .

But what about . . .

Pesticide Exposure
• Routes of Entry
  – Eyes
  – Skin
  – Lungs
  – Oral

Routes of Entry
***EYES***
• Accidents often occur during mixing and loading.
  – Splashes from adding chemicals to the tank.
• Hose breaks.
• Wind blown drift.
• Rubbing of eyes.
Choose Right Equipment

Eye Protection
Especially important during mixing and loading.

- Glasses
- Goggles
- Face Shields

route of Entry

***SKIN***

- Most likely route because blood vessels are near the skin.
  - Fluorescent Dye Indicator Studies.
  - Hands receive the most exposure.
  - Foreheads and Mouth area.
  - Genital areas.

How Much Pesticide Will Skin Absorb?

- Scalp - 32%
- Ear Canal - 40%
- Forehead - 36%
- Abdomen - 18%
- Genitals - 100%
- Palm - 12%
- Back of Hand - 21%
- Ball of Foot - 13%
**Routes of Entry***

***SKIN***

- Cuts, Scrapes, and Rashes
  - 100% of pesticide can enter.

**Pesticide Ingredients**

- **ACTIVE** – responsible for killing the pest
- **INERT** – makes the formulation safer, more effective and easier to handle
- **ADJUVANT** – may or may not already be present in the product; used for the same reason as the inert ingredients

**Liquid Formulations and Abbreviations**

- **EC or E** – emulsifiable concentrate
- **RTU** – ready to use
- **AS** – aqueous suspension / solution
- **S, SL or SC** – water soluble liquids
- **AS, F, FL, L or WDL** – flowables, water-dispersible liquids
Dry Formulations and Abbreviations

- D – dusts
- B – baits
- G – granular
- WP or W – wettable powder
- SP or WSP – soluble powder
- DF – dry flowable
- WDG – water dispersible granule

Rank most absorbed to least absorbed

1. Emulsifiable Concentrates
2. Dusts
3. Baits
4. Water Dispersible Granules
5. Water Dispersible Liquids
6. Flowable
7. Soluble Concentrate
8. Bait
9. Dust
10. Emulsifiable Concentrate

Pesticide Formulation

Increasing Absorption

Least
Absorbed
Dry
Based
Water
Based
Emulsifiable
Concentrates
Most
Absorbed

Practical Considerations

- Adjuvants:
  - Penetrants & Emulsifiers
    - Can allow pesticide to enter skin more quickly.
  - Stickers
    - Allows pesticides to stick to PPE and skin.

Personal Protective Equipment (PPE)

Choose the Right Equipment.
Clean and Maintain it Properly.
Use PPE Correctly.

PRECAUTIONARY STATEMENTS (continued)

Personal Protection Equipment (PPE):

- Wear long-sleeved shirt and long pants.
- Use chemical-resistant gloves, such as latex, neoprene, or nitrile rubber.
- Use chemical-resistant boots, such as rubber or neoprene rubber.
- Use chemical-resistant aprons when handling or storing.
- Use chemical-resistant face masks when handling or storing.

User Safety Recommendations:

- Wash hands before eating, drinking, or smoking.
- Wash face, hands, and arms with soap and water.
- Remove clothing immediately if pesticide gets on it.
- Do not eat, drink, or smoke when in the treated area.
- Bathe or wash clothing before entering.

Replace clothing before entering. Avoid open cuts or sores, wash thoroughly and change into clean clothing.
The more toxic a pesticide, the more PPE that is required

**CAUTION**
Regular work clothes—long-sleeved shirt, long pants, shoes & socks, waterproof gloves

**WARNING**
Coveralls over work clothing, shoes & socks, chemical-resistant gloves, eyewear

**DANGER**
Coveralls over work clothing, chemical-resistant gloves and footwear, respiratory and eye protection

Choose Right Equipment

*Chemical Resistant PPE*

- Cotton, Canvas, and Leather are not chemically resistant.
  - Avoid cloth lined shoes, hats, gloves, etc.

Routes of Entry

***LUNGS***

- Pesticides are more likely to enter through your lungs if you are spraying in poorly ventilated areas.
  - Protected areas – limited air movement
Routes of Entry

**ORAL**

- Not likely to swallow large amounts of pesticide unless someone puts chemicals in food and beverage containers.
  - Pop Bottles, Milk Containers, etc.
- Small amounts of pesticides are likely to enter if eating, drinking, smoking, or chewing tobacco & gum.

Clean and Maintain Properly

Contaminated PPE is dangerous!

- Dispose of PPE contaminated with pesticides labeled with the signal words *danger* or *warning*
- Wash contaminated work clothes and PPM separately.
  - Hot water with heavy duty detergent.
  - Rinse twice.
  - Wash the washing machine.

Let’s consider your team... 

Questions or Comments

Photo Credits

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- Gempler’s

Mention of trade names in this presentation is solely for providing specific information. It is not a guarantee or warranty of the products named, and does not signify that they are approved to the exclusion of others of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer’s label.