BMPs for Medical Marijuana Pest Management

Kathy Murray
Maine Department of Agriculture, Conservation and Forestry
contact: hillary.peterson@maine.gov
www.Maine.gov/ipm
The Problem

Pests!

Pathogens

Insects

Mites

Photo: Whitney Cranshaw
Pesticides are Also Problematic

- $ 
- Labor 
- Worker and patient health risks 
- Pest resistance to pesticides 
- Pest resurgence 
- Regulatory & marketplace restrictions
IPM is the Answer!

• Integrated Pest Management
  – Organized and systematic approach to preventing and managing all pests

• IPM Offers
  – Minimized risks (health, $, disruption)
  – Effective, long-term pest control
  – Improved crop quality/quantity
Integrated Pest Management

STEP 1 - KNOWLEDGE
- Key pests
- Pest lifecycles
- Natural enemies
- Growing area

STEP 2 - PREVENTION
- Site selection
- Variety
- Time of planting & rotations
- Water & nutrition management
- Farm hygiene
- Pest host management

STEP 3 - OBSERVATION
- Crop monitoring
- Pest prediction models
- Pheromone traps
- Yellow sticky traps

STEP 4 - INTERVENTION
- Mechanical controls
- Biological controls
- Chemical controls

STEP 5 - EVALUATION & PLANNING
- Review monitoring records,
  Talking, listening, reading,
  thinking
- Consult & adapt

IPM model of continual improvement
State of Maine

Best Management Practices for Pest Prevention and Management in Maine Medical Marijuana Cultivation
BMP 1: Design and operate facilities to prevent introduction and spread of pests

• Keep plants healthy
• Design spaces and processes to permit excellent sanitation and quarantine.
• Indoors: keep pests out and don’t give them shelter. Install and maintain air filters. Seal pest entryways, cracks, crevices and voids.
• Outdoors: maintain space around plants, control weeds, install barriers
BMP 2: Use, Store and Dispose Pesticides in Accordance with Regulations

- Know and follow all regulations
- Read and follow product label directions for use, storage and disposal.
- Ensure worker protection standards are met.
- Pesticides only used by licensed applicator unless growing only for self and household patients.
- Ensure any product used is registered and not prohibited for use on Cannabis in Maine.
BMP 3: Establish and Utilize Sanitation Protocols to Prevent the Spread of Pests and Contaminants by Workers

• Establish protocols to prevent pests from hitchhiking on workers’ clothing, shoes or equipment.
  – Start clean. Keep clean.
  – Work in infested areas last

• Provide training and verify pest preventive procedures are being followed.
BMP 4: Provide Optimal Growing Conditions to Promote Healthy Plants, Encourage Natural Enemies and Minimize Pest Conducive Conditions
Keep Weeds Out! Insect Pests Thrive in weeds!
BMP 5: Implement Effective Procedures to Regularly and Systematically Monitor for Pests
BMP 6: Develop and Utilize an Integrated Pest Management Plan that includes Least-Risk Protocols for Preventing and Managing Common Pests
Powdery mildew of *Cannabis*

*Podosphaera macularis*

Also infects hops, strawberry, delphinium, phlox, potentilla, geranium

Photos: Whitney Cranshaw
Conditions that Promote Powdery Mildew

- High humidity
- Moderate temperature
- Still air
Powdery Mildew Prevention

• Quarantine new plant material
• Maintain humidity at or below 70%
• Maintain good air circulation among plants
• Maintain positive airflow at entrances/exits
• Use strict sanitation protocols for workers and equipment
  – Wear clean dedicated clothing/shoes or protective coverings to prevent intro
    – of spores into growing areas
  – Sterilize pots or don’t reuse.
  – Sterilize cutting tools before each cut.
Powdery Mildew Management

• Isolate, bag, and remove infected plants

• Apply approved, registered pesticides when/where/if needed

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide
Home Made Pest Control Products NOT Allowed
Pythium root rot fungi
*Pythium* spp.
Zoospores can easily spread through a hydroponic system
Prevent Pythium

• Start with clean plants and sterilized pots, flats, trays, tools
• Avoid practices that allow spores to spread between plants
• Disinfect floors, equipment, hard surfaces between growing cycles with an approved/registered product.
• Place disinfectant foot bath mats at entry points

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.
Two-spotted spider mite

*Tetranychus urticae*
Hemp russet mite

*Aculops cannabicola*
Constantly Monitor Plants for signs of mite presence/activity

Catch early signs such as this...
...Take action well before it gets like this!

Photos: Whitney Cranshaw
Avoid conditions that allow “steamrolling” of mite populations
Spider Mite Management

• Start with clean plants
• Quarantine new plant material to avoid bringing mites into facility
• Train workers in sanitation protocol to prevent transfer of mites to clean areas
• Maintain humidity closer to 50% when possible
• Release predatory mites and/or beneficial nematodes in indoor grows.
• Avoid pesticides that kill natural enemies indoors and outdoors.
Cuttings, if used, must be disinfested of all living stages of mites before introduction into a growing area.
Dark-winged fungus gnat, *Bradysia* spp.
Fungus Gnat Trapping
Some IPM Tools for Fungus Gnats

• Avoid overwatering. Let potting media dry out on top before watering.
• Sticky Traps
• Biological control agents
  – Soil-dwelling predatory mites
  – Entomopathogenic nematodes
Aphids

- Complex life cycle
- Sucks plant sap from roots, stems, or leaves
- Parthenogenic: reproduces without mating
- Viviparous: live birth

Figure 2. General life cycle of aphids. Asexual reproduction occurs during most of the year (summer cycle). Some aphid species produce a generation of sexual individuals that produce overwintering eggs as shown in the winter cycle.

All aphids have a pair of cornicles
Rice root aphid

*Rhopalosiphum rufiabdominalis*

Photos: Whitney Cranshaw
Biological Control

Use (or augment) natural enemies to prevent and manage pests.

- Predatory mites
- Beneficial nematodes
- Insect predators and parasites
Conservation Strategies

• Minimize pesticide impact on natural enemies
  – Product selection (ai, formulation)
  – Application methods
  – Timing
  – Spot treating

“When we kill off the natural enemies of a pest we inherit their work” — Carl Huffaker
Farmscape to Attract and Support Natural Enemies

• Create diverse plantings
  – Provides shelter and alternate food for natural enemies
  – Insectary plantings

• Plant strips, borders or banks of flowering plant
  – provides nectar and pollen for beneficial insects
Predatory Mites for Control of Spider Mites and Fungus Gnats

- **Mesoseiulus longipes**
  - Can tolerate 70°F, 40% RH, but needs higher humidity with increasing temperature

- **Galendromus occidentalis**
  - Best in hot, humid conditions (80-100 F, >50% RH)

- **Neoseiulus californicus**
  - Best at temps up to 100 F, >50% RH
Hypoaspis miles
(aka Stratiolaelaps scimitus)
Biocontrol of Fungus Gnats

Diagram showing the lifecycle of the nematodes used for biocontrol:

1. Bacteria released
2. Infective juveniles enter host
3. Infective juveniles emerge
4. Nematodes reproduce in host
5. Insect dies and nematodes begin development
Aphid Biocontrol

Predatory Midge
*Aphidoletes aphidimyza:*

• Very mobile, generalist predator
• Adults attracted to aphid honeydew → lays eggs
• Larva kill up to 80 aphids per day
• Kill by paralyzing toxin
• Larva are sneaking up onto their prey, paralyze it, and then suck the aphid dry
• Works best in aphid ‘hot spots’
Aphid Biocontrol
Parasitic Wasps

*Aphidius colemani*
- Good mobile searcher
- Effective against green peach and melon aphids
- Suitable with aphid banker plants

*Aphidius ervi*
- Good mobile searcher
- Effective on potato and foxglove aphids

*Aphelinus abdominalis*
- Effective for potato and foxglove aphids
Banker Plants
Provide Pollen or Alternative Hosts to Increase Beneficial Insect Population

Beneficial insects migrate from banker plant to crop plants to control pests

Crop pests on crop plant

Banker plants infested with alternative host for beneficial insect
1. Plant cereal, keep in insect-proof cage to keep beneficials out. Repeat weekly for steady supply through season.

2. Infest with cereal aphids. Keep covered.

3. Uncover and distribute infested banker plants throughout greenhouse.


5. Don't Spray.

6. Scout for Mummies.
Final Thoughts on Biological Control

• Do your Homework
  – Get good research-based information.
  – Has effectiveness been demonstrated in the field?

• Plan Well in Advance
  – Contact suppliers. Get technical recommendations specific to your system. Compare prices, shipping costs.

• Don’t kill your good bugs!
  – Store and release according to directions. Details are critical!
  – Avoid pesticide impacts (if you have to spray, check compatibility charts, spot treat, time application to avoid direct impact on beneficials
  – Protect them from the elements (heat, cold, rain, etc)
  – Put the good bugs where the pests are!
Shop Smart

The Association of Natural Biocontrol Producers (ANBP)

Guidelines for Purchasing and Using Commercial Natural Enemies and Biopesticides in North America

Lynn M. LeBeck and Norman C. Leppla

Grower Guide: Quality Assurance of Biocontrol Products

Compiled by Rose Buitenhuys, PhD, Research Scientist, Biological Control, Vineland Research and Innovation Centre, 2014

Find resources and suppliers at www.anbp.org
Greenhouse Scout Mobile App

Find it at your favorite app store:
Greenhouse Scout on the App Store on iTunes
Greenhouse Scout—Android Apps on Google Play
For more information contact:
Betsy Lamb, eml38@cornell.edu
If you really need to use a pesticide

• Applicator must have ‘Agricultural Basic’ applicators license unless growing only for self or other household members
• Use must be consistent with Maine Best Management Practices for Pests
• Product must be registered for use in Maine
• Product must be ‘not prohibited’ for use on cannabis by Board of Pesticide regulations
How to Determine if a Pesticide Product Can be Used on Cannabis in Maine

1) Read the product label carefully

2) Use the Pesticide Decision Flow Charts to determine if product can be used
   - Flow Charts dated 1-8-2016 or later must be used (older versions are outdated)
   - Current Flow Charts are at: www.thinkfirstspraylast.org and www.maine.gov/IPM
   - Active and inert ingredients referred to in the Flow Charts are at:

3) Contact ME Board of Pesticides Control (207-287-2731) if have any questions
Important Info About Maine’s Pesticide Regulations

• Pesticides may only be used on cannabis by a person with the proper, valid pesticide applicator’s license

• In Maine, all cannabis must be considered ‘edible’ therefore **any pesticide prohibited on food crops is NOT ALLOWED on any cannabis**.

• Any pesticide used **must not be prohibited for use in a greenhouse** even if it is grown outdoors

• Pesticides may only be used:
  – In accordance with all pesticide regulations,
  – In a manner consistent with the ‘Best Management Practices for Pest Management’ (see [www.maine.gov/ipm](http://www.maine.gov/ipm)), and
  – Worker Protection Standards must be followed.
EcoSmart Organic Fungicide

Is this product OK for use on Cannabis?

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.
• No!
• Specific Use Sites are Listed
• Does not say can be used on ‘any plant’

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.
Can this Product be Used?

Liquid Ladybug V™ is formulated for use on plants in vegetative growth.

- Can be used Daily
- Can be used under Lights
- For all Plants and Food Crops
- Leaves No Residue
- All Natural Ingredients
- Ready to use spray

For Mite Shield information & helpful treatment advice visit:

www.LiquidLadybug.com
Eco Organics
PO Box 202191 • Austin TX 78720
877.596-2727

Liquid Ladybug V™ is exempt from registration with the US Environmental Protection Agency since it qualifies as a minimum risk pesticide under FIFRA section 25(b).

Directions for Use

Shake Bottle Well Before Use.
Spray thoroughly to saturate all plant surfaces. Complete coverage of all plant tissue is necessary for effective control.

Application Instructions:
Spray plants on days 1, 2 and 7 (or daily if desired).

Use a Mite Shield during treatment to prevent re-infestation.

Allow the plant to completely air dry with room fans off after treatment.

Active Ingredients:
Peppermint Oil 0.80%
Rosemary Oil 0.80%
Clove Oil 0.20%
Citric Acid 0.10%
Other Ingredients* 98.10%
Total 100.00%

*Other Ingredients: Water, Soap, Lauric Acid.

Caution: Keep out of eyes. If contacted, flush eyes well with water to remove.

KEEP OUT OF REACH OF CHILDREN

Buyer assumes all responsibility for proper use of this product.

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.
Liquid Ladybug V™ is formulated for use on plants in vegetative growth.
- Can be used Daily
- Can be used under Lights
- For all Plants and Food Crops
- Leaves No Residue
- All Natural Ingredients
- Ready to use spray

For Mite Shield information & helpful treatment advice visit:

www.LiquidLadybug.com
Eco Organics
PO Box 202191 • Austin TX 78720
877.596-2727

Liquid Ladybug V™ is exempt from registration with the US Environmental Protection Agency since it qualifies as a minimum risk pesticide under FIFRA section 25(b).

Extra Strength
All Natural Spider Mite Spray
32 fl oz (1 Qt) 946mL

Directions for Use
Shake Bottle Well Before Use.
Spray thoroughly to saturate all plant surfaces. Complete coverage of all plant tissue is necessary for effective control.

Application Instructions:
Spray plants on days 1, 2 and 7 (or daily if desired).

Use a Mite Shield during treatment to prevent re-infestation.
Allow the plant to completely air dry with room fans off after treatment.

Active Ingredients:
- Peppermint Oil 0.80%
- Rosemary Oil 0.80%
- Clove Oil 0.20%
- Citric Acid 0.10%
- Other Ingredients* 98.10%
Total 100.00%

*Other Ingredients: Water, Soap, Lauric Acid.

Caution: Keep out of eyes. If contacted, flush eyes well with water to remove.

KEEP OUT OF REACH OF CHILDREN
Buyer assumes all responsibility for proper use of this product.
Is this an ‘EPA-Registered’ Product or is it a ‘25-B Exempt’ Product?

Can this product be used?

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.
Yes, it can be used

EPA Reg. No. 1021-1872
Rev. 0515-0715
EPA Est. No. 1021-MN-2
F2905-107MGK

NET CONTENTS
1 GALLON

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.

KEEP OUT OF REACH OF CHILDREN
CAUTION PRECAUCIÓN

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(if you do not understand the label, find someone to explain it to you in detail).

FIRST AID
IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.

CALL A POISON CONTROL CENTER OR DOCTOR FOR TREATMENT ADVICE.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF SWALLOWED: Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
These terms do not prohibit use on cannabis.
Can this Product be Used?

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.

A fungicide for the control of powdery mildew and other diseases on terrestrial and indoor ornamental plants, greenhouse and garden crops, and turf.

ACTIVE INGREDIENT:
Potassium Bicarbonate.......................... 85.00%
OTHER INGREDIENTS......................... 15.00%
TOTAL...................................................... 100.00%

AMR LISTED
For Organic Use

Produce For:
H & I AGRITECH, INC.
95 BROWN RD BOX 1030
ITHACA, NY 14850 -1257

EPA REG. NO. 70870-1
EPA EST. NO. 67187-NY-001

NET 8 oz (227 g)

CAUTION
KEEP OUT OF REACH OF CHILDREN
See inside panel for the First Aid Information.
No! Label lists specific food and ornamental crops. The word 'including' is not here, therefore this product **cannot be used**.
Green Cure®
Fungicide
FOR ORGANIC GARDENING

A fungicide for the control of powdery mildew and other diseases on terrestrial and indoor ornamental plants, greenhouse and garden crops, and turf

Makes up to 16 Gallons of Spray

Produced For:
H & I AGRITECH, INC.
95 BROWN RD BOX 1030
ITHACA, NY 14850 -1257

EPA REG. NO. 70870-1
EPA EST. NO. 67187-NY-001

NET 8 oz (227 g)

ACTIVE INGREDIENT
Potassium Bicarbonate........85.00%
OTHER INGREDIENTS........15.00%
TOTAL........................100.00%

CAUTION
KEEP OUT OF REACH OF CHILDREN
See inside panel for the First Aid Information.
Is this Product a Pesticide? Can it be Used?

NOTE: No endorsement or approval indicated. Products shown for example only. Check with Maine Board Pesticides Control or read product label before using any pesticide.
This product has an EPA Reg. No. indicating that it is an ‘EPA-Registered’ Pesticide. Plant hormones and growth regulators are pesticides.

Yes, it can be used on cannabis – it says ‘including’ therefore is not limited to specific crops.
Resources

• Insect and plant disease help (insects or photos only. Do not bring or send plant material):
  – Cooperative Extension County Offices
  – UM Pest Management Office
    (http://extension.umaine.edu/ipm, 800-287-0279)

• Pesticide questions:
  – ME Board of Pesticides Control (www.thinkfirstspraylast.org, 207-287-2731)

• ‘Best Management Practices for Pests’ questions:
  – ME Department of Agriculture, Conservation and Forestry IPM Program (www.maine.gov/ipm, hillary.peterson@maine.gov)