Possible Ways Farm Families May Be Exposed

Farmers use a variety of tools and methods to carry out pest control. As a result, they may be exposed to pesticides. This publication provides an overview of these possible pathways of exposure. The same percentage of scientists compared the largest groups of applicators in North Carolina and Iowa, about 16,000 and 5,000, respectively. Scientists thought that two possible reasons accounted for this:

- North Carolina (31,094) - Commercial pesticide applicators (4,916)
- Iowa (17,757) - Residential pesticide applicators (1,079)

In addition, scientists looked closely at Iowa farmers who experienced a High Pesticide Exposure Event. Scientists thought that the products that the applicators used most often included 2,4-D, chlorpyrifos, and imazethapyr. In contrast, the applicators in this group, the basal group, used mostly herbicides and a fungicide called Metalaxyl.

Scientists Focus on Exposure to Current-Use Pesticides

Agricultural Health Study Between 1993 and 1997, they provided detailed information about their pesticide use, demographic characteristics, and health symptoms. Scientists studied about 4,600 applicators and their spouses in Iowa and North Carolina to better understand pesticide exposure and its potential health effects. In total, the team collected personal air, dust, and urine samples from participants and their spouses. The researchers also conducted questionnaires to learn about the applicators’ pesticide use habits. Scientists examined the applicators’ use of protective gear, training, and safety practices. They also looked at whether the applicators were using less toxic pesticides.

In summary, scientists urged all applicators to follow the label and beginners to seek training. They recommended that applicators repair equipment and clean up after use. Because agricultural practices and the crops grown or livestock raised on farms change, scientists suggest that applicators focus on their personal health and safety practices. They also suggest that farmers and family members also be trained to reduce exposure through the family. Parents of small children should teach them not to pick up fallen pesticide containers or use pesticides. Children should always be supervised when handling or using pesticides. Finally, parents should always use pesticides in a well-ventilated area and follow the label instructions. Children who are exposed to pesticides should be watched carefully for any symptoms.

Both exposure and outcome differ by race. In North Carolina, 31% of the Black farmers who reported high pesticide exposure had at least one medical condition, compared to 14% of Non-Black farmers. In Iowa, 45% of the White farmers who reported high pesticide exposure had at least one medical condition, compared to 33% of African-American farmers. In both states, Black farmers were more likely to report high pesticide exposure than White farmers. In North Carolina, 45% of Black farmers and 30% of Non-Black farmers reported high pesticide exposure. In Iowa, 30% of White farmers and 20% of African-American farmers reported high pesticide exposure.

Scientists thought that these results were due to differences in farm size, farm type, years of pesticide use, and educational level. They did not find any differences in health outcomes by race. The researchers also found that the number of pesticide applications was not associated with health outcomes. They suggest that applicators should use protective gear and follow the label instructions. They also suggest that farmers and family members should be trained to reduce exposure through the family. Parents of small children should teach them not to pick up fallen pesticide containers or use pesticides. Children should always be supervised when handling or using pesticides. Finally, parents should always use pesticides in a well-ventilated area and follow the label instructions. Children who are exposed to pesticides should be watched carefully for any symptoms.

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Pesticide Exposure Varies with Application Method

**Application Methods**

- Backpack sprayer
- Mist blower/fogger
- Ear tags
- Chemically Resistant Gloves

**Use of Chemically Resistant Gloves Has Increased**

<table>
<thead>
<tr>
<th>Year</th>
<th>North Carolina</th>
<th>Iowa</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>2010</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>2020</td>
<td>40%</td>
<td>50%</td>
</tr>
</tbody>
</table>

**Average Work-Day Exposure Formula**

\[
\text{Lifetime Exposure Score} = (\text{Mix} \times \text{Apply} \times \text{Repair}) \times \text{PPE} \times \text{Duration}
\]

- **Mix (0-3)**: represents the proportion of time applicators use a specific type of equipment (e.g., backpack sprayer).
- **Apply (0-3)**: represents the proportion of time applicators use a specific application method (e.g., band application).
- **Repair (0-3)**: represents the proportion of time applicators personally repair their equipment.
- **PPE (0-3)**: represents the use of personal protective equipment (PPE).
- **Duration** (in years): represents the number of years an applicator has used a particular pesticide.

**Lawn and Garden Applicators**

- Phased use of 2,4-D and chlorpyrifos has reduced exposure.
- Use of PPE has increased over the past decade.

**Commercial Applicators Apply More Days Than Farmers**

- North Carolina: 500-999 acres
- Iowa: 200-499 acres

**Widely Used Herbicide 2,4-D and Insecticide Chlorpyrifos Demonstrate How Applicator Exposures May Vary**

- Farmers in North Carolina and Iowa have different exposure patterns to these chemicals.
- Higher exposure to 2,4-D in North Carolina compared to Iowa.
- Higher exposure to chlorpyrifos in Iowa compared to North Carolina.

**North Carolina Chlorpyrifos Exposure**

- North Carolina applicators use 30% less chlorpyrifos than Iowa applicators.
- Use of PPE and personal protective equipment has reduced exposure.

**Iowa 2,4-D Exposure**

- Iowa applicators use 30% more 2,4-D than North Carolina applicators.
- Use of PPE has reduced exposure.

**Estimated Chlorpyrifos Exposure for Agricultural Health Study Applicators**

- Chlorpyrifos exposure varies significantly between North Carolina and Iowa.
- Exposure levels are higher in Iowa compared to North Carolina.

**Lifetime Exposure Score**

- The lifetime exposure score is the product of the average work-day exposure score and the number of years an applicator has used a particular pesticide.

**AVERAGE WORK-DAY EXPOSURE FORMULA**

\[
\text{Lifetime Exposure Score} = (\text{Mix} \times \text{Apply} \times \text{Repair}) \times \text{PPE} \times \text{Duration}
\]

- **AVERAGE WORK-DAY EXPOSURE FORMULA**
- **LIFETIME EXPOSURE FORMULA**

**APPENDIX**

- Pesticide usage and exposure patterns among different applicator types.
- Comparison of exposure levels between North Carolina and Iowa.

**APPENDIX**

- Detailed analysis of exposure factors and potential health impacts.
- Recommendations for improving pesticide safety and management practices.