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 Per Year, Pesticide Type, 1982 - 2001 Estimates

<table>
<thead>
<tr>
<th>Year</th>
<th>Million Pounds of Active Ingredient</th>
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<tr>
<td>1982</td>
<td>420.0</td>
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</tr>
<tr>
<td>1983</td>
<td>375.0</td>
<td>105.0</td>
</tr>
<tr>
<td>1984</td>
<td>401.0</td>
<td>106.0</td>
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<tr>
<td>1985</td>
<td>411.0</td>
<td>107.0</td>
</tr>
<tr>
<td>1986</td>
<td>405.0</td>
<td>108.0</td>
</tr>
<tr>
<td>1987</td>
<td>412.0</td>
<td>109.0</td>
</tr>
<tr>
<td>1988</td>
<td>413.0</td>
<td>110.0</td>
</tr>
<tr>
<td>1989</td>
<td>415.0</td>
<td>111.0</td>
</tr>
<tr>
<td>1990</td>
<td>417.0</td>
<td>112.0</td>
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Table 5.6

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</tr>
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Are Pesticides Safe?

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

Hazard (Risk) = Toxicity X Exposure

Toxicity = How poisonous is the pesticide?

Exposure = Amount X Duration

Hazard (Risk) = Toxicity X Exposure

• All pesticides are toxic - they differ only in the degree of toxicity.
  – Measure toxicity using an LD_{50} value.
  • LD_{50} – Lethal Dose to kill 50% of the test animals.
  – The lower the LD_{50}, the more toxic the pesticide.
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

**LD₅₀ Values for Common Fungicides**

<table>
<thead>
<tr>
<th>Fungicide (Common Name)</th>
<th>Trade Name</th>
<th>LD₅₀ Oral (mg/kg)</th>
<th>LD₅₀ 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>Boreas</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;5,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Iprodione</td>
<td>Chipco 26GT</td>
<td>&gt;5,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Polyzone D</td>
<td>Ebose</td>
<td>9,600</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Tidaneuron</td>
<td>Bayleton</td>
<td>1,141</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Trifloxystrobin</td>
<td>Compass</td>
<td>&gt;9,050</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)       1. Buctril = 250 mg/kg
2. RoundUp (glyphosate)       2. 2,4-D = 300 mg/kg
3. Manor (metsulfuron)        3. RoundUp = 4,300 mg/kg
4. 2,4-D                      4. Manor = > 5,000 mg/kg

**LD₅₀ Values for Common Herbicides**

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<thead>
<tr>
<th>Herbicide (Common Name)</th>
<th>Trade Name</th>
<th>LD₅₀ Oral (mg/kg)</th>
<th>LD₅₀ Dermal (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metribuzin</td>
<td>Manor</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>Bush</td>
<td>260</td>
<td>&gt;5,660</td>
</tr>
<tr>
<td>Flusilox-methyl</td>
<td>Fastacide</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)

1. Dursban = 270 mg/kg
2. Talstar = 375 mg/kg
3. Dursban = 980 mg/kg
4. Distance = > 5,000 mg/kg

**LD₅₀ Values for Common Insecticides**

<table>
<thead>
<tr>
<th>Insecticide (Common Name)</th>
<th>Trade Name</th>
<th>LD₅₀ Oral (mg/kg)</th>
<th>LD₅₀ 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>Acetophen</td>
<td>Orthene</td>
<td>380</td>
<td>10,250</td>
</tr>
<tr>
<td>bifenthrin</td>
<td>Talstar</td>
<td>375</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>Cythion</td>
<td>Tempris</td>
<td>826</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Cyhalothrin</td>
<td>Telocon</td>
<td>129</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>Merit</td>
<td>450</td>
<td>2,900</td>
</tr>
<tr>
<td>Indoxacarboxim</td>
<td>Offozol</td>
<td>30</td>
<td>700</td>
</tr>
<tr>
<td>Malathion</td>
<td>Malathion</td>
<td>1,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Pyrimethrin</td>
<td>Distance</td>
<td>&gt;5,000</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Tebufentrin</td>
<td>Dytec, Precol</td>
<td>250</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>1.00 lbs</td>
</tr>
<tr>
<td>Mancozeb</td>
<td>Practically Non-Toxic</td>
<td>8,000 mg/kg</td>
<td>0.75 lbs</td>
</tr>
<tr>
<td>Iprodione</td>
<td>Slightly Toxic</td>
<td>5,000 mg/kg</td>
<td>0.37 lbs</td>
</tr>
<tr>
<td>Baking Soda</td>
<td>Slightly Toxic</td>
<td>4,220 mg/kg</td>
<td>0.63 lbs</td>
</tr>
<tr>
<td>Table Salt</td>
<td>Slightly Toxic</td>
<td>3,000 mg/kg</td>
<td>0.44 lbs</td>
</tr>
<tr>
<td>Propiconizol</td>
<td>Slightly Toxic</td>
<td>1,300 mg/kg</td>
<td>0.20 lbs</td>
</tr>
<tr>
<td>Aspirin</td>
<td>Slightly Toxic</td>
<td>1,250 mg/kg</td>
<td>0.19 lbs</td>
</tr>
<tr>
<td>Dithane</td>
<td>Moderately Toxic</td>
<td>866 mg/kg</td>
<td>0.13 lbs</td>
</tr>
<tr>
<td>Taxyn</td>
<td>Moderately Toxic</td>
<td>550 mg/kg</td>
<td>0.08 lbs</td>
</tr>
<tr>
<td>Caffeine</td>
<td>Moderately Toxic</td>
<td>192 mg/kg</td>
<td>0.027 lbs</td>
</tr>
<tr>
<td>Nicotine</td>
<td>Highly Toxic</td>
<td>53 mg/kg</td>
<td>0.008 lbs = 1/8 oz</td>
</tr>
</tbody>
</table>

Hazard (Risk) = Toxicity × 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

- Illnesses or injury that occur within 24 hours.
  - Mild poisoning symptoms: May be vague and can be compared with the flu.
    - Nausea, headache, tightness of chest, loss of appetite, stomach cramps.
  - Moderate poisoning symptoms: More pronounced than mild symptoms.
    - Nausea, trembling, muscular incoordination, excessive saliva, blurring of vision, tightness of chest, difficulty in breathing, flushed or yellow skin, abdominal cramps, vomiting, diarrhea, tearing from eyes, profound weakness, rapid pulse, cough.

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);
- Allergic sensitization (development of allergies to pesticides or chemicals used in formulation of pesticides).

Allergenic Effects

- Asthma
- Shock
- Skin Irritation - chaffing, rashes
- Sneezing, itchy, watery eyes

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

Pesticide Exposure

- Routes of Entry
  - Eyes
  - Skin
  - Lungs
  - Oral

Routes of Entry

- 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

Routes 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

Practical Considerations

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

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

Personal Protective Equipment (PPE)

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

Pesticide Formulation

Increasing Absorption

Least Absorbed

Most Absorbed

Dry Based Water Based Emulsifiable Concentrates
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

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

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

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

Choose Right Equipment

Choose Right Equipment

Chemical Resistant PPE

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

Mechanics Gloves

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.

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