Pesticide Use in Denver Parks and Mitigating the Risks of Pesticide Use

Dan Goldhamer, CSU Extension Horticulture Agent
Presentation adopted from Thia Walker CSU Extension Specialist-Pesticide Safety Education

Introduction and My Relationship With Pesticides

- I grew up here in Denver
- College and my organic farming stage
- I also obtained a M.S. in Soil and Crop Sciences from CSU and worked in the horticulture department on an organic research farm
- Worked at the Colorado Department of Agriculture as an inspector for the Plant Industry Division and worked closely with commercial and public pesticide applicators
- Since April 2013, I have worked at CSU Extension here in Denver as the Horticulture Agent

What are Pesticides?

- Pesticide law defines a "pesticide" (with certain minor exceptions) as:
  - Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.
  - Any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.
  - Any nitrogen stabilizer.
- Pesticides Include:
  - Herbicides
  - Insecticides
  - Fungicides
  - Bactericides
  - Rodenticides

Understanding why people may fear or dislike the use pesticides
- Health
  - Birth defects, cancer, poisonings
- Food Residues
- Environment
  - Bioaccumulation, wildlife, groundwater & surface water contamination, pet exposures

IT IS THE LACK CONTROL OVER PESTICIDE APPLICATIONS THAT MAY AFFECT THEM!
What are some of the benefits of using pesticides?
- Satter, More Consistent Food Supply
- Protect our Health
- Productivity of Agriculture
- Labor Savings
- Recreational
- Wildlife Habitat / Environmental

Using 'RITE' to protect ourselves and others
Risk
Is equal to
Toxicity times
Exposure

How do you measure RISK when using pesticides? Use RITE...
Risk
Is equal to
Toxicity times
Exposure
RISK = Toxicity x Exposure
No exposure = No RISK

FIFRA: Federal Insecticide, Fungicide and Rodenticide Act
- Regulates:
  - Registration
  - Manufacture
  - Sale
  - Transportation
  - Use of pesticides
This act set the standard for labeling pesticides
Federal Food, Drug, Cosmetic Act

- **SAFE** - reasonable certainty that no harm will result from aggregate exposure to the pesticide residue.
- Considers:
  - toxicity of the pesticide and its break-down products
  - aggregate exposure to the pesticide in foods and from other sources of exposure
  - any special risks posed to infants and children

FQPA: Food Quality Protection Act

- Set health based standard for pesticide risk
  - Based on aggregate and cumulative risks
  - Includes children's risk when setting tolerances (additional 10-fold safety factor)
  - Requires testing of toxicity as 'endocrine disrupters'
  - Re-review older pesticides based on new standard

EPA Tests Required

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of Tests Required</th>
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</thead>
<tbody>
<tr>
<td>Product Performance</td>
<td>8</td>
</tr>
<tr>
<td>Product Properties</td>
<td>35</td>
</tr>
<tr>
<td>Fate, Transformation, Transformation</td>
<td>43</td>
</tr>
<tr>
<td>Spray Delt</td>
<td>2</td>
</tr>
<tr>
<td>Ecological Effects</td>
<td>51</td>
</tr>
<tr>
<td>Health Effects</td>
<td>49</td>
</tr>
<tr>
<td>Occupational &amp; Residential Exposure</td>
<td>12</td>
</tr>
<tr>
<td>Bioavailability</td>
<td>7</td>
</tr>
<tr>
<td>Microbial Pesticides</td>
<td>41</td>
</tr>
<tr>
<td>Endocrine Disruptor Screening</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>274</strong></td>
</tr>
</tbody>
</table>

But how safe is 'safe enough'?

**LD<sub>50** Median Lethal Dose
Amount of a substance required to kill 50% of a test population

mg substance/kg body wt


http://www.compoundchem.com/
Even Pesticides used in Organic Production can be toxic to bees.

Everything is poison. There is poison in everything. Only the dose makes a thing not a poison.
Paracelsus
1493-1541
Father of Toxicology

Chemical toxicity is a sliding scale. Not black and white – and whether a chemical is naturally occurring or man-made tells us NOTHING about it's toxicity.

How do applicators protect the public?
- Following label instructions
- Not apply when people are present
- Posting treated areas
- Remove after REI
- Target application sites
- Spot spray versus broadcast
Other ways applicators mitigate pesticide risk
- Use IPM, apply the least toxic, effective pesticide, if necessary
- Spot treat when possible
- Use FieldWatch to identify hives near treatment areas
- Do not apply when pollinators are present
- Apply early morning or around dusk
- Do not leave 'puddles' of rinsates when cleaning equipment

We mitigate the risks of pesticides through the Product label!
- First Aid statements
- Precautionary Statements
  - Hazards to Humans & Domestic Animals
  - Hazards to the Environment
  - Chemical & Physical Hazards

MERIT® 75WSP
INSECTICIDE

STOP - READ THE LABEL BEFORE USE
KEEP OUT OF REACH OF CHILDREN

CAUTION

MERIT® 75WSP is a synthetic pyrethroid insecticide for controlling insect pests and controlling insect pests in and around commercial livestock and poultry buildings. It is a systemic insecticide that is effective against a wide range of pests, including ants, cockroaches, fleas, flies, mosquitoes, and other insects. It is easy to use and has a low odor, making it ideal for use in commercial facilities.

In case of emergency, call the local pesticide control agency or the emergency response team. For further information, contact the manufacturer or the local pesticide control agency.
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

PRECAUTIONARY STATEMENTS

CAUTION

Handle with care, avoid contact with skin, eyes, or clothing. Avoid breathing dust or vapor. Wash thoroughly with soap and water immediately if contaminated clothing or skin comes in contact. Keep children or pets out of treated area for at least 24 hours. Store in original container out of reach of children and pets.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Wearing protective clothing, including rubber gloves, long sleeves, long pants, and closed-toe shoes is recommended. Avoid contact with skin, eyes, or clothing. Thoroughly wash hands and clothes afterward.

PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS: Do not allow persons to enter treated area(s) until the pesticide residue has been reduced to an acceptable level. Keep children and pets out of treated area(s) until the residue has been reduced to an acceptable level. Store in original container out of reach of children and pets. Do not use on plants likely to be eaten by animals. Do not contaminate water, food, or feed by accidental application. Do not contaminate water sources or fish ponds or contaminate water supply areas. This product is to be used only as directed. Do not use this product in a manner or in a volume or concentration at which it may reasonably be expected to cause or induce unreasonable adverse effects on the environment.

PROTECION OF POLLINATORS

APPLICATION RESTRICTIONS: Do not use this product in or around areas where bees are known to be present. Do not apply this product to any place where bees are known to be present. Do not apply this product to any place where bees are known to be present. Do not apply this product to any place where bees are known to be present. Do not apply this product to any place where bees are known to be present.

Making Policies for Pesticide Use

- Establish goals and thresholds
- Sources of information
- Avoid anecdotal evidence
- Use GOOD science... and scientists as resources.
- Determine benefits/risks and costs
- Risk assessment/costs
- Collateral damage?
- Make the decision, set standards and adopt policies
- Implement the decision
- Review and correct errors
Any questions about the information you just heard?

**Outline**

- Glyphosate mode of action
- Toxicology profile
- Glyphosate and cancer

**Glyphosate: Resistance Risk, Safe Use & Public Perception**

Dr. Todd Gaines
Bioagricultural Sciences & Pest Management

**Glyphosate**

- Non-selective herbicide, reported in 1971
- Globally important
- Used in fallow, orchards, vineyards, and glyphosate-resistant crops
- Low environmental toxicity

![Glyphosate molecule](image)
**Movement in Plant**
- Used post-emergence on growing plants
- Absorbed across cuticle
- Rapid translocation to growing points
- Growth inhibition and general chlorosis and necrosis within 4 to 20 days
- Rapidly and tightly adsorbed to soil
  - No crop planting restrictions

**Shikimic Acid Pathway**
- 5-enolpyruvylshikimate-3-phosphate synthase – EPSPS
  - Nuclear encoded
  - Located in the chloroplast
  - Highly conserved in plants

**EPSPS**

**Toxicology**
- Eye exposure – flush with water
- If ingested, drink water to dilute

**Acute**

<table>
<thead>
<tr>
<th>Species</th>
<th>LD50</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>5500 mg/kg (oral)</td>
<td>60 kg person (150 lb) 27.2 g/day of pure glyphosate (0.96 oz/day)</td>
</tr>
<tr>
<td>Rabbit</td>
<td>&gt;5000 mg/kg (dermal)</td>
<td></td>
</tr>
</tbody>
</table>

**Chronic**
- NOEL: No Observable Effect Limit

<table>
<thead>
<tr>
<th>Species</th>
<th>24 month diet NOEL</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>4500 mg/kg/day</td>
<td>Microscopic liver changes at 4500 mg/kg/d: not carcinogenic</td>
</tr>
<tr>
<td>Rat</td>
<td>400 mg/kg/day</td>
<td>Reduced weight gain at 1000 mg/kg/d</td>
</tr>
</tbody>
</table>

**Mode of Action Summary**
- Structure similar to glycine (amino acid) and PEP
- Inhibits EPSPS
- Only found in plants, fungi, and bacteria
  - Only plant EPSPS sensitive to glyphosate

**Toxicology**

Toxicology

Teratogenicity

NOEL: No Observable Effect Limit

<table>
<thead>
<tr>
<th>Species</th>
<th>NOEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>1000 mg/kg/day</td>
</tr>
<tr>
<td>Rabbit</td>
<td>175 mg/kg/day</td>
</tr>
</tbody>
</table>

Mutagenicity

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gene mutation</td>
<td>Negative</td>
</tr>
<tr>
<td>Structural chromosomal aberration</td>
<td>Negative</td>
</tr>
<tr>
<td>DNA damage/repair</td>
<td>Negative</td>
</tr>
</tbody>
</table>


Glyphosate usage in the U.S.

1992 vs 2016

Use by Year and Crop


Glyphosate usage

- Use by Year and Crop
  - ~20X increase

NIHL incidence & mortality

- No increase

International Agency for Research on Cancer

- Glyphosate added to list of agents that are “probably carcinogenic to humans”
- March 2015
- IARC group 2A classification
- Lancet paper stated “evidence in humans” is “limited”
- Cancer site stated was non-Hodgkin lymphoma (NHL)

IARC Group 2A

Classification of Glyphosate

Does glyphosate cause cancer?

Hazard Assessment

- Limited evidence in humans for the carcinogenicity of glyphosate
  - Evidence in humans is from studies of exposure, mostly agricultural, e.g., not from dietary exposure... A possible association has been observed for non-Hodgkin lymphoma.
  - There is strong evidence that exposure to glyphosate of glyphosate-based formulations is carcinogenic.

IARC placed glyphosate in its hazard category Group 2A: probably carcinogenic to humans along with red meat, hot beverages, working as a hairdresser. The evidence on carcinogenicity was less robust than for agents such as bleach, salted fish, and contraceptives and some.

IARC Group 2A Agents

- Are problematic for occupational exposure
  - Meaning people who work with or around the chemical on a regular basis over a long period of time
- General public is highly unlikely to see ill effects from any agent with this classification based on available evidence
- Group 2A does not mean that a chemical will definitely cause cancer
- Other 2A agents: wood smoke, working night shifts, and hot mate (the South American drink)
- “Probably causes cancer” video explanation:
  - https://www.youtube.com/watch?v=CbBkB8lySxQ
What do Regulatory Agencies Say?

**EPA**

Human health risk assessment concludes that glyphosate is not likely to be contaminate to humans... and is either meaningful or negligible to nonhuman health even the product is used according to the label. 2017

**Health Canada**

Products containing glyphosate do not present unacceptable risks to human health in the environment when used according to the label. 2017

**Longitudinal Study**

No association was observed between glyphosate and non-Hodgkin's lymphoma and its subtypes... some evidence of increased risk of NHL (non-Hodgkin's lymphoma) among the highest exposed groups that require confirmation. 2016

**Agricultural Health Study**

No evidence to be carcinogenic to humans or produce meningiomas, gliomas, or astrocytomas. 2010

**Academy of Environmental Protection**

Glyphosate is not likely to be genotoxic to mammalian sperm, or to the reproductive system in animals. 2010

**World Health Organization (WHO)**

Under usual conditions, the presence of glyphosate and AMPA (N-[(phosphonomethyl)glycine, a metabolite of glyphosate) forms 2-ketoisocaproate, a hormone of human health. 2004

**International Programme on Chemical Safety**

No evidence for exposure to glyphosate causes cancer.

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**Conclusion to Date**

- Based on these data, there does not seem to be a basis for alarm.
- IARC 2A classification means “take care”
- Glyphosate is a pesticide
- As with all pesticides, proper personal protective equipment should be worn and proper procedures followed.
- No strong evidence to suggest that exposure to glyphosate causes cancer.