

## CHEMICAL HAZARDS

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### Types of Exposures

- p **Acute**
  - One quick exposure
  - Immediate effect (24 hours)
  - Results in injuries that are reversible
    - p Skin inflammation
    - p Sneezing/coughing
    - p Irritated mucous membranes
    - p Dizziness
    - p Nausea
  - Can be fatal if dose is high enough



*Acute dermatitis:  
Wearing a t-shirt  
contaminated with a  
pesticide*

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### Types of Exposures

- p **Chronic**
- p **Repeated exposures**
- p **Delayed effects**
- p **Results in non-reversible injuries**
  - Birth defects
  - Mutations
  - Cancer
  - Central nervous system



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## Types of Exposure

- p Exposure to multiple pesticides may have an additive effect

- Combined pesticides equal the sum of each
- $2 + 2 = 4$ 
  - p Inhalation
  - p Absorption




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## Factors Effecting Toxicity

- p Individual characteristics effect the toxicity
- p Age
  - Youngest and oldest most effected
- p Health conditions
  - Hereditary
  - Pregnant
  - diseased



Females of child bearing age need to be carefull

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## Protecting The Investment

- p Cannabis grow
  - Natural enemies
    - p Insects
    - p Rodents
    - p Animals




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**Cannabis**

## Pests that like Cannabis

p **Puncture the leaves and suck the juices**

p **Eat the leaves**

p **Bore into the stems**

p **Damage the roots**



**Aphid piercing the stem and sucking the juices**

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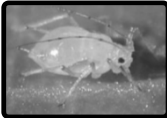
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**Cannabis**


## Pests that like Cannabis

p **Insects:**


- Spider mites
- Aphids
- Cucumber beetle
- Thrips
- Beetle borers
- Caterpillars
- Slugs/snails
- Whiteflies
- Root maggots
- Nematodes
- Mealybugs



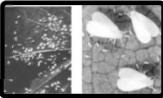
**Aphids**



**Cucumber Beetle**



**Thrips**



**White Flies**

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**Cannabis**

## Pests that like Cannabis



**Spider Mite Damage**



**Thrip Damage**

**Piercing-sucking insects – pierce the leaf and suck the juices**  
**Examples: Spider mites, whiteflies, Thrips, leafhoppers, mealybugs**

*Big problem for indoor grows or grows in warm climates.*

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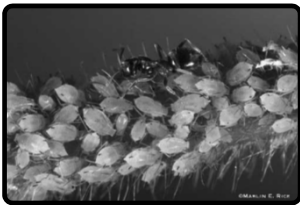
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Cannabis

## Pests that like Cannabis



**Whitefly damage**



**Aphids  
(Plant Lice)**

**Piercing-sucking insects**

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Cannabis

## Pests that like Cannabis



**Caterpillar Damage**



**Slug**

**Caterpillars, snails, slugs eat the leaves – will leave slim trails and holes in leaves**

*Slugs and snails wreck havoc on seedlings.*

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Cannabis

## Pests that like Cannabis







**Leaf Miner**

**Leaf Miner will burrow in the leaf leaving a visible trail. Damage slows photosynthesis allows for disease**

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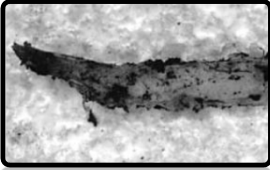
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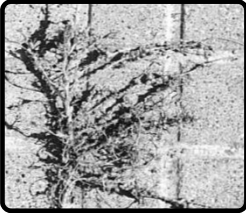
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**Cannabis**

## Pests that like Cannabis



**Root maggots – gnaw off root hair and hollow out roots**



**Nematodes damage roots and limit water movement to plant impairing its growth**

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**Cannabis**

## Pests that like Cannabis

**p Rodents**

- Mice
- Gophers
- Moles
- Rabbits
- Squirrels
- Ground hogs
- Rats
- Raccoons
- Voles (meadow mice)



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**Cannabis**

## Pests that like Cannabis



**Deer will eat Cannabis. Not as a preference, but when other food sources become exhausted.**

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**Cannabis**

**Pests that like Cannabis**



Deer will also eat Cookies. Not as a preference, but when other food sources become exhausted (or when the Narc's feed it to them... LOL!!!).

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**Cannabis**

**Controlling Insects and Rodents**

- p Evidence of insect and rodent problems
- p Chemicals and spray equipment at grow sites



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**Cannabis**

**Pesticides Growers Look For**

- p Acute toxicity
- p Short half-life
- p Biodegradable



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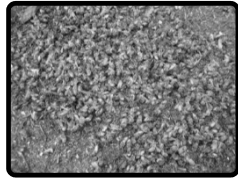
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## Pesticide Control

- p **General purpose of pesticides:**
  - Pesticides are designed to kill or adversely affect living organisms.



*Many pesticides are extremely toxic to bees.*

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## Chemicals

- p **Types of Chemicals (pesticides) used for grows:**
  - Insecticides
  - Miticides
  - Herbicides
  - Rodenticides
  - Fungicides
  - Molluscicides




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## Insecticides

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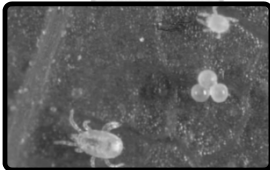
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**Cannabis**

## Insecticides

- **Insecticides**

  - **4 chemical types**
    - Organophosphorus (OP)
    - Carbamates
    - Chlorinated hydrocarbons
    - Pyrethroids

Mites on cannabis

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**Cannabis**

## Insecticides

- **Organophosphorus (OP)**

  - **Most widely used insecticide today**
  - **Over 40 registered varieties**
    - Highly toxic to humans
    - Toxicity and absorption vary depending on variety
    - Diazinon
    - Malathion
    - Dimethoate
    - chlorpyrifos



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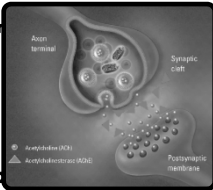
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**Cannabis**

## Insecticides

- **Organophosphorus (OP)**

  - **Inhibit cholinesterase**
    - Stops enzymes responsible for breaking down acetylcholine
    - Acetylcholine builds up at neural junctions
    - Leaves muscles, glands, and nerves in a constant state of stimulation
  - **Reaction is irreversible**
  - **Symptoms typically develop within 12 hours**



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## Insecticides

**Organophosphates**

- **Diazinon (spectracide)**
- **Inhibits acetylcholinesterase**
- **Readily absorbed through the skin**



Products containing diazinon

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## Insecticides

**Malathion**

- **Metabolized to malaoxone which is more toxic than malathion**
  - **Malathion and malaoxone are excreted primarily in the urine**
- Elimination takes days




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## Insecticides




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## Insecticides

- p **Product: Metafos**
  - Methamidophos
  - Organophosphorus Insecticide
- p **Extremely Toxic!**
- p **Rapidly absorbed through skin, stomach and lungs**



Banned by EPA for use in U.S.\*

\* Federal Register: September 23, 2009 (Volume 74, Number 183)

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## Insecticides

- p **Possible mutagen**
- p **Half-life**
  - 6.1 days in sand
  - Up to 309 days in water




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## Insecticides

### Carbamates

- Similar action to that of OP compounds
- Decrease in cholinesterase activity
- Reaction is reversible



Carbaryl



Methomyl

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## Insecticides

Carbamates  
Carbofuran




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## Insecticides

- p Chlorinated hydrocarbons
- Extremely toxic
  - Heptachlor



Aldrin

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## Insecticides

- p Organochlorines
- Methoxychlor (chlorinated hydrocarbons)
  - Disrupt function of nervous system, mainly the brain



Contains 10% methoxychlor

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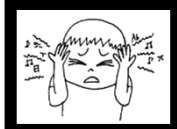
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## Insecticides

### Organochlorines

- Symptoms of exposure
  - Headache
  - Dizziness
  - Weakness
  - Shaking
  - Nausea
  - Excitability
  - Disorientation




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## Insecticides

### Pyrethroids

- Derived from the extract of chrysanthemum flowers (pyrethrum)
- Contact poison effecting the insects nervous system
  - Delays the closing of sodium ion channels in the nerve cell membrane
    - Disrupts charge in cell membrane causing release of neurotransmitters

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## Insecticides

### Pyrethroids

- Some pyrethroid insecticides contain piperonyl butoxide
  - Synergistic effect
    - restricts the enzyme that insects use to detoxify the pyrethrins
    - Allows the insecticide to be more effective!



Bugwacker contains 4% piperonyl butoxide

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## Insecticides

**Permethrin**

- Synthetic pyrethroid family
- Neurotoxin
- Carcinogenic
- Inhibits the activity of the immune system
- More toxic to children than to adults
- Widely used around households

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## Insecticides

**Products containing pyrethrins**

- Indoor bug bombs or foggers
- Human head-lice treatments
- Pet flea sprays

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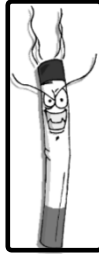
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## Insecticides

### p Nicotine

- Sold in 40% solutions
- Extremely toxic to humans and animals
- Degrades quickly
- Effective against spider mites, aphids, whiteflies, and thrips




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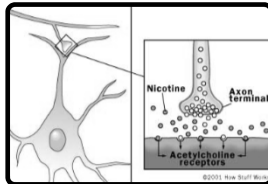
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## Insecticides

### p Nicotine

- Readily absorbs through the skin
  - p Skin PEL = 0.5 mg/m<sup>3</sup>
  - p Skin TLV = 0.5 mg/m<sup>3</sup>
- PEL = 0.08 ppm
- Fatal dose = 50 mg
- Mimics acetylcholine




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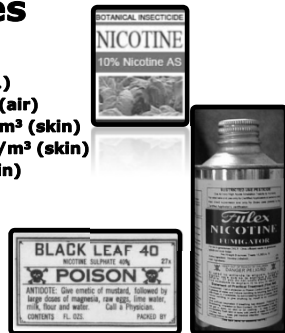
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## Insecticides

### p Nicotine Sulfate

- Banned in U.S. (2001)
- OSHA PEL = 50 ppm (air)
- OSHA PEL = 0.5 mg/m<sup>3</sup> (skin)
- ACGIH TLV = 0.5 mg/m<sup>3</sup> (skin)
- IDLH = 5 mg/m<sup>3</sup> (skin)
- Black Leaf 40
  - p Injures nervous system
  - p Minimal but readily absorbed through the skin



Lethal dose = 0.6 grams (oral)

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## Insecticides

### p Nicotine

- Commercial products containing nicotine
  - p Cigarette = 8 mg
  - p Cigar = 100 – 200 mg
- Extracted from tobacco
  - p Leaf contains 2 – 7%
- Process
  - p Boil tobacco leaves in water
  - p Strain leaves
  - p Spray water on plants



Homemade nicotine insecticide

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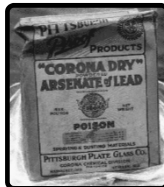
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## Insecticides

### p Arsenic based

- Used in the U.S. until the less toxic insecticide DDT became popular.
- Still in limited use in developing countries
- Rarely seen insecticide



Paris Green

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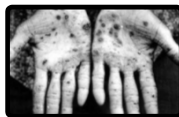
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## Insecticides

### Arsenical

- One of the fastest acting poisons
- Toxic to liver, kidney, brain, bone marrow, and nervous system
- Accumulates in body. Chronic headaches, dizziness, stomach-aches, salivation, low fever, garlic breath




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Cannabis

Insecticides

Arachnoid

Symptoms of exposure

- Headache
- Burning stomach pain
- Vomiting
- Diarrhea
- Disinnes
- Garlic odor on breath and face

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Cannabis

Rodenticides

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Cannabis

Rodenticides

Three main types

- Phosphines
- Blood thinners (Coumarin) – most popular
  - Brodifacoum
  - Bromadiolone
  - Coumatetralyl
  - Difenacoum

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## Rodenticides

**Phosphine**  
**Zinc phosphide laced bait**  
**Death occurs 1 to 3 days**




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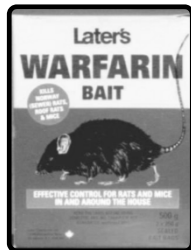
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## Rodenticides

**Coumarin anticoagulants**  
 ■ Warfarin  
 ■ Prevents blood from clotting




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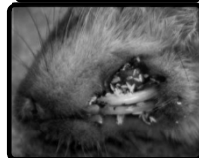
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## Rodenticides

**Brodifacoum**  
 ■ Decreases level of vitamin K  
 in blood – needed for  
 clotting



Causes internal bleeding

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**Cannabis**

**Rodenticides**

**Brodifacoum**



The image displays three different rodenticide products. At the top left is a box of 'd-CON' labeled 'KILLS MICE RATS'. To its right is a white tub of 'PESTOFF RODENT BAIT'. Below these is a box of 'Talon' labeled 'POISON'.

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**Cannabis**

**Rodenticides**

**Brodifacoum**



The image shows four rodenticide products. At the top left is a box of 'VERTOX'. To its right is a box of 'RATSAK'. Below these are two tubs of 'Havoc' and a jug of 'Ratsak'.

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**Cannabis**

**Fungicides**

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## Fungicides

### Fungicides

- Chemical compounds used to kill or inhibit fungus or their spores
- Most contain sulfur as an active ingredient




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## Fungicides

### Copper Salts

- Copper sulfate
- Injuries
  - Intestinal lining
  - Brain
  - Liver
  - Kidneys
  - Blood
  - Mucous membranes




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## Fungicides

Fungicide	Hazards
Mancozeb	Cancer (Ethylenethiourea)
Thiram	Nerve poison, birth defects
Benomyl	Birth defects
Thiophanate	Mutations, birth defects
Pentachloronitrobenzene	Accumulates in food chains, hormone effects
Phenyl mercuric acetate	Heavy metal poisoning
Fixed Copper	Toxic to plants and phytoplankton
Kitazin-P	Nerve poison
Streptomycin	Allergic reaction

### Risk factors of some commonly used fungicides

Pesticide Properties That Affect Water Quality, Texas A&M University

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## Molluscicides

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## Molluscicides

Used for snails and slugs

3 types

- Metal salts
  - Relatively non-toxic
- Metaldehyde – Most common
  - Highly toxic
- Acetylcholinesterase inhibitors
  - Highly toxic



Snails eating poison pellets

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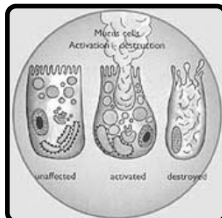
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## Molluscicides

■ Metaldehyde

■ Most common molluscicide

- Attacks the snail's mucus producing cells
- Snail becomes immobile
  - Cannot feed
  - Exposed to drying
  - Leads to death




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## Molluscicides

### p Metaldehyde

- Most common poisoning agent for dogs\*
- Toxic to humans
- Half-life = several days
- No antidote
- Also toxic to birds and aquatic life



Contains 3.25% metaldehyde

\*The Pet Health Library, Wendy C Brooks, Educational Director, Veterinarypartner.com

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## Pesticide Tidbits

### Worldwide each year:

- 3 million pesticide poisonings
- 250,000 deaths
  - Majority (2/3) by ingestion - suicide
- Half of pesticide deaths in U.S. are kids under 10



World Health Organization (WHO), September 9, 2006

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## Insecticides

### p Organophosphates

### p Carbamates

#### ■ Symptoms of exposure

- Headache
- Dizziness
- Weakness
- Shaking
- Stomach cramps
- Diarrhea
- Sweating
- Loss of appetite
- Weight loss




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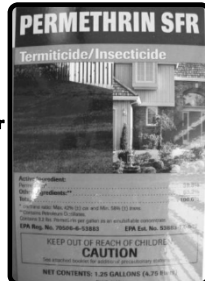
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## Insecticides

## Permethrin

**Symptoms of exposure:**

- Tremors
- Incoordination
- Elevated body temperature
- Increased aggressive behavior
- Disruption of learning



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## Insecticides

p Nicotine Sulfate

- Symptoms of exposure

- Nausea
- Headache
- Diarrhea
- Dizziness
- Shaking
- Abdominal pain
- Lack of coordination
- Sweating
- salivation.

[illegible]

## Fungicides

### Copper sulfate

- **Symptoms include**

### Vomiting

### Burning pain in chest

## Diarrhea

## Headache

## Sweating

[illegible]

## Molluscicides

p Metaldehyde poisoning

p Onset 1 – 3 hours

p Symptoms:

- Lethargy
- Abdominal pains
- Nausea
- Vomiting
- Diarrhea
- Hyperthermia
- Seizures
- Coma
- Death



Beverley Sales and Ann Marie Walton – victims of an attempted metaldehyde poisoning by their neighbor

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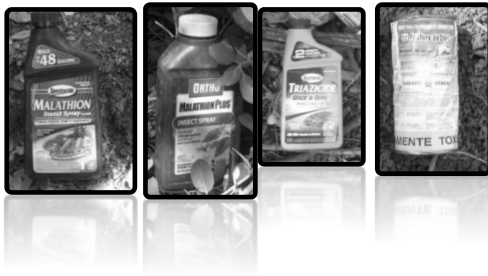
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## Pesticides Found at Grows




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## Chemicals found at Grows



Animal Repellent  
(slight hazard,  
causes  
unpleasant/bitter  
taste:  
•Denatonium  
•Thymol

Brodifacoum  
Toxic (can be fatal)  
Reduces clotting of blood and  
hemorrhaging

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**Cannabis**

### Chemicals found at Grows

**Rodenticide:**  
Zinc phosphide  
Health hazard

**Insecticide (Pyrethroid):**  
Esfenvalerate

**Insecticide (Pyrethroid):**  
Lambda-Cyhalothrin



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**Cannabis**

### Chemicals found at Grows

**Fungicide (substituted benzene)**  
Chlorothalonil  
Highly toxic  
Possible carcinogen





**Insecticide (carbamate)**  
Carbaryl  
Toxic – potential carcinogen

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**Cannabis**

### Routes of Exposure

**Grow op inhalation hazards:**

- Solids
  - Mold spores
- Mists
  - Spray from pesticides
  - Spray from fertilizers
- Dusts
  - pesticides



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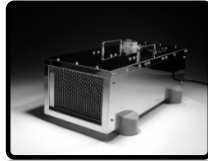
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## Routes of Entry - Inhalation

- ρ **Whole respiratory irritants**
  - **Partially water soluble**
  - **Chemicals include:**
    - ρ Chlorine
    - ρ Bromine
    - ρ Ozone



Ozone generator

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## Routes of Entry - Inhalation



Ozone generator

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## Routes of Entry - Inhalation



Ozone generator

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## Toxicology of Reagents

### Organic Solvents

- Used to extract MJ resin
- Can be carcinogenic
- Exposures affect the CNS, liver and kidneys
- Defatting action to oils on skin




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## Toxicology of Reagents

### Alcohols

- Used to extract MJ resin
- Methanol (Heet, wood alcohol)
  - Breaks down to formaldehyde in the body – very toxic
  - Loss of vision




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## Toxicology of CO<sub>2</sub>

Can be produced at indoor grows from

- Portable generators
- Kerosene lamps
- Burning propane




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## Toxicology of CO<sub>2</sub>

- PEL = 5000 ppm
- TLV = 5000 ppm
- IDLH = 40,000 ppm
- Ambient air = 300 ppm
- MJ grow = 1500 ppm
- Symptoms
  - ρ Nausea
  - ρ Dizziness
  - ρ Headaches



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