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Integrated pest management resources at MSU

Beginning Farmer Webinars, 2015
Erin Lizotte, MSU Extension

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Erin Lizotte
Statewide Integrated Pest Management Educator, Commercial Agriculture

Phone (231)944-6504
Email taylo548@msu.edu

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Overview

- The history of IPM
- The tenants of IPM
- Scouting
- Pesticides
- Beneficial insects
- IPM resources at MSU

Lacewing egg. E Lizotte

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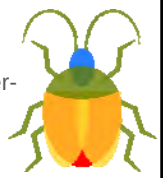
It's all a big competition

- Humans have been in competition with pests since the beginning of our ancestral history
- Competition with pests for food has grown as we moved from being hunter-gatherers to cultivating crops and keeping livestock (16,000 years ago)
- As crop/livestock densities increased, so did pest pressure
- Early pest control was mechanical



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Early pest control

- Documented in 2500 BC, sulfur
- Egyptians used oils and arsenic control insects 2,000 years ago
- AD 307, biological control in citrus was documented in China
- Soap-based insecticides arrived in 1100 AD
- Insecticidal plant extracts (including nicotine) were used in Europe 400 years ago

Pesticide development

- 1865 Paris green (cupric acetoarsenite) was developed and controlled Colorado potato beetle
- Lead arsenate
- 1939 DDT
- Organic compounds
- Highly effective

Retroarama.com

Heavy reliance on pesticides

- Resistance
- Residue
- Effects on natural enemies
- Emergence of new pests
- Non target issues

The tipping point

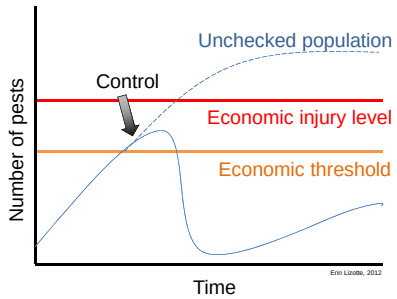

Dr. Rachel Carson

- '62 publication of Silent Spring
- '70 EPA formed
- '71 Federal Insecticide, Fungicide and Rodenticide Act
- '72 DDT banned
- '72 Nixon makes IPM national policy

What is IPM?

"a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks"

Decision to treat based on economics



Today IPM is a comprehensive program

- Knowledge and information intensive
- Multidisciplinary
- Focused on multiple tactics
- Cognizant that 100% control is rarely economically necessary or possible
- Based on the concept that cropping systems and pests are not static
- Applicable to commercial agriculture, home gardens, urban horticulture, homes, schools, public buildings
- Encompasses insects, pathogens, weeds, and vertebrate pests


Oblique-banded leafroller larva. E. Lizotte

Limitations of IPM

Some reasons for not having an effective IPM program include:

1. No IPM program to implement
2. No thresholds
3. No experts
4. Resistance to pesticides
5. Invasive species

These are knowledge limitations and can be resolved over time with resources.

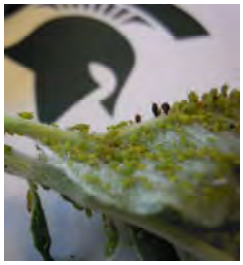
IPM Adoption

- IPM programs occur along a spectrum from largely conventional strategies including protectant pesticide applications all the way to biologically-based and intensive strategies
- IPM is not limited to biodynamic producers but includes conventional, organic and biodynamic producers as well as everyone in-between
- The practice of IPM is site-specific, crop specific and dependent on environmental factors

All IPM programs should follow the tenants of IPM

Tenants of IPM (PAMS)

- **P**revention
- **A**voidance
- **M**onitoring
- **S**uppression



Green apple aphid. E. Lizotte

Prevention: exclusion of a pest population from a field or site

Howard F. Schwartz, Colorado State University, Bugwood.org

- pest-free seeds and transplants
- preventing weeds from reproducing
- irrigation scheduling to avoid situations conducive to disease development
- cleaning tillage and harvesting equipment between fields or operations
- eliminating alternate hosts

Avoidance: when pest populations exist in a field or site but the impact of the pest on the crop can be avoided through some cultural practice

- crop rotation
- choosing cultivars with genetic resistance to pests
- using trap crops or pheromone traps
- choosing cultivars with maturity dates that allow harvest before pest populations develop

Wine grapes planted in sandy soil on hill top. E. Lizotte

Avoidance

- fertilization programs to promote rapid crop development
- not planting areas where pest populations are likely to occur

Avoidance

- Start transplants in pathogen free soil
- Sanitation: remove diseased material

Workers in a nursery

Monitoring

- Scouting and trapping for pests regularly
- Correct identification of pests
- Weather monitoring
- Soil and tissue nutrient testing where appropriate
- Records should be kept of pest incidence and distribution for each field or site

Scouting boards. J. O'Donnell

Suppression: control of pests as needed

- Suppression may become necessary to avoid economic loss
  - Cultural suppression
    - No-till, mulching, cultivation
  - Physical suppression
    - Row covers, pruning, trunk guards
  - Biological suppression
    - Mating disruption, natural enemy conservation
  - Chemical suppression
    - Pesticide application

Suppression with pesticides

- Considerations
  - Economics
  - Consider non-target impacts
  - Resistance management

Successful IPM Practitioners…

- Understand pest life cycles, epidemiology, ecology
- Evaluate the range of pests to be controlled
- Utilize all available tools
- Consider economic constraints
- Technology dependent
- Consider ecosystem scale

Borer pupal casing. E. Lizotte

Scouting

Scouting

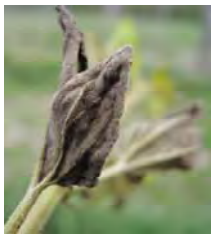
- Scouting involves monitoring the crop and cropping area for insects, diseases and abiotic issues
- Scouting should begin as soon as plants begin to grow or pests become active and should continue until the crop is dormant or the risk of the pest has passed

Scouting

- Scouting is a critical step in quantifying the potential damage that can be caused by a pest
- Aids in determining if intervention to control the pest is warranted
- Identifies the present life stage of the insect or disease which is often critical to the proper selection and timing of management strategies
- Assists in determining the efficacy of a management strategy (farmer scientists)

Scouting

- Scouting for diseases includes monitoring the crop for signs and symptoms of disease



Scouting

- Scouting for insects includes looking for all life stages and attempting to quantify the population
- May also include inspecting for crop damage and setting traps to collect them

Scouting tools

- Hand lens for inspecting for small insects, mites, insect eggs or feeding damage
- Traps of various forms
- A beating tray or scouting board
- A sweep net
- A knife, shovel and pruners
- Containers for collecting samples
- A small cooler
- A camera for taking pictures
- Reference material for helping identify pests

Yellow sticky trap. E. Lizotte

Scouting protocol

- Section your farm off into manageable portions based on location, size and crop or variety and scout them separately
  - It's easier to deal with blocks that are 10 acres or smaller and that contain plants of the same variety, age and spacing—it's also often how we make management decisions
- If degree day tools or biological information are available to predict the emergence or arrival of certain pests, use them to gauge when you might scout more intensively

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Seasonal Primary Pest Occurrence in Michigan Hopyards

	Date	April				May				June				July				August				September			
		7	14	21	23	27	1	8	15	22	29	7	17	21	28	4	11	18	25	1	8	15	22	29	5	12	19	26
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	Growth stage[2]	Dormant				Bline emergence				Vegetative growth			Sidearm formation				Burr stage			Cone development and maturation				Harvest			
Pest	Pest lifestage																											
Downy mildew	Systemic infection	Begin treatment at 6"																										
	Secondary infection	Continue treatments on a 7-14 day schedule up until harvest																										
Two-spotted	Overwintering females					Monitor for activity as temps warm																						
	Eggs and mottles	Monitor populations of eggs and mottles weekly, treat as needed																										
Potato leafhopper	Arrive on spring storms							Scout carefully following spring storms																				
	Eggs, nymphs and adults							First generation egg laying								Eggs, nymphs and adults may be present at this time, treat as needed												
Rose chafer	Adult beetles												Beetles present, treat as needed															
Japanese beetle	Adult beetles															Beetles present, treat as needed												

1. Degree day accumulation based on 5-year average at the Fremont Enviroweather Station.
2. Growth stage is highly dependent on location, annual weather fluctuations and cultivar, this table is meant as a guide to estimate pest activity in Michigan.

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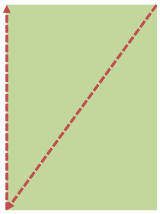
General scouting protocol

- Walk a transect and edge when scouting to ensure you view plants from both the edge and inner portion of the block
- Change the path you walk each time you scout to inspect new areas
- Revisit problem areas
- Make up a scouting sheet and keep good records



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Wait-- What am I looking for?

- One of the hardest things to learn about scouting is how to pick up on the visual cues that something is wrong with the plant
- Consider the following as a starting point:
  - Cupped, chlorotic, spotted or malformed foliage
  - Discolored, damaged, swollen or sunken areas of bark
  - A large number of insects
  - Pockets of less vigorous or dying plants
  - **Anything out of the ordinary**

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Consider the weather

- One of the greatest allies a grower can utilize to be an effective scout and pest manager is historical and forecast weather data
- This information can inform you of when to intensify your scouting for certain pests and disease, when to apply a pesticide to optimize treatment and when the ideal conditions might occur to apply a spray

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Trapping

- Spore traps
- Pheromone traps
- Baited traps
- Passive traps
- Visual trap

Clean and check traps regularly. Use according to recommended university and manufacturer guidelines.

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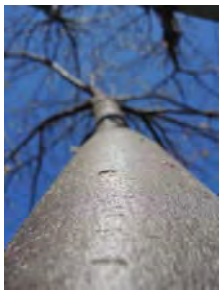
The benefits of trapping

- Detect presence earlier
- Quantify pressure
- Optimize management strategy timing
- Indicate treatment efficacy

Cherry fruit fly on yellow sticky trap. E. Lizotte

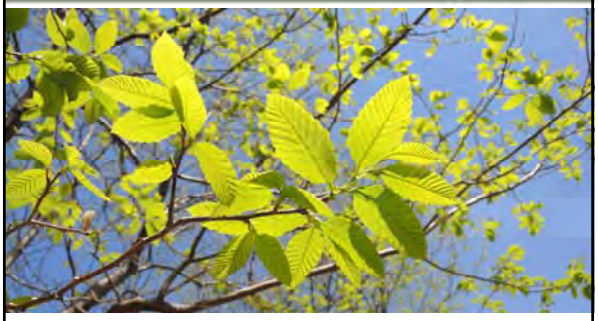
Scouting

- Growers should keep records of their scouting, including maps of their fields, a record of sampling and pest pressure, as well as the control measures utilized



IPM supplies

- Great Lakes IPM
- Ben Meadows Company
- Forestry Suppliers
- Gardener's Supply
- Insects Limited
- Gaylord Brothers
- University Products
- Gempler's
- Peaceful Valley Farm Supply
- Trece Incorporated
- IPM Laboratories



Pesticides resources and considerations

Management considerations and IPM

- Necessity of application
- Resistance management
- Outcomes of application

Necessity of application

Consider the following before making a treatment:

- Does the treatment make economic sense?
  - Are plants small or well established?
  - Are plants healthy and thriving or struggling?
  - What is the Cost-benefit ratio?

Necessity of application

- What is the historical pest pressure on this site?
  - Sometimes we make decisions based on history and not current conditions
- Use your grower experience, it is your BEST tool.

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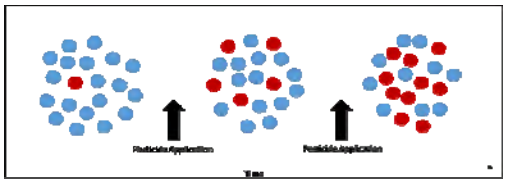
Resistance considerations

What is pesticide resistance?

Pesticide resistance describes the decreased susceptibility of a pest population to a pesticide that was previously effective at controlling the pest.



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Factors that affect resistance

- Use of similar modes of action
- Frequency of applications
- Persistence of the chemical
- Pest's rate of reproduction and number of offspring

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Managing Pesticide Resistance

- Don't make successive applications of the same pesticide
- Don't make successive applications of the same mode of action
- Follow label directions for resistance management
- Use tank mixes with multisite partners
- Recognize signs of pest resistance, sudden or gradual loss of control

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Fungicides labeled for use on hop in Michigan, 2016

	Active ingredient (FRAC code[1])	Trade name	Diseases listed on label[2]	REI/PHI[3]
Single site	cyazofamid (21)	Ran Man, Ran Man 400 SC	DM	12h/3d
	cymoxanil (27)	Curzate 60 DF	DM	12h/7d
	mefenoxam (4)	Ridomil Gold SL, Ultra Flourish	DM	48h/45d
	metalaxyl (4)	MetaStar 2E, Metalaxyl 2E Ag	DM	48h/45d
	myclobutanil (3)	Rally 40 WSP	PM	24h/14d
	quinoxyfen (13)	Quintec	PM	12h/21d
	spiroxamine (5)	Aztrue	PM	12h/7d
	tebuconazole (3)	Mosoon, Onset 3.6 L, Orius 3.6 F, Solera tebuconazole 3.6 F, Teb 3.6 SC, Tebustar 3.6 F, Tebu-Crop 3.6 F, Tebucon 3.6 F, Tebustar 3.6 L, Tebuzole 3.6 F, Toledo 3.6 F	PM	12h/14d
	trifloxystrobin (11)	Flint	PM	12h/14d
	triflumizole (3)	Procure 480 SC	PM	12h/7d
Multi-site	basic copper sulfate (M1)	Agristar Basic Copper 53*, Basic Copper HB, C-O-C-S WDG, Cuprofix-Ultra 40 Disperss, Cuprosat, Mastercop	DM	48h/24d
	copper octanoate (M1)	Cueva*	Anthracnose, DM, PM, cercospora leafspot	4h/0d
	copper diammonia diacetate complex (M1)	Copper-Count-N	DM	48h/24d
	copper hydroxide (M1)	Champ DP Dry Prill, Camp Ion, Champ Formula 2 Flowable, Champ WG*, Champion++, Kentan DF, Kocide 2000, Kocide 3000, Kocide-DF, Nu-Cop 3L, Nu-Cop 50 DF*, Nu COP 50 WP*, Nu-Cop HB*	DM	48h/24d
	copper oxychloride + copper hydroxide (M1)	Badge SC, Badge X2*	DM	48h/24d
	cuprous oxide (M1)	Nordox 75 WG*	DM	12h/-
	dimethomorph (40)	Forum	DM	12h/7d
	mandipropamid (40)	Revus	DM	4h/7d
	metrafenone (U8)	Vivando	PM	12h/3d
	sulfur (M2)	Cosavet DF*, Cosavet DF Edge*, Microfine Sulfur*, Thiolux*	PM	12h/7d
Pyrenx	boscalid (7) pyraclostrobin (11)	Pristine	DM, PM	12h/14d
	famoxadone (11) + cymoxanil (27)	Tanos	DM	12h/7d
	tebuconazole (3) + sulfur (M2)	Unicorn		/14d
Post-infection inducers	fosetyl-Al (33)	Aliette WDG, Linebacker WDG	DM	12h/24d
	phosphorous acid, mono & di-potassium salts (33)	Agri-Fos, Confine Extra, K-Phite, K-Phite 7LP Ag, Phiticide, Phostrol	DM	4h/0d
	potassium phosphite (33)	Foxphite, Fungi-Phite, Prophyt, Rampart	DM	4h/0d
	Bacillus amyloliquefaciens strain			

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Outcomes of application

- Consider the outcomes before making a treatment:
  - Can this application control more than one target pest?
  - How should I position my applications to optimize control and minimize use?

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Outcomes of application

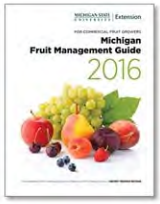
- How will beneficial insects, particularly predatory mites be affected?
- Are there implications for pollinators?
  - How can I mitigate negative effects?

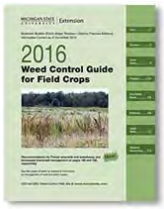
Pest management considerations for new growers

- Get your pesticide applicators license-organic producers too
- Consider the pros ad cons of production systems
- You should have a tractor and sprayer on farm before planting
- Carefully select cultivars—consider not just the market but the challenge of pest management
- Consider ordering a few plants or seeds from prospective suppliers and check the quality and cleanliness before committing to a large order

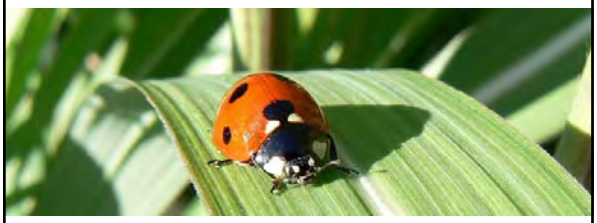
Utilizing all the information we have at our disposal regarding pesticides and pests can help in making educated management decisions that optimize the environmental and economic components of our production systems

Registered pesticides resources





Greenbook.net, cdms.com



Hot topic! Beneficial insects

Good bugs?

- Beneficials include a number of species of insects that perform valued services like **pollination** and **pest control**
- In farming and agriculture, where the goal is to raise selected crops, insects that hinder the production process are classified as pests, while insects that assist production are considered beneficial

Praying mantis in a Christmas tree plantation. E. Lizotte

Natural enemies-the good guys!

As research into natural enemies continues, our understanding of the importance of these partners continues to grow

Lady beetle feeding on aphids. D. Landis, MSU

Insect predators and parasites, known as natural enemies, can control pest populations in agricultural crops and landscapes

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Common Natural Enemies

Braconid wasps-Parasitoid

- Parasitize larvae of beetles, caterpillars, flies and sawflies
- Adults usually are less than ½ inch long with an abdomen that is slender and longer than the head and thorax combined

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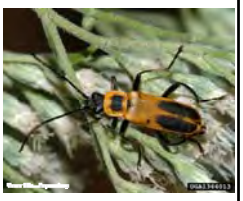
Common Natural Enemies

Soldier beetle-Predator

- Adults of some species feed on nectar and pollen, other adults eat aphids, insect eggs and larvae or feed on both flowers and insects
- Larvae are dark, flattened and elongate, and feed in soil, leaf litter or under bark, primarily on eggs and larvae of beetles, butterflies, and moths



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Common Natural Enemies

Green Lacewing-Predator

- Adults of many species are not predaceous
- Predaceous larvae have long, curved mandibles that they use to pierce and suck the fluids out of their prey
- The larvae are about 1/8 inch long, look like tiny alligators, and prey on most small soft bodied insects, often pale with dark markings
- Eggs are laid on individual silken stalks

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Common Natural Enemies

Lady Beetles-Predator

- Most adults and larvae feed on soft-bodied insects
- These may be important in aphid population control
- Adults are rounded, and range in size from tiny to medium-sized (about ¼ inch long), color ranges from black to brightly colored
- Larvae are active and elongate with long legs, and look like tiny alligators

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Common Natural Enemies

Crab spiders-Predator

- Crab spiders stalk and capture insects resting on surfaces or walking, they do not spin webs
- The front two pairs of legs are enlarged and extend to the side of their body, giving them a crablike appearance
- Over 200 species in North America

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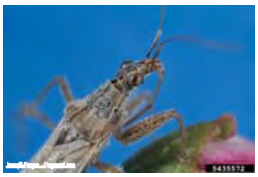
Common Natural Enemies

Damsel bugs-Predator

- These bugs prey on aphids, leafhoppers, mites, caterpillars, and other insects
- Most often yellowish, gray or dull brown, they are a little over ¼ inch long
- Slender insects with an elongated head and long antennae



Common Natural Enemies

Predatory mites

- Predatory mites are often translucent, larger than pest mites and move at a much faster speed across the leaf surface
- Predatory mites play an important role in balancing the pest mite populations and should be protected when possible

Attracting Natural Enemies

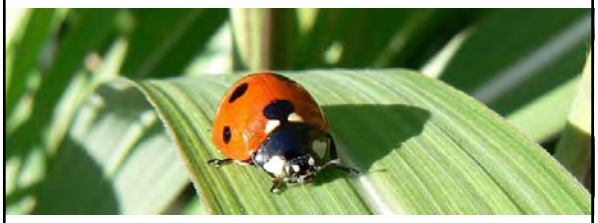
- Natural enemies are more likely to thrive in undisturbed areas that provide overwintering habitat, flowers to support their survival and reproduction, and refuge from pesticide applications in crops
- Natural enemies may be conserved with the same plantings that support pollinators

www.nativeplants.msu.edu

Resources for beneficial insects

- MSU Native Plants Website: **www.nativeplants.msu.edu**
- Identifying Natural Enemies in Crops and Landscapes, MSU Bulletin, MSUE Bookstore Online

E2985 and E2973



IPM Resources at MSU

Resource overview

- Enviroweather
- MSUE news and linked resources
- IPM website and associated pages
- Diagnostics lab
- Soil and nutrient testing

Real-time information

Enviroweather is a weather-based information system to help make pest, production and resource management decisions

Enviroweather disease modeling

Enviroweather insect modeling

Enviroweather irrigation scheduling

Enviroweather

- Access the MSU Agricultural Weather Office Forecasts
- Look up historical weather data and compare across years
- Reference for record keeping (wind speed, directions, temperature)

Information portal- msue.msu.edu

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MSUE Ag page

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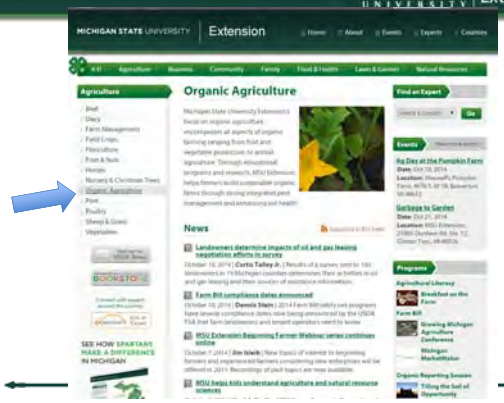

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MSUE News

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Receive customized MSUE News Digests!

- **Pest Management**
- Turf
- Water Usage
- Energy
- Fisheries & Wildlife
- Forestry
- Green Energy
- **Invasive Species**
- Lakes, Streams & Watersheds
- Water Quality
- Pork Production
- Poultry Production
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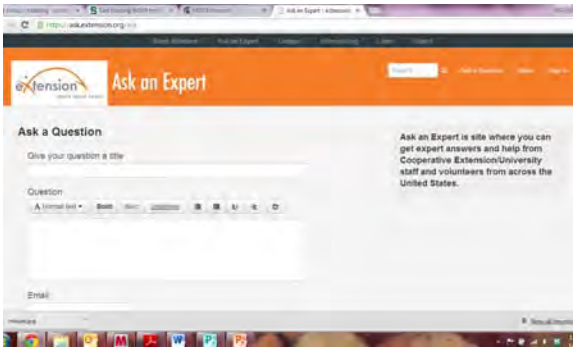

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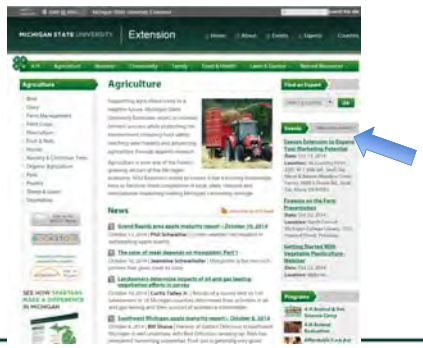

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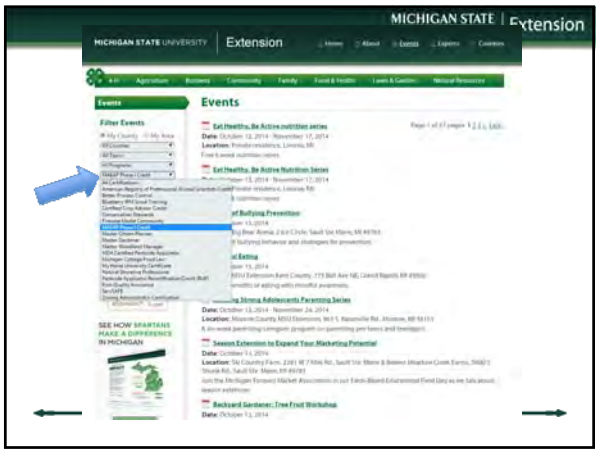
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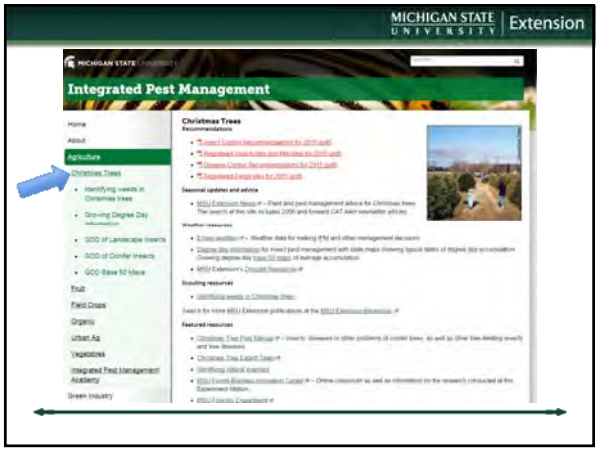
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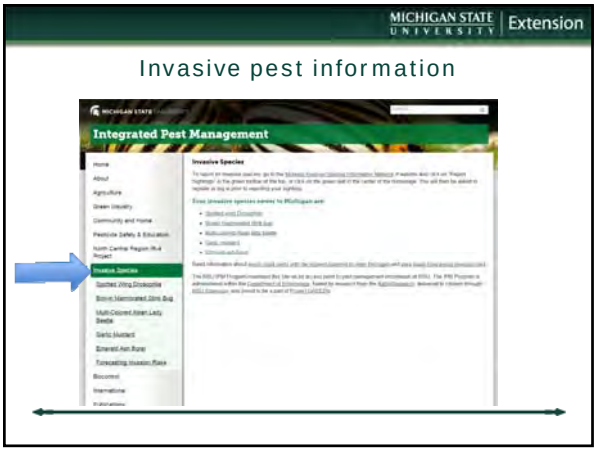
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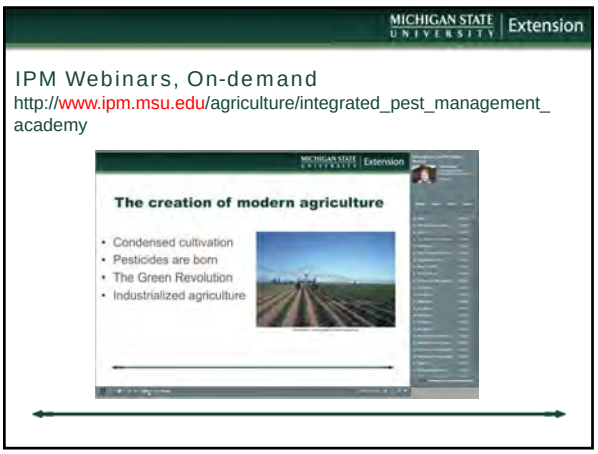
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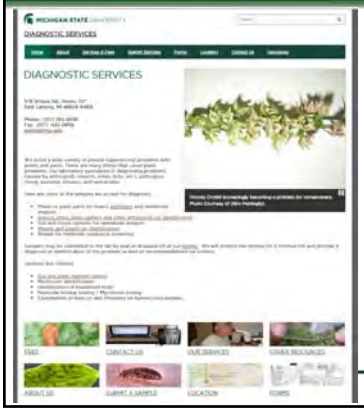

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Identifying IPM resources

Thanks

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