

Pest Management Issues Affecting Cannabis in Colorado



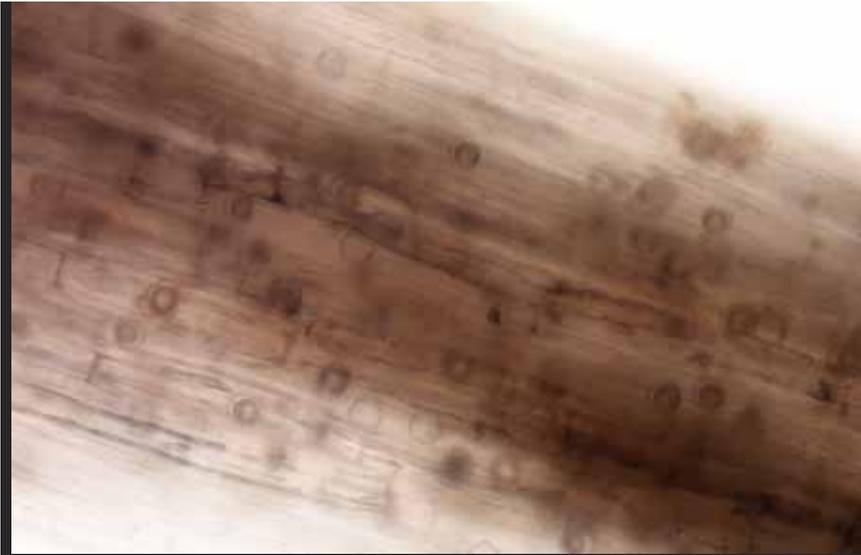
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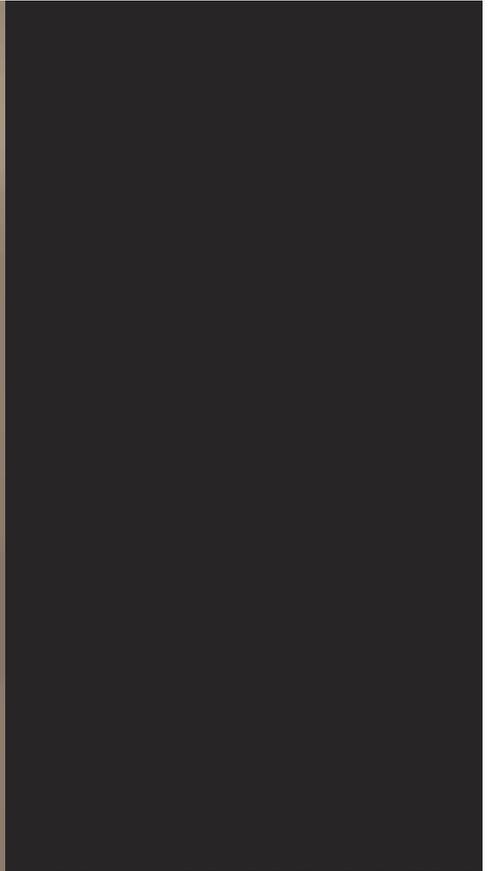
Primary Pest Problems of Observed with Indoor Grown Cannabis

- **Abiotic disorders (e.g., nutrition)**
- **Pathogens**
 - Powdery mildew
 - Pythium root rots
- **Arthropods**
 - Twospotted spider mite
 - Hemp russet mite
 - Rice root aphid
 - Fungus gnats



Pythium root rots
Pythium spp.





**Twospotted spider
mite**

Tetranychus urticae





Powdery mildew of *Cannabis*

Podosphaera macularis





Hemp russet mite
Aculops cannabicola



Photo credit Karl Hillig

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Rice root aphid
Rhopalosiphum abdominalis





Darkwinged fungus gnats
Bradysia spp.



Federal Laws and Pesticides

- **Marijuana is classified as Schedule I Controlled Substance**
 - As a result no federal agency will recognize the crop for any purpose – other than drug law enforcement
- **EPA will not establish a crop category for cannabis under pesticide laws**
 - EPA regulates the use of pesticides under provisions of law defined by FIFRA
 - *No pesticides can be used legally on a crop if the use is not allowed for that crop category*

Phases of Pesticide Use Regulation in Cannabis Production

- **Phase I - “Wild West” Phase**
- **Phase II - State Finesse Phase**
- **Phase III - Normalization Phase**
 - **Cannabis is federally recognized as a crop**
 - **Cannabis is regulated as a normal crop**

“Wild West Phase”

- **All registered pesticides are illegal**
- **Pesticide laws are completely ignored**
- **Pesticide regulation and enforcement is ignored by state and federal agencies**
- **All pest management information sources devolve to the internet and hearsay**

Spider Mite Management on the Internet

“Consider this situation, you spray your chemicals, the mites may not die right away depending on the mode of action, what happens next is the mites panic and start laying eggs like crazy. Before you know it, the mites have become twice as bad as before you hit them.....”

Information from Legal Hydro web site



Spider Mite Management on the Internet

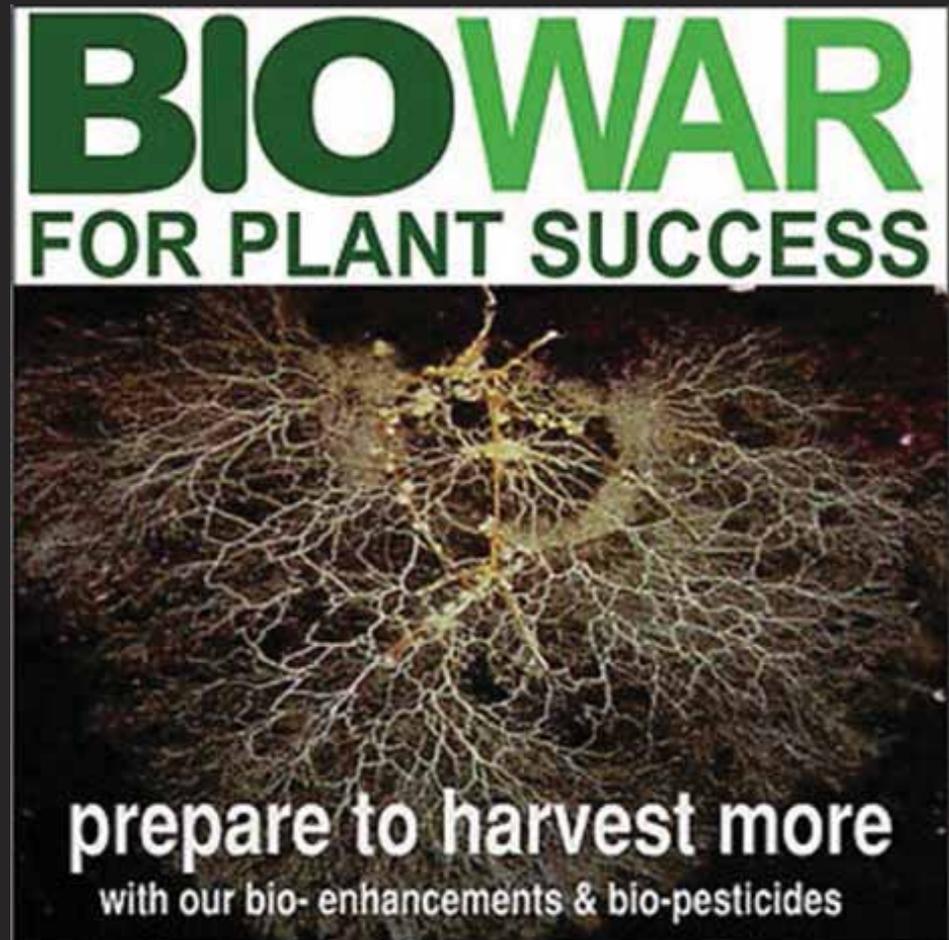
“The best method to control this pest is to switch your mode of attack each and every day. Never spray them with the same stuff twice in a row, if you choose the chemical approach, you want to use a Neem Oil along with as many other forms of Miticides as you can get your hands on...”

Information from Legal Hydro web site

August 14 Letter from a Cannabis Producer

Checklist of treatments July 18-August 12

- BioWar (unspecified “beneficial soil microbes)
- Sulfur/pyrethrins



August 14 Letter 2013 from a Cannabis Producer

Checklist of treatments July 18-August 12

- **BioWar (unspecified “beneficial soil microbes)**
- **Sulfur/pyrethrins**
- **Abamectin (Avid)**
- **Chlorfenapyr (Pylon)**
- **Abamectin/binfenzate (Scirocco)**
- **Fenpyroximate (Akari)**
- **Abamectin**
- **Fenazaquin (Magister)**

FOR RESIDENTIAL USE IN
HOME GARDENS, LAWNS
AND ORNAMENTALS

EPA Reg. No. 62719-314-54705

Produced For / Fabricado

LAWN AND GARDEN PRO

Present Status of Pesticide for Use on the Crop: Any pesticide *that is a registered pesticide* is illegal to use on *Cannabis* under federal law

Pesticide Use On Cannabis

Pesticides that are illegal because of regulatory indecision



Horticultural oils

Pyrethrins



Azadirachtin



Microbial controls

Pesticide Use on Cannabis

Pesticides that are illegal because they have not been tested on nor registered for any crops similar to cannabis



Fenpyroximate



Bifenazate



Abamectin

“State Finesse Phase”

- **Some pesticides are identified by State agencies as allowable in Cannabis production**
- **Uneasy alliance with Federal agencies as Cannabis remains unrecognized as crop**
- **Pest management information sources are provided minimal support by state and local agencies**

2013 Washington State Finesse on the Subject of Pesticide Use on Cannabis

- **Pesticides that require federal registration under Section 3 of FIFRA**
 - **Active ingredient is exempt from the requirements of food crop tolerance, *and***
 - **Label has directions for use on unspecified food crops, including unspecified food crops grown as bedding plants**
 - **EPA and WSDA registration is required**
- **Section 25b minimum risk pesticides (exempt from federal registration)**

Products allowed with WDA Finesse

- Azadirachtin
- *Bacillus pumilus*
- *Bacillus subtilis*
- *Bacillus thuringiensis*
- Canola oil
- *Chromobacterium*
- *Gliocladium virens*
- Hydrogen peroxide
- Mineral oils
- Neem oil
- Phosphorous acid
- Potassium bicarbonate
- Insecticidal soaps
- Pyrethrins
- *Streptomyces* spp.
- *Trichoderma* spp.

Criteria for April 2015 Colorado Department of Agriculture Listing of Allowable Pesticides on Cannabis

- . The label allows for use on unspecified crops and/or plants, and;**
- . The label allows use at the intended site of application, and;**
- . The label directions do not prohibit use on crops or plants intended for human consumption.**



COLORADO
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- Inspection/Consumer Svcs ▾
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- Plants ▾
- State Fair

Pesticide-use-marijuana-production

The Colorado Pesticide Applicator Act prohibits use of a pesticide in a manner inconsistent with the product labeling:

35-10-117(1)(i)C.R.S.: unless otherwise authorized by law, it is unlawful and a violation of this article for any person to use, store or dispose of pesticides, pesticide containers, rinsates, or other related materials, or to supervise or recommend such acts, in a manner inconsistent with labeling directions or requirements, unless otherwise provided for by law, or in an unsafe, negligent, or fraudulent manner.

Additional pesticide uses that are required for legal cannabis production may be obtained under certain circumstances under Section 24(c) of FIFRA. These are referred to as Special Local Need Registrations. See the following documents for more information:

[EPA letter to CDA SLN's for Marijuana](#)

[CDA Letter to Marijuana stakeholders - SLN's for Marijuana](#)

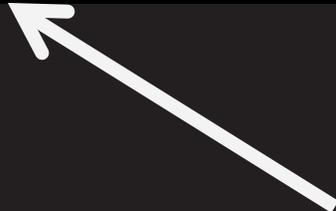
[24\(c\) Criteria](#)

[SLN checklist - Cannabis](#)

[SLN guidance Colorado draft](#)

We are currently reviewing pesticide labels upon request and maintaining a list of products whose label we have reviewed that we believe could be used on marijuana without violating 35-10-117(1)(i), as long as the applicator follows the label directions. To view or download the current list, click the link below:

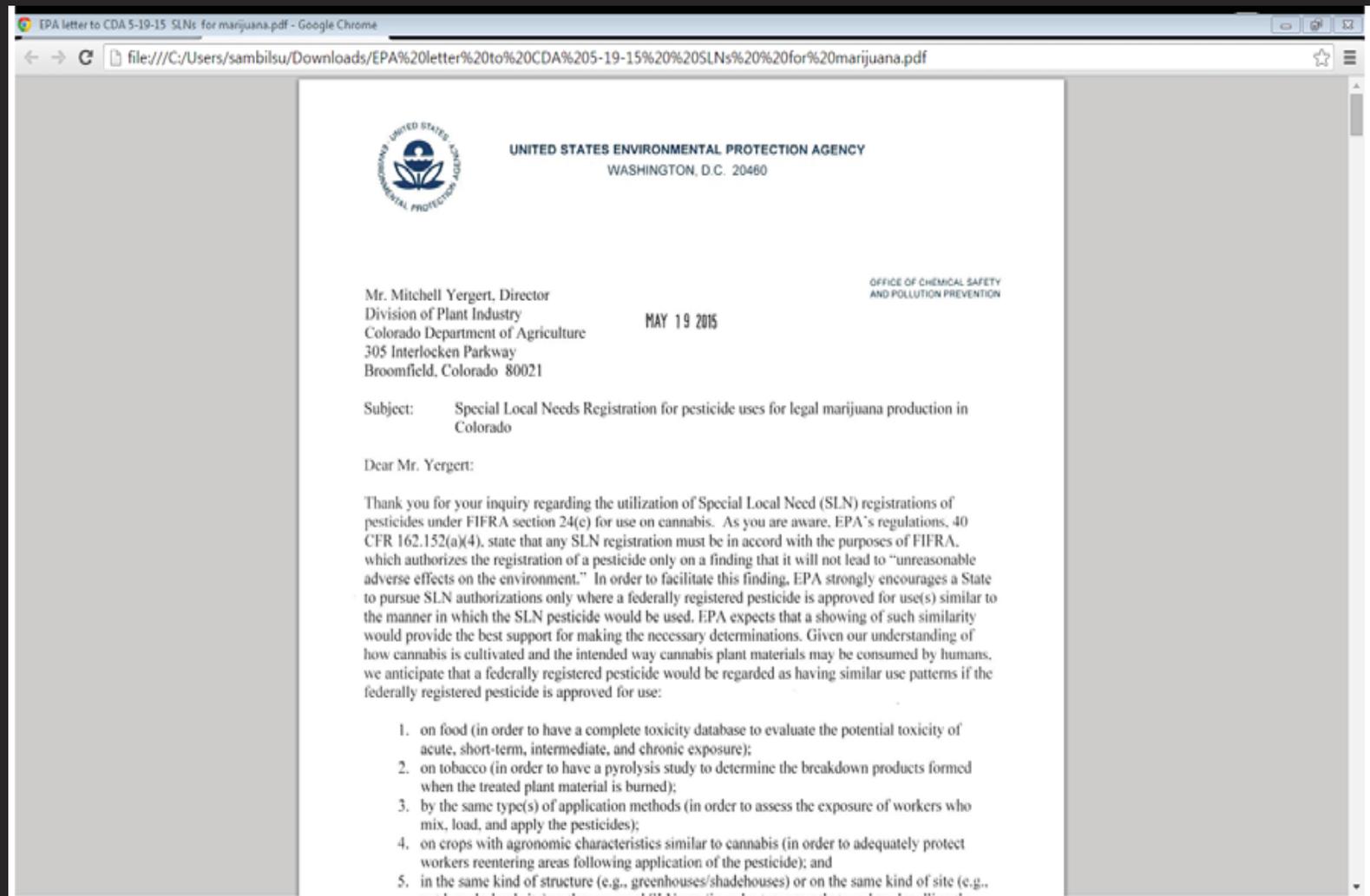
[Pesticides for use in marijuana production](#) (As of 06-02-2015)



Products Listed as Allowable by the CDA on Cannabis Grown in Colorado

- Azadirachtin (some)
- Insecticidal soaps (some)
- Horticultural oils
 - Mineral
 - Seed/Vegetable
- Various essential oils
- Pyrethrins (some)
- Phosphorous acid
- Potassium bicarbonate (some)
- Many microbes used for biological control
 - Some fungi
 - Some bacteria

A step to normalization? EPA does indicate it would consider Special Local Needs registrations for Cannabis (May 19)



Criteria for selection of a potential product:

The applicant for a SLN must be the primary EPA registrant of the product. The manufacturer, EPA registrant, makes the application to CDA.

Product's currently labeled uses must include:

- Food uses
- Tobacco uses
- Uses with the same types of application methods. (e.g. foliar spray, via hydroponics, mixed into soil growing media)
- Uses on crops with similar agronomic characteristics and worker handling exposures as would happen in Cannabis. Hops and greenhouse-grown tomatoes?
- Greenhouse uses.



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General Thoughts on Pest Management Approaches for Key Pests





Powdery mildew of *Cannabis*

Podosphaera
(=*Sphaerotheca*)
macularis

Susceptible crops to
this species of
powdery mildew
fungus include: hops,
strawberry,
delphinium, phlox,
potentilla, geranium

Some IPM Tools for Powdery Mildew

- **Exclusion of causal organism**
- **Oils, desiccants to kill stages on leaf surfaces**
- **Biological control agents**
- **Improved air circulation**

Powdery Mildew Treatments

- **Oils**
 - **Petroleum/Paraffinic**
 - **Neem**
- **Biological Controls**
- **Potassium bicarbonate**

Horticultural Oils

- Primarily act by smothering insects
- Derived from various sources
 - Petroleum/Mineral oils
 - Vegetable oils (cottonseed, soybean)
 - Neem seed extracts
 - Fish oils



Examples of a highly refined petroleum oils (mineral oils) that has labeling for use on herbs and spices – *and Colorado Cannabis*



Neem oil products (clarified hydrophobic extracts of neem seed oil)



Note: In these products *the azadirachtin has been removed*



Streptomyces lydicus WYEC
108 Strain

Microbial BioControls for Powdery Mildew

Bacillus amyloliquifaciens
Strain D747



Bacillus subtilis QST713 Strain





Potassium bicarbonate product – Presently CDA allowable, *but only for home uses*

Potassium bicarbonate product – Not presently CDA allowable. Candidate for Special Local Need registration?

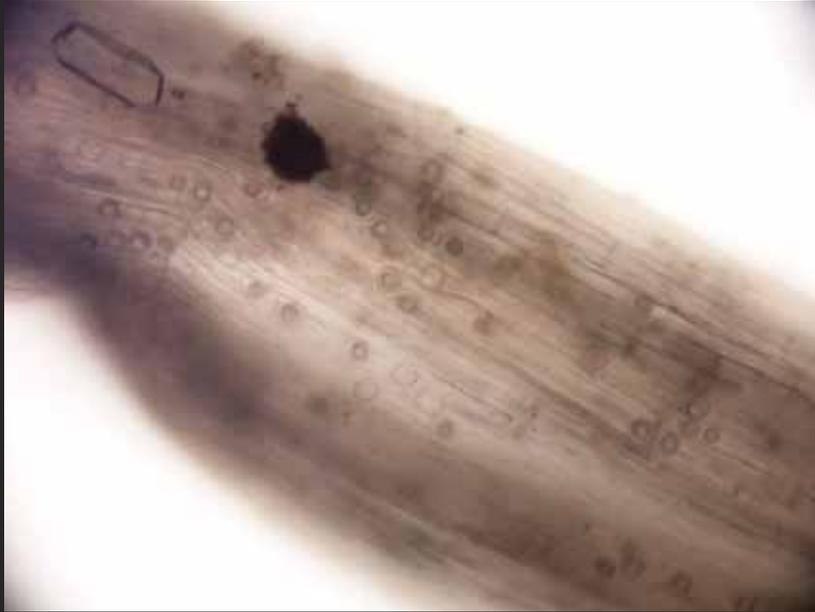


Sulfur



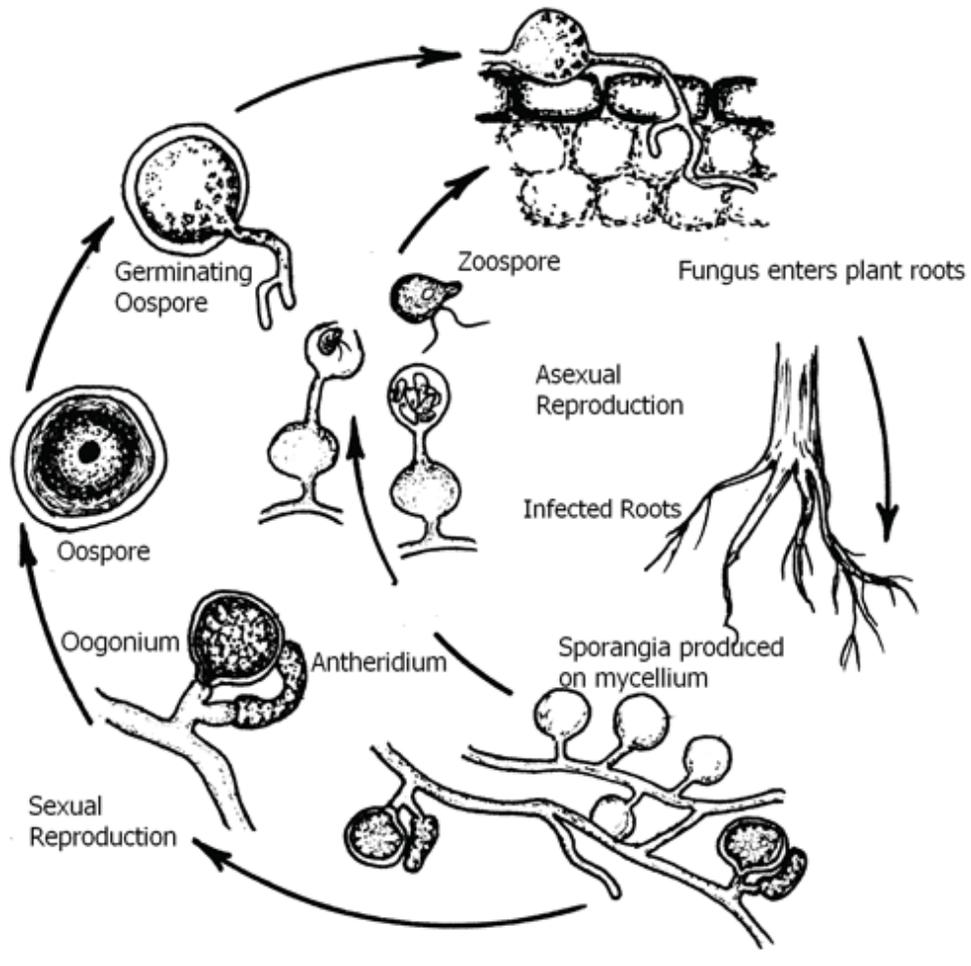
Only sulfur product presently on CDA Allowable List.

Not allowed in commercial production.

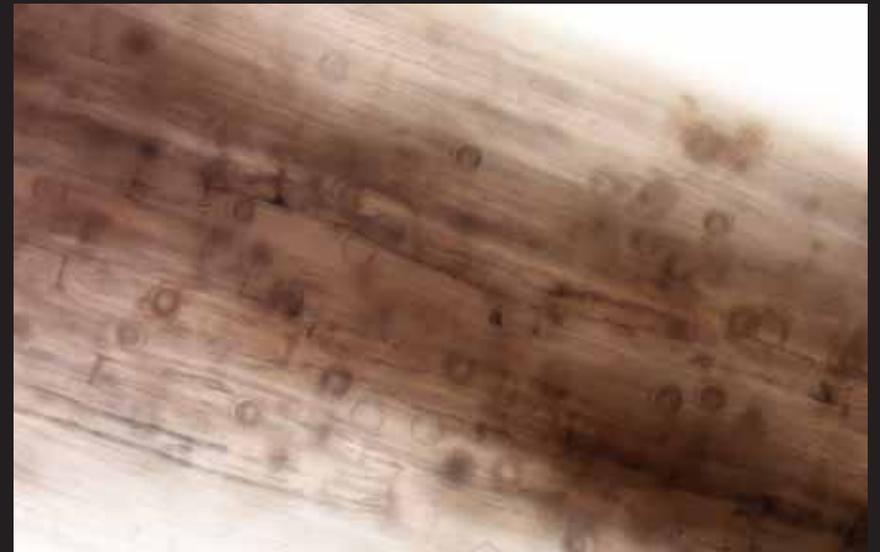


Pythium root rots





The life cycle of Pythium includes a stage (oospores) designed to survive for long periods and is very difficult to kill.



Pythium oospores in Cannabis root



Rooting areas, once colonized by Pythium, can easily become a continuous source of new infections



Zoospores can easily spread through a hydroponic system



HOWTOGROWWEED420



Some IPM Tools for Pythium Root Rots

- **Start with clean plants**
- **Avoid practices that allow spores to spread between plants**
- **Incorporate effective biological control agents into root growing media and/or seedling starts**

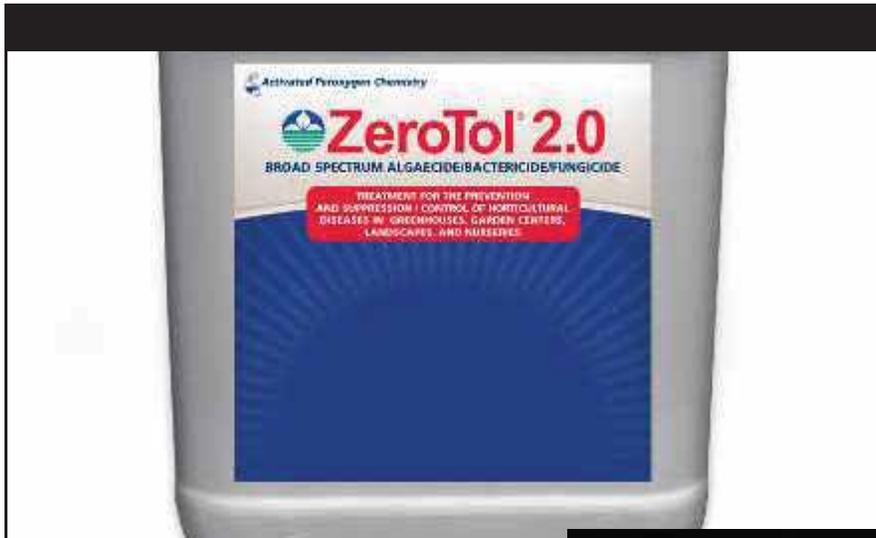
Disinfesting Pythium

- Do not reuse infested equipment
- Disinfestation with oxidizing agents
- Heat/pressure disinfestation/Autoclave
- Ozone sterilization?
- Ultraviolet sterilization?



Key point in production – *rooting areas must be kept clean of Pythium*

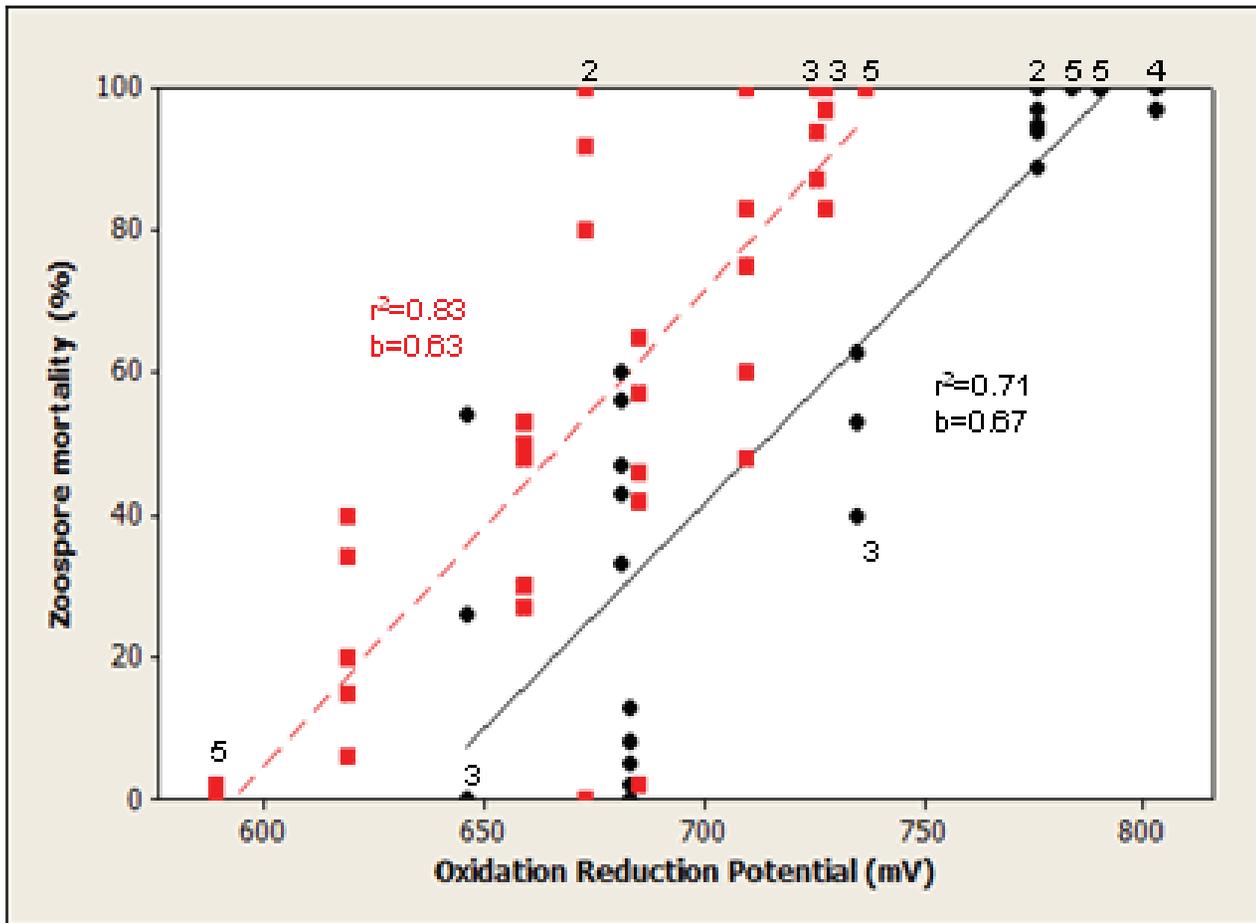




Hydrogen peroxide products

The only oxidizer-type pesticide that is presently allowed for use on Cannabis





Lowering pH increase Oxidation Reduction Potential – which increases mortality of Pythium

Phosphorous Acid Fungicide



- Act by stimulating **systemic acquired resistance** response
- Primarily active against “water mold” types of fungi



Potential Biological Control Agents for Pythium

- Phosphorous acid products
- Various *Trichoderma* species fungi
 - Strains of *T. gamesii*, *T. hamatum*, *T. harzianum*, *T. virens*; *Gliocladium virens*
- *Streptomyces lydicus*
- *Bacillus pumilus*

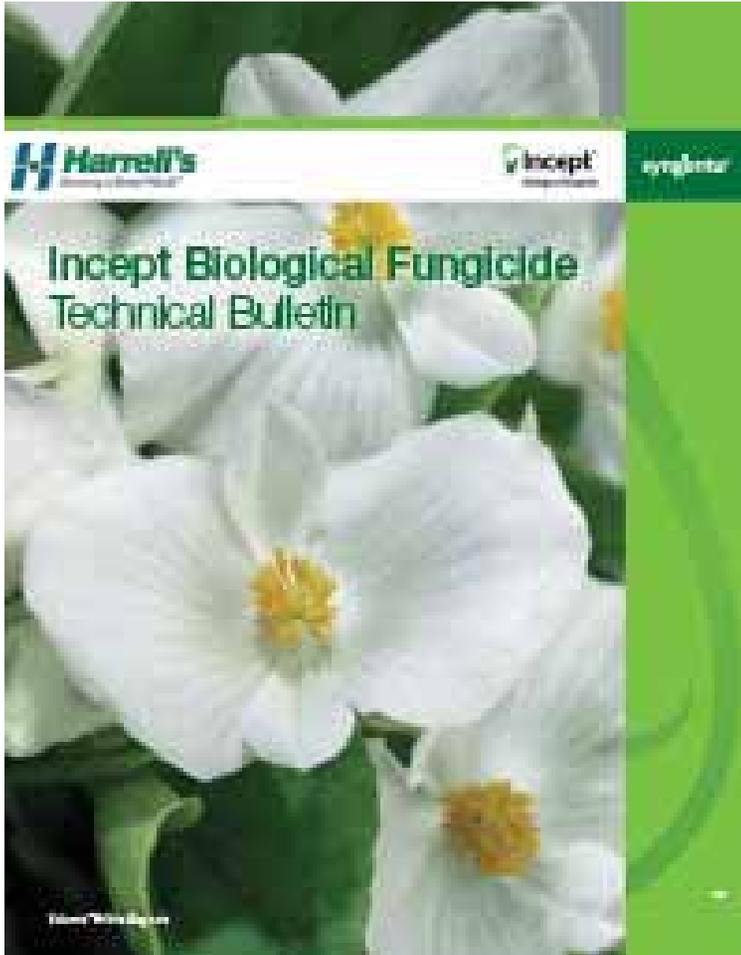


Trichoderma harzianum
(RootShield)

Trichoderma harzianum
and *Trichoderma virens*
(Rootshield Plus)

**Antagonistic to some soil fungi
(competition, antibiosis)
Used as a preventive treatment**

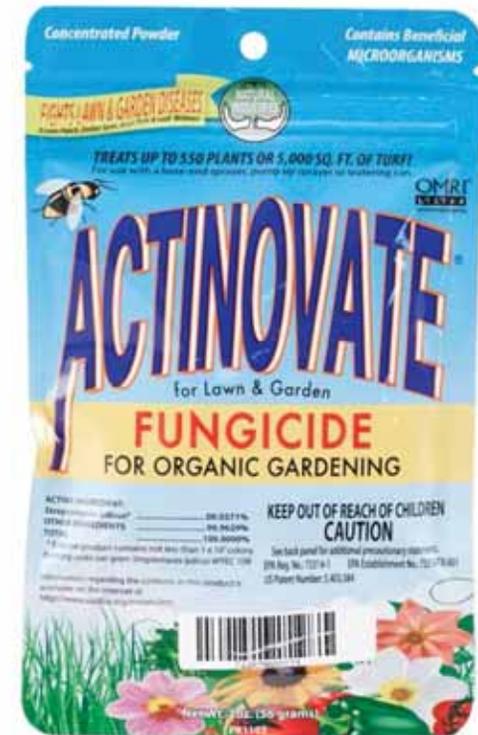




Trichoderma hamatum
isolate 382

Incept

Streptomyces lydicus
WYEC 108 Strain
Actinovate





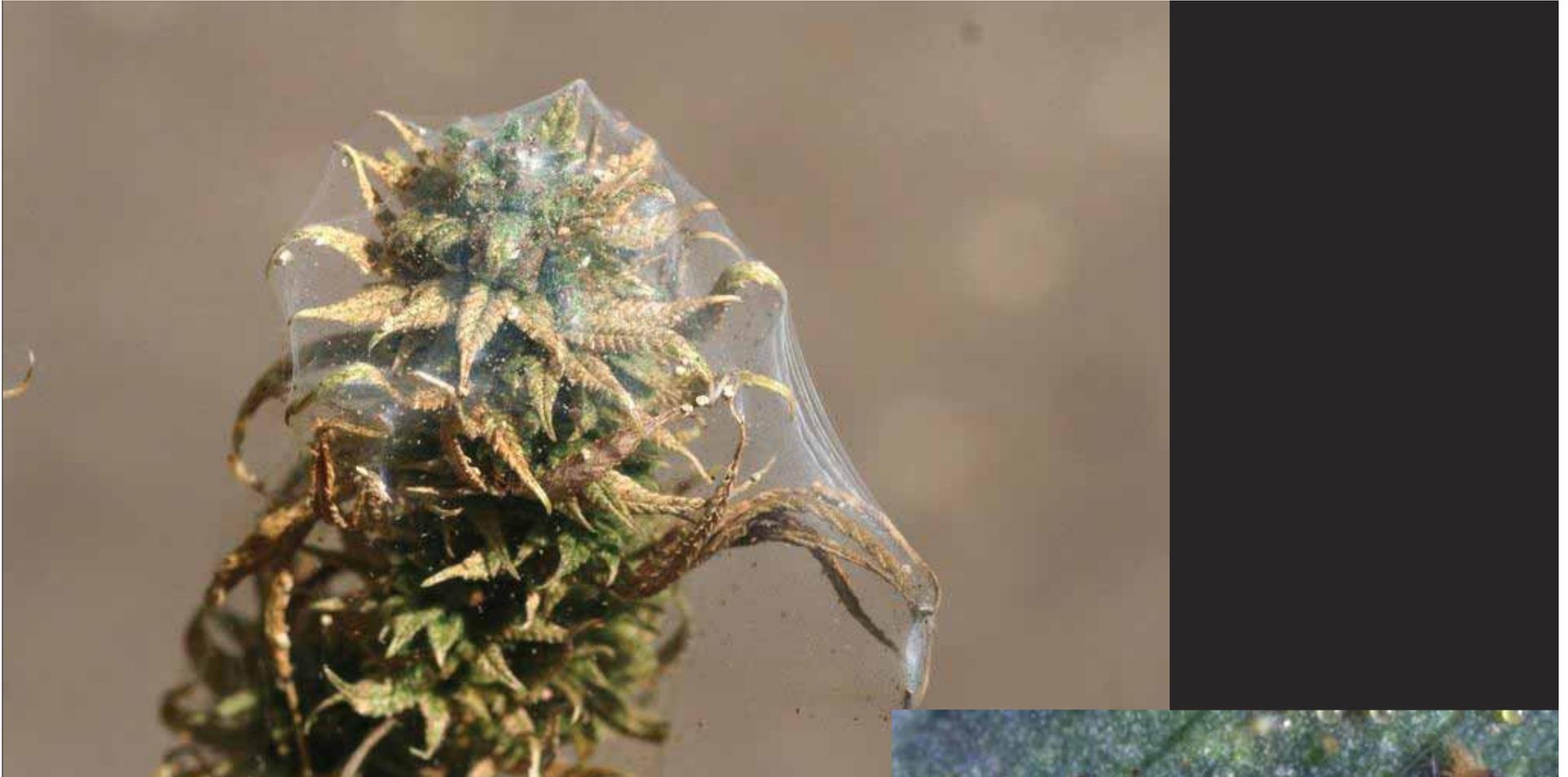
Biological control fungi are best used in early seedling stages – they must colonize the root surface ahead of the pathogen for best effect





Mites





**Twospotted spider
mite**

Tetranychus urticae





Hemp russet mite
Aculops cannabicola

Note: Cannabis is the only known host for the hemp russet mite



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Spider Mite Management

- **Prevent introduction of mites into growing facility**
- **Start with clean plants**
- **Move plants through production ways that prevent cross contamination**
- **Oils can be used as sprays**
- **Biological controls?**

Constantly monitor plants for signs of spider mite presence/activity



Catch early signs such as this...



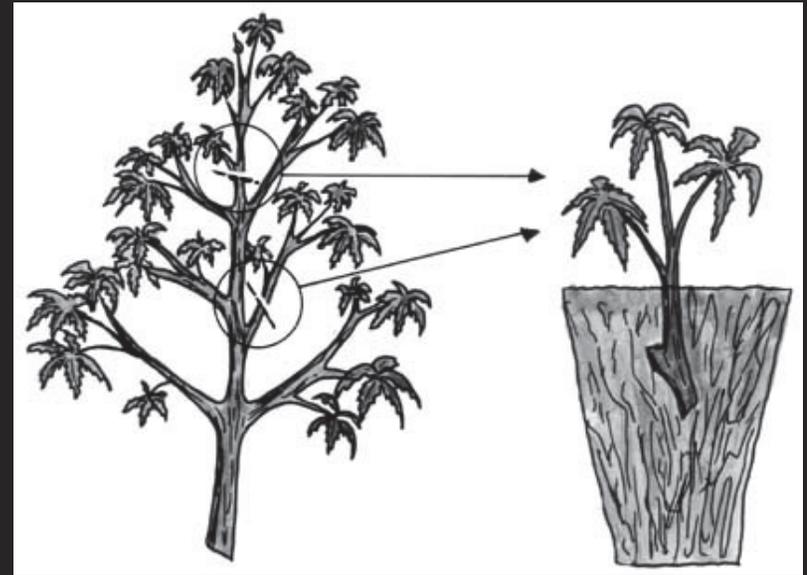
...before it progresses
to this....





...and way before this.

Cuttings, if used, must be disinfested of all living stages of mites before introduction into a growing area



Avoid conditions that allow “steamrolling” of mite populations



Sprays with some activity against spider mites

- Horticultural oils
 - Petroleum/Paraffinic
 - Neem
- Insecticidal soap?
- Essential oils?



Examples of mineral/petroleum/paraffinic oils* that are allowable in Colorado

***Typically used at 2% concentration of active ingredient**

Some neem oil products* (clarified hydrophobic extracts of neem seed oil) allowable for use in Colorado



* Typically used at 2% concentration of active ingredient

Essential Oil Products?

- **Derived from a wide variety of plants**
 - Rosemary, thyme, garlic, geraniol, cedar.....
- **Most are exempt from pesticide registration requirements**
- **Phytotoxicity potential with some**
- **Most have very little testing to support claims of effectiveness under Cannabis growing conditions**

Essential Oil Products??



Predatory Mites for Use on Cannabis?

- *Mesoseiulus longipes*
- *Neoseiulus californicus*
- *Galendromus occidentalis*



Note: The above species are the predatory mites that are most tolerant of low humidity. However, performance of all is reduced under low humidity.

Predatory Mite: *Galendromus occidentalis*

Optimal environmental conditions

80-100 degrees F

> 50% RH



Predatory Mite: *Mesoseiulus longipes*

Can only tolerate the very low humidity of 40% when the temperature is 70°F.

Requires increasing humidity as temperature rises.



Are there spider mite resistant Cannabis cultivars???

Plants that do not support spider mites (Antibiosis)

Plants that do not sustain loss from spider mite injury (Tolerance)



Pest Management Issues Affecting Greenhouse Grown Cannabis in Colorado



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