Successful Pest Management in Organic Vegetable Production

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Conventional Management

Medium to High Chemical Input

- Pest Control
  - Weed Management
    - Pre and Post Emergent Herbicides
  - Insect Management
    - Cultural, Growing Degree Days, Scouting, followed by insecticide spray program
- Disease Management
  - Cultural, Software Modeling, Scouting followed by Fungicide program
IPM Continuum Proactive vs Reactive

Source: ATTR // Biointensive Integrated Pest Management
Integrated Management

Low to No Chemical Inputs, Sustainable, or Organic

• Pest Control
  • “Plant Positive” Start (create ideal conditions for plant growth)

• Weed Management
  • Stale Seed Bed Management, Flame Weeding, Silage Tarps, Cover Crops, Mulches (organic and non-organic), No-Till, Weed Blasting, Cultivation strategies, Transplants, Biological/Non-synthetic Inputs

• Insect Management
  • Plan, ID via Scouting/Monitoring, Plantings Adjusted in Time and Space, Trap Crops, Insect Netting/Row Covers, Biological Control, Biological/OMRI approved spray program

• Disease Management
  • Disease resistant varieties, timed plantings and other cultural strategies, protected cultivation (high tunnels), scouting followed by biological/OMRI approved products
The cast of pest insect characters

- seed and root maggots
- cutworms
- flea beetles
- potato leafhopper
- cabbage worms
- cucumber beetles
- bean leaf beetle
- squash bug
- Colorado potato beetle
- Aphids
- Corn Earworm
- Tomato Hornworm
- Stink Bugs and Plant Bugs
- Two spotted Spider Mites
The slate of IPM tools

- crop rotation
- cover crops
- tillage
- time of planting
- resistant varieties
- interplanting
- mulching
- row covers / exclusion
- irrigation
- OMRI-approved
- Insecticides/fungicides
- Beneficial
- insects/nematodes/bacteria
- hand removal
- culling
### Pest Control

**Insect Management: HAVE A PLAN IN PLACE!**

I wish to emphasize that we use insecticides on our farm not to kill pests but rather to reduce crop damage that have not caused us enough damage to justify an intervention.

#### Solutions to Fight Insect Pests at Les Jardins de la Grelinette

<table>
<thead>
<tr>
<th>Pest Type</th>
<th>Anti-insect netting*</th>
<th>Btk**</th>
<th>Handpicking</th>
<th>Insecticidal soap</th>
<th>Kaolin clay</th>
<th>Orthophosphate</th>
<th>Pyrethrum</th>
<th>Spinosad</th>
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<td>Flea beetle</td>
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*Mesh size must be chosen based on insect size.

**Bacillus thuringiensis var. kurstaki**

* = Preferred solution

O = Also effective

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CHAPTER 10: INSECT PESTS AND DISEASES

extension.illinois.edu
Identification Critical!

• Always the first step!
• Look for other clues:
  • Excreted or secreted
    • Honey dew
    • Frass
    • Fecal
  • Fruit and Foliage Injury
  • Transmitted Disease Symptoms
    • Bacterial wilt
• Illinois Fruit and Vegetable News
  • Pest Reports
Insect ID

- Visual ID, feeding damage, and fecal all on ID’d on a collard plant

Imported Cabbage Worm on Collards
ID Using Egg Clusters

Brown Marmorated Stinkbug

Tomato/Tobacco Hornworm

Squash Bug

Tomato Fruitworm/Corn Earworm

European Corn Borer

Colorado Potato Beetle
Pest Control

Insect Management

- IPM and Monitoring
  - Prevent Conditions that Favor Pests
    - Sanitation and good soil health
    - Planting healthy, fast growing transplants
    - Other proactive cultural, physical, and biological techniques
  - Establish Economic Thresholds
    - Pest population or crop damage level above which additional action is taken
- Monitor Pest Populations
- Take Action
  - Use targeted, least toxic chemical methods
  - Or additional reactive cultural, physical, and biological techniques


Credit: Jon J. Tollefson
Pest Control

Insect Management

• Adjusted Plantings (Cultural)
  • Spatially Rotation
    • High crop density creates less contrast to adjacent fields and can confuse migration of insects
    • Locating dissimilar crops adjacent to each other prevents pest movement at the macro scale
  • Rotating to different areas prevents insects that burrow or hibernate in soil from causing an issue the following year (scale dependent)

http://www.theproductivegarden.com/vegetable-gardens/crop-rotation/
Pest Control

Insect Management

• Adjusted Plantings (Cultural)
  • Temporal Rotation (avoidance)
    • Planting crops at times insect damage will be low
    • Based around insects life cycle or an entire season
    • Tolerance or avoidance strategy
    • Harvesting just before or after life cycle stage of insect becomes a problem for crop
  • Planting early, season extension, and transplanting help this
Pest Control

Insect Management

• Trap Crops (Cultural)
  • Diversion of insects away from primary crop to a preferred host
  • Pest infests trap crop and can then be controlled in a more confined space
  • Could be same species or different
  • Timing is critical so the lure is maximized
    • Trap crop might need time to catch up to primary crop
Pest Control

Insect Management

• Insect Netting/Row Covers (Physical)
  • Provide a physical screen from insects
  • Both pests and beneficials are excluded
  • If pests get under cover, additional control is needed
    • No natural enemies for control
  • Different weights/mesh sizes
  • Should rotate crops and covers to avoid pests that emerge near previous year hosts
Pest Control

Insect Management

• Biological Control
  • Augmentative
    • Release of mass reared beneficial insects to augment native populations
      • Convergent Lady Beetle
      • Parasitic Wasp
      • Lacewings
    • Release when native populations are normally present, just before pests emerge, or after pesticide application
    • Not all meant for permanent establishment
    • Best in confined spaces
      • Greenhouses
    • Can Require replenishment

Parasitic wasp larvae have eaten their fill inside this hornworm caterpillar. They chewed their way out to spin white silk cocoons and pupate, and the caterpillar will soon die. Bad news for the caterpillar, good news for tomato plant growers!
Pest Control

Insect Management

• Biological Control
  • Conservation
    • Providing food, shelter, and habitat to increase number of beneficial insects
    • This can be accomplished through multiple strategies:
      • Hedgerows
      • Insectary Strips
      • Field Borders
      • Wind breaks
      • Pollinator Banks
      • Beetle banks
    • Does require labor for establishment and some management
    • Use only insecticides that minimally affect beneficials
The Xerces Society Guide

Attracting Native Pollinators

Protecting North America’s Bees and Butterflies

Ensure pollination in your garden, orchard, or farm
Identify the flower-visiting insects of your region
Provide host plants and nesting sites for bees and butterflies
Create a landscape that is beautiful, diverse, and pollinator friendly

Foreword by Dr. Marla Spivak

The Xerces Society Guide

Farming with Native Beneficial Insects

Ecological Pest Control Solutions

Identify the beneficial insects controlling pests on your farm
Provide habitat for beneficial insects with hedgerows and buffer strips
Improve crop yields by reducing pest damage

extension.illinois.edu
Pest Control

Insect Management

- Least Toxic Spray Program Options
  - Even OMRI approved/Reduced Risk/Biopesticides need to be used with caution
  - Know how to read labels
    - REI and PHI!
  - Application Methods
  - Used for crop
  - Pesticide applicator training is still useful for applying organic sprays
  - Part of a larger effort to control pests, not a silver bullet
  - Can still kill beneficials and pollinators!

Source: Johnny’s Selected Seeds
Source: http://www.rationalityunleashed.net/pesticides-in-organic-and-conventional-farming/
Sprayers

Chapin Pro Backpack Sprayer

4 gallon capacity, Piston Pump, operate at 90 psi. Better tank cap, gasket, Brass & plastic adjustable nozzle tip included. Belt and shoulder harness, similar design to Solo. Most parts interchange with Solo.

Electric Lawn and Garden Sprayers

All Units Feature:
- 12V Shurflo pump set at 90 PSI
- 15' Hose w/ Teejet spray gun
- Angled swivel nozzle, stream to mist. Connected wire leads with fused switch.

Spray Caddy

Battery-powered unit on 10" wheels. 12V battery and regulated charger that prevents overcharging the battery. A convenient six gallon container that lifts out to fill and clean. Sprays approx 18 gal. per charge. SUP5 $289.00

Portable Sprayer

Yellow blocky tank, same components as spray caddy. Connects to 12 volt battery. Ideal to mount on a garden cart, ATV, etc.

Sup5 15 Gallon $188.00 Sup25 25 Gallon $210.00

Solo Backpack Mist Blower

Backpack Mist Blower
- Ideal for applying plant protection chemicals in small orchards and, or row crops and pasture control in storage areas, containers, or animal feedlots. Creates a fine mist, applying chemicals over large areas more efficiently than spraying.
- Hose control allows easy manipulation to air intake mouth.
- 46's large polyethylene impeller produces high volume air blower. 70 psi reducing flow. 80 psi increasing flow.
- All-weather aluminum blades.
- Long-life pump and impellers reduce wear.
- High pressure delivery is ideal for long row rows.
- Over-exposed to water with Duster Control to reduce drift.
- Designed for electronic ignition, and wide range of calibrated nozzles.

Model: 451
Displacement: 66.5 cc
Electronic Ignition: Yes
Application Range: 38 ft
Weight: 23.8 lbs
Commercial Warranty: 1 year

SOL451 $645.00
Midwest Vegetable Production Guide for Commercial Growers

2015

Illinois
University of Illinois Extension
C1373-15

Indiana
Purdue Extension
ID 56

Iowa
Iowa State University

extension.illinois.edu
RESOURCE GUIDE FOR ORGANIC INSECT AND DISEASE MANAGEMENT

Brian Caldwell
Cornell University

Eric Sideman
Maine Organic Farmers and Gardeners Association

Abby Seaman
New York State Integrated Pest Management Program

Anthony Shelton, Entomology
Cornell University/NYSAES

Christine Smart, Plant Pathology
Cornell University/NYSAES
Controlling plant diseases ...

Avoidance
   By geographic area (climate), planting date, topography and drainage, disease-free planting stock, crop rotations

Exclusion
   By disease-free planting stock, quarantines, exclusion of insect vectors

Eradication
   (Or at least reduction in inoculum) By crop destruction, crop rotation, fumigation or other soil treatments

Protection
   By application of fungicides or bactericides, habitat modification (high tunnels), control of insect vectors

Resistance
   Usually not immunity, slowing disease progress can be adequate

Therapy
   Removal of diseased plant parts
Non-Infectious “diseases”

Blossom End Rot

Sun Scald

Credit: https://flic.kr/p/aacTwx
Pest Control

Disease Management

- Disease Resistant Varieties (cultural)
  - Part of an IPM approach
  - [Link](http://vegetablemdonline.ppath.cornell.edu/Tables/TableList.htm)

- Not immune, but levels of tolerance and resistance
- Keep up to date, varieties and levels of resistance are always changing
- Not a silver bullet, still need to pay attention to fertility, irrigation, etc.
- Evaluate effectiveness for your site
- Open pollinated varieties developed for your site and pest conditions

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What to look for in a catalog

**DISEASES AND PROBLEMS:** To prevent bacterial spot and phytophthora, drip irrigate only, plant only in well-drained soils, minimize soil compaction, follow a 4-year crop rotation. Sunscald is caused by an inadequate foliage canopy. Prevent blossom end rot with adequate soil calcium and regular moisture. Big bushy plants with few peppers can be caused by an excess of nitrogen, hot or cold temperature extremes during the flowering period, tarnished plant bug injury, and choice of late, poorly-adapted varieties.

**BACTERIAL SPOT NOTICE:** Bacterial spot can be seed borne. All Johnny's pepper seed lots are tested for bacterial spot, and we chlorine wash any positive lots. No treatment can insure absolute freedom from disease.

**NOTE:** A disease-free test result does not guarantee a seed lot to be disease-free, only that in the sample tested, the pathogen targeted was not found.

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**Pepper Resistance Codes**

- **(BLS 1-3)** Bacterial Leaf Spot Races 1-3
- **(BLS 1-2)** Bacterial Leaf Spot Races 1-2
- **(PC)** Phytophthora Root Rot
- **(PVY)** Potato Virus Y
- **(TEV)** Tomato Etch Virus
- **(TM 0-2)** Tobamovirus Races 0-2
- **(TM 0-3)** Tobamovirus Races 0-3
- **(TMV)** Tobacco Mosaic Virus

HR: = High Resistance  IR: = Intermediate Resistance
Intermediate Resistant Variety

**Eleonora** – the first basil with intermediate resistance to downy mildew!

**Eleonora (A)** 65 days. 

Intermediate resistance to downy mildew. Slightly cupped to flat, 3” leaves with a somewhat spicier flavor than traditional pesto types. The leaf shape and more open habit make this variety less susceptible to basil downy mildew pressure than typical pesto types. Crop environment should still be managed to reduce conditions favorable to this disease. Select organic seed, non-organic seed, or organic seed with NOP-compliant pelleting.

**3148G Organic OG**

- PKT $4.20; 1/2 Oz. $13.10;
- Oz. $22.95; 1/4 Lb. $59.65;
- Lb. $205.00; 5 Lbs. @ $194.00/Lb.;
- 25 Lbs. @ $188.00/Lb.

**3148 Nonorganic**

- PKT $3.95; 1/2 Oz. $10.90;
- Oz. $19.15; 1/4 Lb. $49.75;
- Lb. $171.35; 5 Lbs. @ $161.87/Lb.;
- 25 Lbs. @ $158.36/Lb.
Pest Control

Disease Management

- Timed Plantings and other Cultural Strategies
  - Seeding or setting transplants out during windows where disease pressure will be minimal.
  - Planting later in warmer soils can avoid soil pathogens in cool soil
- Exclusion and Sanitation
- Plant material and Equipment
- Tilling in inoculum
- Staking and Pruning
- Hot water seed treatment
- Soil Solarization
- Soil Steaming

Sanitation and Airflow

Pruning and Lower Leaves Removed

Reduced pruning = Lack of Air Flow!!!!
Pest Control

Disease Management

• Irrigation Strategies
  • Overhead/Sprinkler
    • Leaf wetness
    • Irrigate in morning
  • Airflow and Spacing
  • Some crops prefer this
  • High Pressure
  • Even wetting

• Drip Irrigation
  • Water delivered right where it is needed
  • No leaf wetness
  • Can interfere with cultivation
  • Used with mulches
  • Low Pressure
Pest Control

Disease Management

• Protected Cultivation

• High Tunnels/Low Tunnels
  • Combine techniques of avoidance and physical protection
  • Plant crops earlier and later to avoid pest windows
    • Plants establish and grow to harvest quicker, before diseases and insects can establish
  • Control irrigation and relative humidity to reduce leaf wetness and disease establishment

• Movable tunnels allow for true spatial crop family rotation

• Minimize leaf moisture diseases
Pest Control

Disease Management

• IPM and Scouting
  • Prevent Conditions that Favor Diseases ( 
    • Sanitation and good soil health
    • Planting healthy, fast growing, disease resistant transplants
    • Other proactive cultural, physical, and biological techniques
  • Scout Disease Symptoms
  • Take Action
    • Use targeted, least toxic chemical/biological methods
    • Or additional reactive cultural, physical, and biological techniques