



Great Lakes Fruit, Vegetable & Farm Market EXPO Michigan Greenhouse Growers EXPO

December 4-6, 2018

DeVos Place Convention Center, Grand Rapids, MI



48 Organic Market Vegetable Production

Where: Grand Gallery A & B

MI Recertification Credits: 2 (COMM CORE, PRIV CORE)

OH Recertification Credits: 0.5 (presentations as marked)

CCA Credits: CM (1) PM (1)

Moderator: Vicki Morrone, Michigan State University

1:00 PM A Sound IPM Program for Organic Production (OH CORE, 0.5 he)

- Lori Hoagland, Purdue University
- Petrus Langenhoven, Purdue University

1:30 PM Build Your Farm Brand Through Organic Environmental Stewardship

- Harriet Behar, University of Wisconsin-Madison

2:00 PM Protecting Your Farm From Pesticide Drift

- Bob Walters, FieldWatch

2:30 PM Farmer Round Table and Taste of Michigan

3:00 PM Session Ends

A sound IPM program for organic production

Liz Maynard and Lori Hoagland
 Dept. of Horticulture and Landscape Architecture
 Purdue University
emaynard@purdue.edu; lhoaglan@purdue.edu

Outline of today's talk

- ❖ What is an IPM program?
- ❖ Why do pest outbreaks occur?
- ❖ Basic strategies for protecting crops from pest outbreaks
- ❖ Importance of soil health in pest outbreaks
 - Example from our research
- ❖ Organic pesticides (*the last resort*)

Integrated pest management (IPM)

- ▶ Broad-based approach that integrates all available pest control techniques to discourage pest populations
- ▶ *Emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control measures*

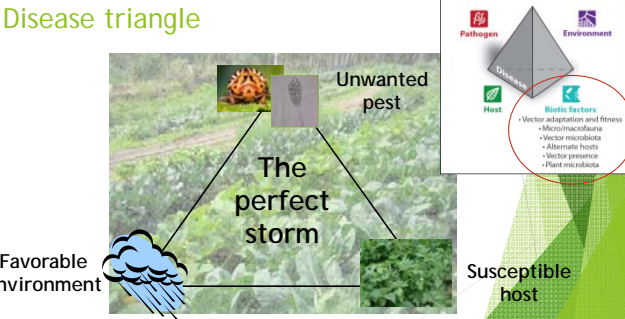
Most important component of an IPM program - *Know what you are dealing with!*

- ▶ Scout fields regularly & positively ID pests



Why do pest outbreaks occur?

Disease triangle




The perfect storm

Unwanted pest

Favorable environment Susceptible host

Biological factors:
 - Vector adaptation and fitness
 - Micro/macrobiana
 - Vector microbiota
 - Alternate hosts
 - Vector presence
 - Plant microbiota



Unwanted pest

The perfect storm

Preventing unwanted pests

- Clean Plant material & equipment
- Physical barriers
- Removing infected plant material
- Crop rotation

"An ounce of prevention is worth a pound of cure"

Starting and staying clean

- ▶ Always plant disease free seeds and transplants
- ▶ Use and keep equipment clean
- ▶ Avoid working fields in the morning when plants are wet



Physical barriers

- ▶ Disrupt pest movement
- ▶ Reduce direct contact between soil and plants



Removing and disposing of infected plant material

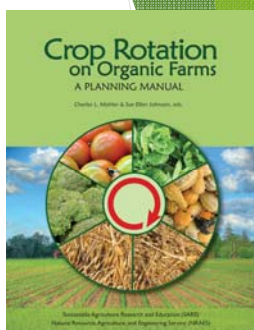
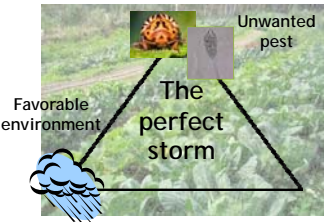
- ❖ Composting diseased plant material
 - efficacy depends on the temperature reached and duration of the process
- ❖ Burying crop residue
 - efficacy depends on the pathogen on the pathogen
- ❖ May want to remove physically remove some plant material from the farm

Ask staff at testing lab or Extension for assistance in how to deal with specific pests



Crop rotation

- ❖ Rotating between families is a good starting point
- ❖ Key points for managing pests
 - how long the pathogen can survive in soil
 - what additional species (including weeds and cover crops) can serve as hosts?
 - how is the pathogen spread

Favorable environment

Unwanted pest

The perfect storm

Making the environment less favorable

- Air-flow
- Chemical and biological deterrents

"An ounce of prevention is worth a pound of cure"

Altering temperature, humidity and leaf wetness

- ▶ Orient crop rows to increase air-flow
- ▶ Increase spacing between plants
- ▶ Use drip irrigation to avoid soil splash and prolonged leaf wetness



<https://articles.extension.org/pages/18332/keys-to-disease-management-in-organic-seed-crops>

Chemical and biological deterrents

Plants that deter pests

TOP 4 PEST-REPELLING PLANTS

CATNIP for aphids, beetles, caterpillars and shield bugs	DILL for aphids, caterpillars, shield bugs and spider mites
MINT for aphids, beetles, caterpillars, shield bugs and spider mites	NASTURTIUM for aphids, beetles, caterpillars and shield bugs

https://www.towergarden.com/blog/read.html/en/2015/5/the_ultimate_guide.html

Plants that attract predators

6 PLANTS that attract beneficial insects

Summer savory Yarrow	Garlic Bighead bug
Chives Green lacewing	Purple loosestrife
Herbs Green lacewing	Yellow nasturtium Shield bug

<https://www.organiclesson.com/plants-for-beneficial-insects/>

The perfect storm

"An ounce of prevention is worth a pound of cure"

Reducing host susceptibility

- Resistant varieties
- Varietal mixtures
- Soil health

Resistant varieties

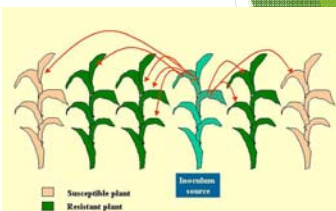
Sylvestra Lettuce Seed

LATIN NAME
Lactuca sativa
DAYS TO MATURITY
52 Days
LIFE CYCLE
Annual
DISEASE RESISTANCE CODES
DM, Nr, LMV



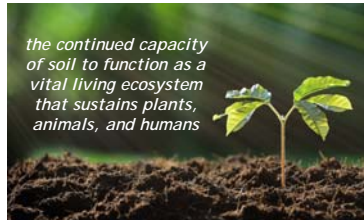
Pest Resistance Codes
DM - Downy Mildew
Nr - Lettuce Leaf Aphid
LMV - Lettuce Mosaic Virus

Varietal mixtures



<http://www.apsnet.org/edcenter/advanced/topics/cultivarmixes/pages/default.aspx>

Soil health



the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans



Soil health and pest outbreaks

- ▶ Soil physical properties (soil tillth)
 - compaction and standing water favor soil-borne pathogens
- ▶ Soil chemical balance
 - over and under application of nutrients, soil pH and accumulation of salts in high tunnels can make plants more susceptible to pests
- ▶ Soil biological activity
 - microbial community can contribute to or reduce pathogen activity



Pest suppressive soil

- ❖ *Suppressive soil*: Pest fails to persist or cause infection despite presence of susceptible host & favorable environment
- ❖ 1st documented in late 1880's with pathogens
- ❖ Since been observed in multiple systems worldwide

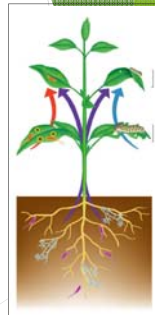


Biological nature of suppression now documented

<http://www.wur.nl/en/show/Role-of-Beneficial-Bacteria-in-Disease-Suppressive-soils.htm>

Mechanisms responsible for pest suppressive soils

- ▶ Competition: *beneficial soil microbes outcompete pests for space and nutrients*
- ▶ Antibiosis: *beneficial soil microbes produce compounds that directly harm pests*
- ▶ Predation and parasitism: *beneficial microbes directly attack or consume pathogens*
- ▶ Induced systemic resistance: *beneficial microbes stimulate and boost a plants immune system*



https://www.researchgate.net/publication/262929979_Induced_Systemic_Resistance_by_Beneficial_Microbes

On-farm organic fertility amendment trial (2013-2015)



Goal and approach:

- ❖ *Objective*: Determine how amendment composition and site-specific soil and environmental factors affect nutrient release and pest severity on organic vegetable farms
- ❖ Repeated applications of four organic fertility amendments were applied on three organic farms over three years
- ❖ A different vegetable crop was grown in each year of the trial



Results

- ▶ Black rot (*Xanthomonas campestris*) severity in cabbage differed among treatments and was correlated with N availability
- ▶ Powdery mildew (several spp.) severity in squash differed among treatments and was correlated with N availability
- ▶ Silverleaf whitefly (*Bemisia argentifolia*) severity in squash differed among treatments and was NOT correlated with N availability (*treatment differences may have been microbially mediated*)
- ▶ Soil in all plots become more suppressive to the soilborne pathogen, *Rhizoctonia solani*, over the three year study regardless of the organic fertility treatment



Black rot (*X. campestris*)



Powdery mildew (multiple spp.)



Silver leaf whitefly (*Bemisia argentifolia*)



Rhizoctonia solani snap bean bioassay

Conclusions from this study

- ▶ Soil factors are intimately tied to plant susceptibility to pathogen and insect pests
- ▶ Ensuring that adequate amounts of nitrogen (N) are available when plants need it, while avoiding excessive application of N, is important for reducing pest outbreaks
- ▶ Management practices that increase soil organic matter and microbial activity have potential to help growers reduce the severity of pathogen outbreaks

General strategies for improving soil health and making soils more pest suppressive

- ▶ Regularly include cover crops in rotation with cash crops whenever possible
- ▶ Rebuild degraded soils by adding high quality, well-aged compost
- ▶ Minimize soil tillage as much as possible
- ▶ Rotate cash crops



Organic pesticides

The last resort



Considerations

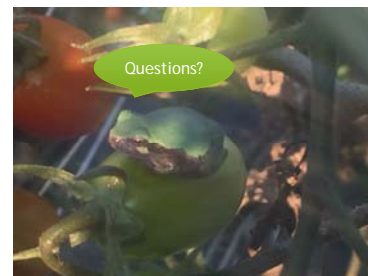
- ▶ Generally act on contact rather than systemic, so must be applied often
- ▶ Frequent applications of copper-based products can negatively impact soil and water quality, and encourage evolution of resistant pest populations
- ▶ Need quality spray equipment to ensure uniform coverage and optimize performance
- ▶ Many of these products can contain live organisms - *must be stored properly and will expire*



Final conclusions and recommendations

- ▶ Effectively managing pests in organic systems requires the integration of multiple approaches
- ▶ Know what your enemies are and prepare accordingly
- ▶ Soil health is an important component of any IPM program
- ▶ Organic pesticides should be used sparingly and managed appropriately to maximize benefits

Thank you for your attention



Build Your Farm Brand Through Organic Environmental Stewardship



Harriet Behar
Outreach Specialist

Organic and Sustainable Cropping Systems Program, U of WI - Madison

Agronomic Crops



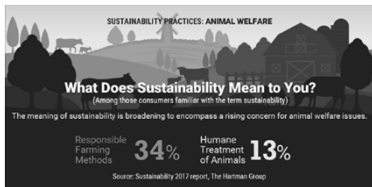
Fruits and Vegetables



Livestock



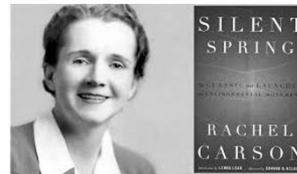
Consumer perceptions of sustainability 83% familiar with the term



“Food is so basic. Everyone must have it, and it impacts everything. So it only makes sense that sustainability has to start with food.”

---Hartman Group (03-13-2018)

Environmental Awareness



1960s- public demand for environmental safeguards
Clean Air Act, Clean Water Act
Federal Commitment to Environmental Stewardship

Environmental Degradation in the News



Plastic in the Oceans
Loss of Coral Reefs



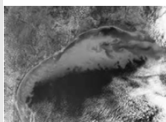
Climate Change
Drought
Floods

Loss of Biodiversity



Organic agriculture can contribute to more than just not hurting the environment, but actually improving it.

- *Dead zone at the base of the Mississippi River, caused by excessive nitrogen runoff, pesticides and herbicides.*
- *Organic farmers do not use herbicides and very few pesticides. Our slow release natural fertility inputs are not as prone to run off as synthetic nitrogen. In addition, our crop rotations with leguminous forages have been shown to reduce N losses by 49-62 percent. (Journal of Environmental Quality, July 2007)*



While organic producers avoid toxic synthetic materials, organic systems represent so much more than just that...

- *Definition of organic from the USDA:*
 - **Organic production- A production system that is managed in accordance with the Act and regulations to respond to site-specific conditions by integrating cultural, biological and mechanical practices that foster cycling of resources, promote ecological balance and conserve biodiversity.**



Conservation Activities

- **Promote biodiversity and sound environmental practices while improving production capabilities on organic farms.**



- *Meet requirement of the National Organic Program regulations to maintain or enhance the natural resources of the operation. These include the **physical, hydrological, and biological features** of a production operation, including **soil, water, wetlands, woodlands, and wildlife.***

Specialty Crops



Planting beneficial insect habitat to attract pollinators as well as predatory insects,

results in higher yields of high quality crops

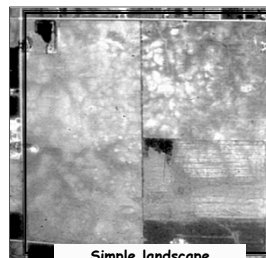
and less use of purchased inputs and labor for pest control.

Systems Approach Instead of Inputs

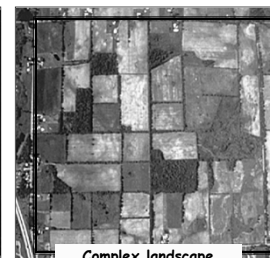
- **Organic farmers rely on a systems based approach starting with soil fertility and plant health, as well as weed, pest and disease control.**



Agricultural Landscapes



Simple landscape



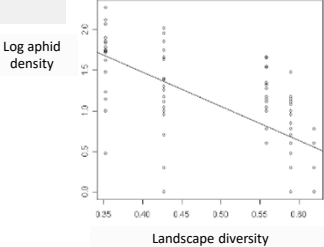


Complex landscape

Ingham Co., Michigan

Complex landscapes with more habitat for beneficial organisms have a direct correlation to lowered pest insect problems.



Relationship between landscape diversity and aphid outbreaks in soybeans

Biological Control of Insect Pests

Conservation biological control:






- Provide nectar and pollen for existing allies.
- Provide overwinter habitat sites.
- Protect habitat from pesticides and tillage.

Flowering alyssum, cilantro and dill attract beneficial insects, and are left standing when adjoining beds are tilled.

Beneficials come in all shapes and sizes and help all types of operations

Publicize what you do on your farm



Your Field Borders and Fallow Areas Provide "Conservation Cover"





You can improve "fallow" areas with more diverse plantings, providing habitat for more species.



Riparian Herbaceous Cover

- Reduces sediment and nutrient runoff
- Provides wildlife cover
- Beneficial insect, reptile, and avian habitat
- Protects field edges from erosion
- Provides recreational opportunities

Restoration and Management of Declining Habitats

Can provide late season forages and grazing if managed properly with staggered harvests (not in nesting season).

- Recreational opportunities
- Land stewardship benefits

Wetland Restoration or Creation Improvement of water quality and provides for wildlife

From a lost corn crop, soil and water quality problems to



Healthy wetland providing wildlife habitat, recreation and water quality protection




Explain your own farm and experience


- The public understands that there are many viewpoints in the media, and they respond well to personal stories and experience.
- Rather than responding to negative comments with a defensive statement, reply with a positive statement explaining the benefits of organic agriculture and the requirements of the organic law. Avoid "tit for tat" type arguments.
- If you have a deeper understanding of an issue, you can specifically address the negative comments, but strive to end with a positive statement.





The human and environmental health benefits of organic production

- Main stream media has positive discussion on organic food production as well as negative.
- TV shows such as Dr. Oz, Books by Michael Pollen, Magazines such as Good Housekeeping, all discuss the benefits of buying and consuming organic foods.
- Refer back to the requirements of the organic law which all organic food sold in the U.S. must follow. **CONSISTENT STANDARD** under the organic label.



- Organic farmers are good land stewards, and strive to protect and enhance their natural resources.
- While many nonorganic farmers also strive to be good stewards, there is no oversight the encourages continual improvement.
- Organic farmers have a yearly visit by an inspector to verify protection of natural resources as well as compliance to all aspects of the organic regulation.

Before





After



Share your success stories with your customers, as well as your long term plans for continual improvement.

Organic agriculture follows the "precautionary principle", which means that a material is not used if long term effects are not clear. Organic farmers do not use GMO seeds.


- The Bt toxin, found in the DNA of many genetically modified corn plants, remains present in the corn stalks and has been found in streams, more than 6 months after harvest.
- Indiana University research finds that this GMO Bt corn harms aquatic insects which results in a disruption of the stream's ecosystem and food chain. Caddisfly larva have high mortality and stunted growth when exposed to Bt corn pollen and crop residues.

Organic agriculture follows the "precautionary principle", which means that we do not use a material if we are unsure of the long term effects.

Organic farmers setup **SYSTEMS** to manage weeds, pests and plant diseases, rather than use of the more toxic pesticides.

Organic regulations promote the use of the tools that nature provides, promoting life and biodiversity.




Organic farmers do not use toxic seed treatments, such as neonicotinoids. Loss of honeybees and other pollinators.

- *These neonicotinoids, which move systemically from the seed coating into the plant, have been identified as a contributing cause to “colony collapse disorder” of honeybees. These neonicotinoids also harm other pollinators as well as aquatic life.*
- *This toxic material is becoming pervasive throughout the Upper Midwest in our streams and lakes.*
- *Instead, organic farmers plant pollinator habitat to encourage beneficial insects to help them with pest control and pollination.*



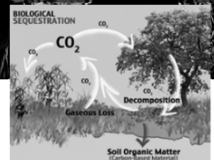
Organic farmers do not use herbicides, which encourages native plants to thrive.

- *The pervasive use of roundup ready crops and the accompanying roundup, has led to a great decrease in milkweeds, and has contributed to the steep decline of monarch butterflies, whose main food source is milkweed.*



Organic Farmers strive to continually improve their soils and sequester carbon

Crop residues Crop residues
 Soil Soil
 20 years of similar tillage intensity
 Different quantity of Carbon inputs



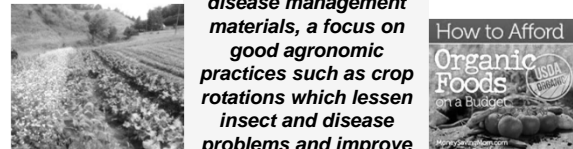
“Why does organic food cost more?”

- Since organic farming relies more on management than synthetic inputs, the cost of this labor drives up the cost of organic foods.
- The tracking and oversight inherent in the organic certification system under the USDA organic law increases cost, but provides trust in the organic label.
- By buying fresh, unprocessed foods, you can afford organic foods. Demographically, organic food buyers tend to be more educated, rather than just in higher income brackets.



Organic Talking Points

Use of naturally based fertility, insect or disease management materials, a focus on good agronomic practices such as crop rotations which lessen insect and disease problems and improve soil fertility while growing crops and protection of natural resources are all mandated by U.S. organic law.




Organic farmers use manure on their crops, making their food more likely to cause illness?

Misconception

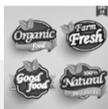
1. Organic vegetable and fruit producers have no other fertility inputs to use other than manure, so there could be manure or pathogen residues on organic food. Nonorganic farmers use synthetic fertilizers which are safer.
2. Organic food processors are not allowed to use soaps and sanitizers, so organic foods are more likely to cause illness.

Response

1. Unlike nonorganic producers, organic farmers have a very strict timeframe between the use of manures and the harvest of organic food. This requirement of 90 or 120 day wait time is verified both on paper and by an organic inspection as part of the organic certification system.
2. Organic food processors are allowed to use sanitizers and soaps, however some with long residual effects that could become part of the organic food are not allowed. Food safety regulations and testing are part of all food production in the U.S.



The natural label guarantees more food purity than the organic label.



Misconception:

1. I hear that the organic label cannot be trusted, and I understand what the word "natural" means.
2. The natural products cost less than the organic ones, but are just as pure, so I buy natural.
3. Sometimes I see the phrase "natural and organic", so that means that all natural products are also organic.

Organic or Natural? What's the difference?

INGREDIENT/PROCESSING	ORGANIC	NATURAL	CONVENTIONAL
Artificial flavors	NEVER	No	May be used
Artificial colors	NEVER	No	May be used
Artificial preservatives	NEVER	No	May be used
Artificial fertilizers	NEVER	May be used	May be used
Artificial pesticides	NEVER	May be used	May be used
Irradiation	NEVER	May be used	May be used
Genetically Engineered Ingredients	NEVER	May be used	May be used

Organic Farming Can Lead to a Brighter Future

- Beginning farmers are attracted to the system of organic production and these young people are attracted to organics as a career.
- Organic farmers are continually developing new and effective methods for crop production, using their knowledge of the natural world, such as release of predatory insects to control pest insects.
- Increases in crop production yields are the result of hybrid seed breeding, which is a technology used by organic farmers.



Are organic foods healthier?



- A few studies do show that organic foods have higher levels of antioxidants, phenols and omega three fatty acids.
- Organic dairy and beef animals must graze during the pasturing season, and it is shown that these grass fed animals have higher levels of omega 3 and CLAs.
- Organic crop farmers strive to "feed the soil" and balance micronutrients which in turn provides more nutrition for their crops to absorb and results in higher levels of food nutrients.

- Many people do say that they can taste the difference between organic and nonorganic foods, with particular crops such as strawberries, carrots and others that have more distinctive flavor grown on nutrient dense soils.



Do organic farmers use any pesticides?



Bug vacuum

- The organic law mandates that before an organic grower can use an approved synthetic, they must try cultural, biological or mechanical pest control methods first, natural products second and as a last resort, the approved synthetic.
- All inputs approved for use in organic production go through a rigorous review process before they are allowed.
- This process considers negative environmental impact in the products manufacture, use and disposal.

Dirty Dozen- Environmental Working Group
<http://www.ewg.org>

Dirty Dozen Plus

1. Apples
2. Strawberries
3. Grapes
4. Celery
5. Peaches
6. Spinach
7. Sweet Bell Peppers
8. Nectarines - Imported
9. Cucumbers
10. Cherry Tomatoes
11. Snap Peas - Imported
12. Potatoes
13. Hot Peppers
14. Kale/collard greens

Clean Fifteen

1. Avocados
2. Sweet Corn
3. Pineapples
4. Cabbage
5. Sweet Peas - Frozen
6. Onions
7. Asparagus
8. Mangoes
9. Papayas
10. Kiwi
11. Eggplant
12. Grapefruit
13. Cantaloupe
14. Cauliflower
15. Sweet Potatoes

Dirty Dozen List of Endocrine Disruptors*

1. BPA
2. Dioxin
3. Atrazine
4. Phthalates
5. Perchlorate
6. Fire retardants
7. Lead
8. Arsenic
9. Mercury
10. Perfluorinated chemicals (PFCs)
11. Organophosphate pesticides
12. Glycol Ethers