

The Maine IPM Toolbox

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My goals with this presentation & document

- **Broadly introduce integrated pest management concepts**
- **For each IPM Concept provide:**
 - Context & Background
 - Toolbox “Shopping List”
 - Resources Available in Maine
 - Resources Available Online
- **The PDF of this presentation is available freely online with clickable links to use as a guidebook**



What is integrated pest management?

Identification

- Proper identification of pest
- Understanding the system where the pest exists

Prevention, Cultural & Mechanical Control

- Prevent and control through physical means
- Set your location up for success

Monitoring & Recordkeeping

- Monitor in a tracked and systematic way
- Make it useful for the future!

Action Thresholds

- What is the population level?
- What methods are needed at this level?

Biological and Pesticide Control

- Dynamic and flexible as methods change

IPM is the standard, and many institutions are involved

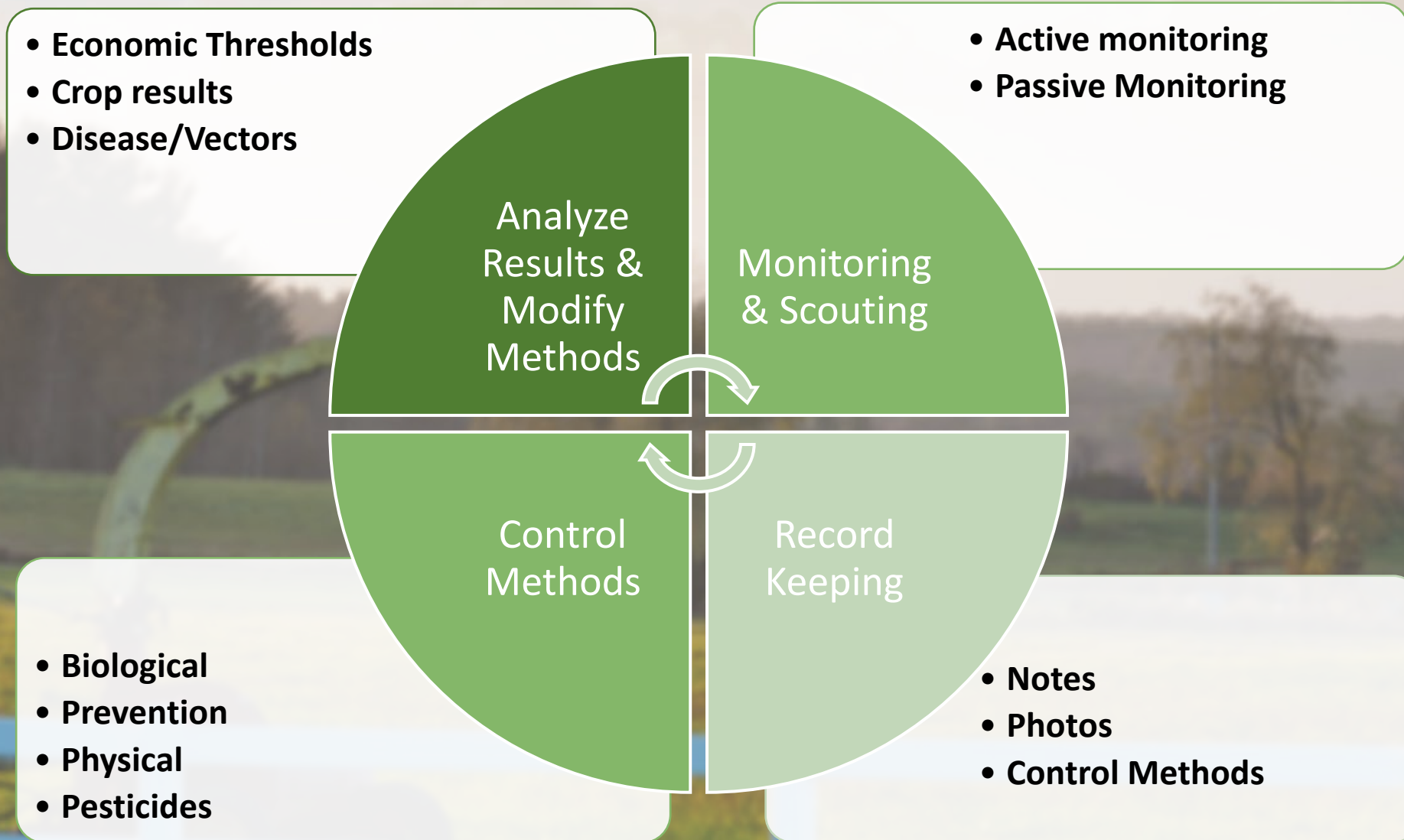


MAINE DEPARTMENT OF
**AGRICULTURE
CONSERVATION
& FORESTRY**



THE UNIVERSITY OF
MAINE
Cooperative Extension

The IPM Cycle



IPM is an Ever-Evolving System – Internally and Externally!

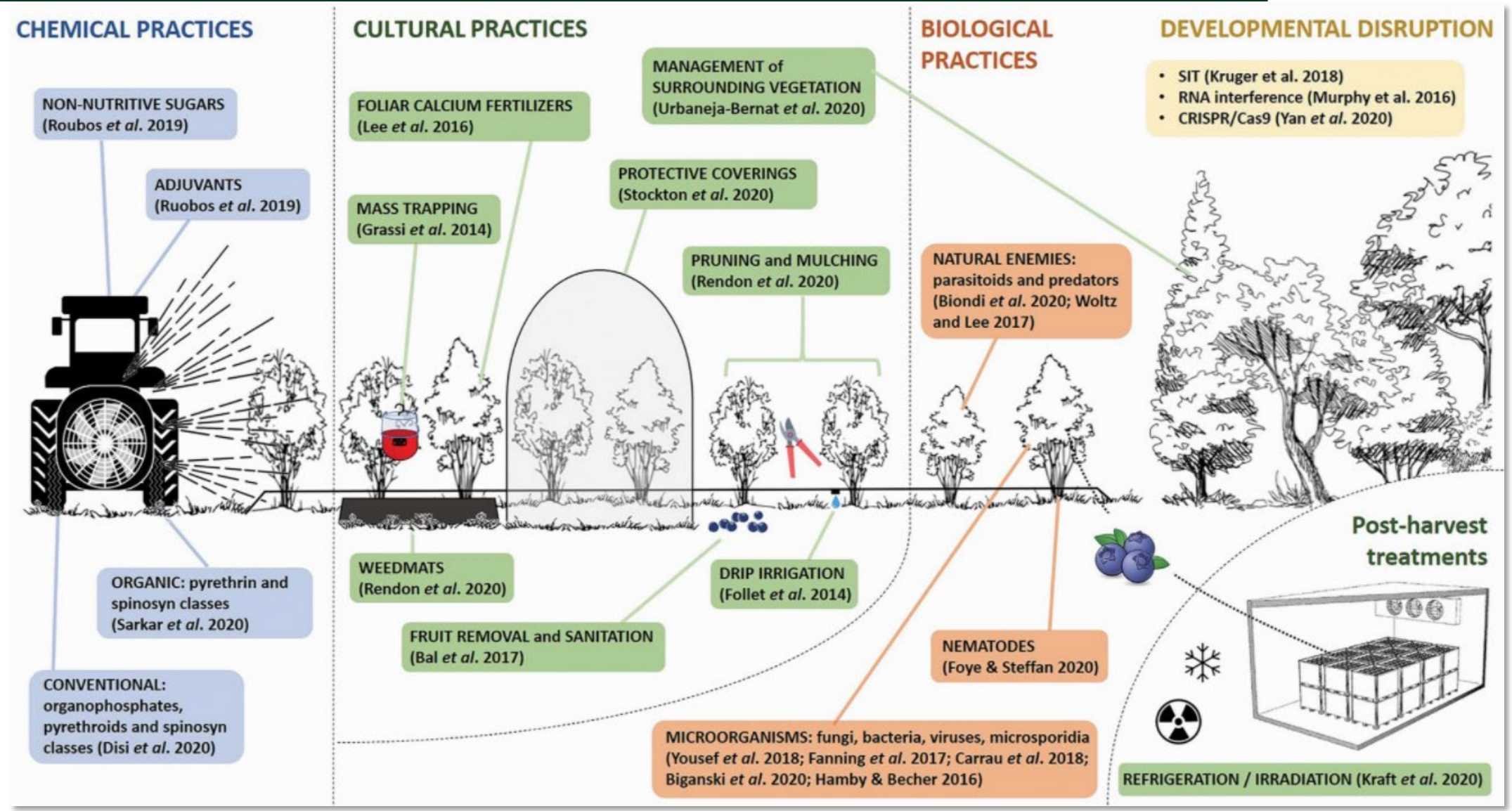


Figure: Tait *et al.* 2021 (Open Access Review Paper)

What is a pest?



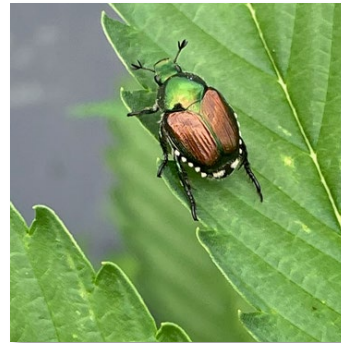
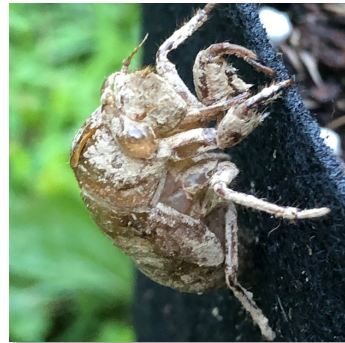
Beneficial

Neutral

Incidental Pests

Low Damage

High Damage



Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

Pests, Pathogens, and Friends, oh my!

Fungal Pathogens



Viral Pathogens



Abiotic Diseases & Problems



Invertebrate Pests



Vertebrate Pests



Weeds



Pests, Pathogens, and Friends, oh my!

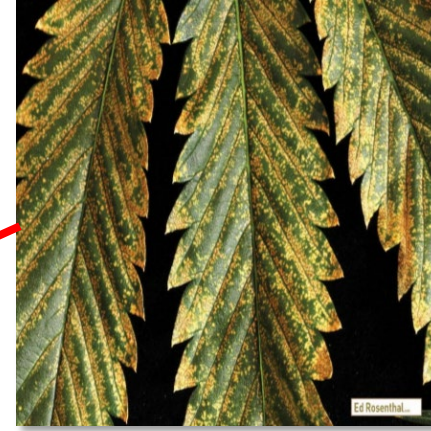
Fungal Pathogens



Viral Pathogens



Abiotic Diseases & Problems



Invertebrate Pests



Vertebrate Pests



Weeds



Pests, Pathogens, and Friends, oh my!

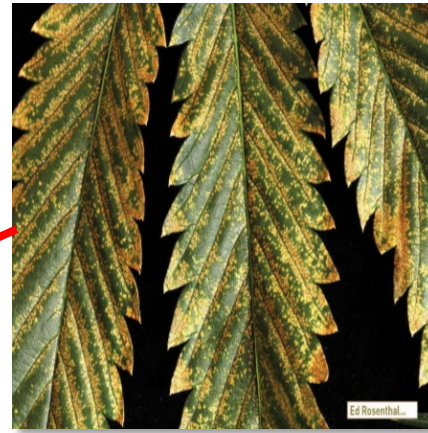
Fungal Pathogens



Viral Pathogens



Abiotic Diseases & Problems



Hemp Grower?

Learn More Here:

[2022 Ag Trades
Presentation Maine
Hemp IPM](#)

Invertebrate Pests



Vertebrate Pests



Weeds



INTERNET SEARCHES: a tool you need to know how to use properly



- The first few links are likely to be ads
- Careful trusting information written by those will profit from it (pest control companies, big box stores)
- Just because a website claims to be “natural” or “earth friendly”, information needs to be backed by research (references and citations)

INTERNET SEARCHES: a tool you need to know how to use properly



- Generally, better resources can be found under **.edu** and **.gov**
- Writing the question in a different way can help (instead of “kill rats”, search for “rat prevention” or “rodent IPM”)



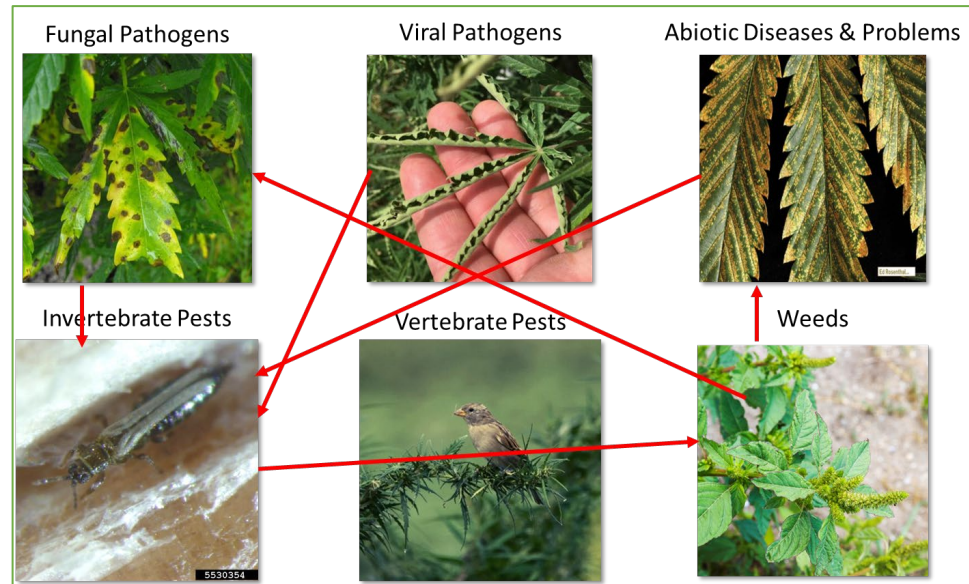
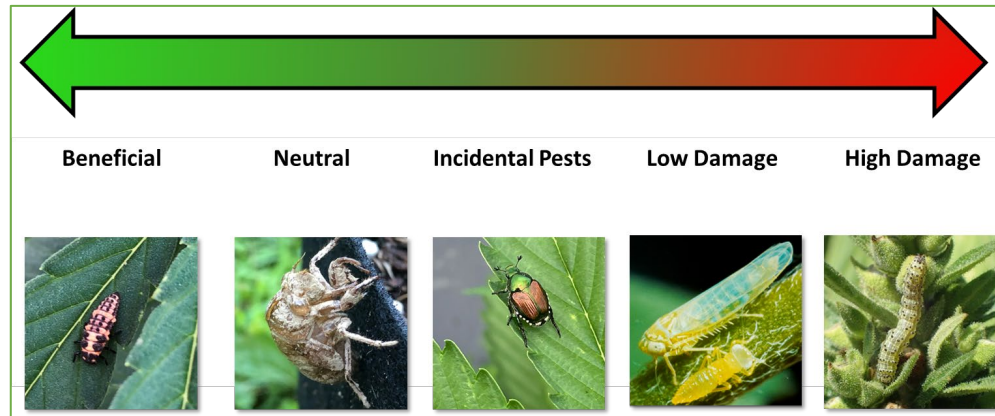
Identification

Identification: Overview & Considerations



Without proper identification, you cannot understand the organism or problem you are having with your crop.

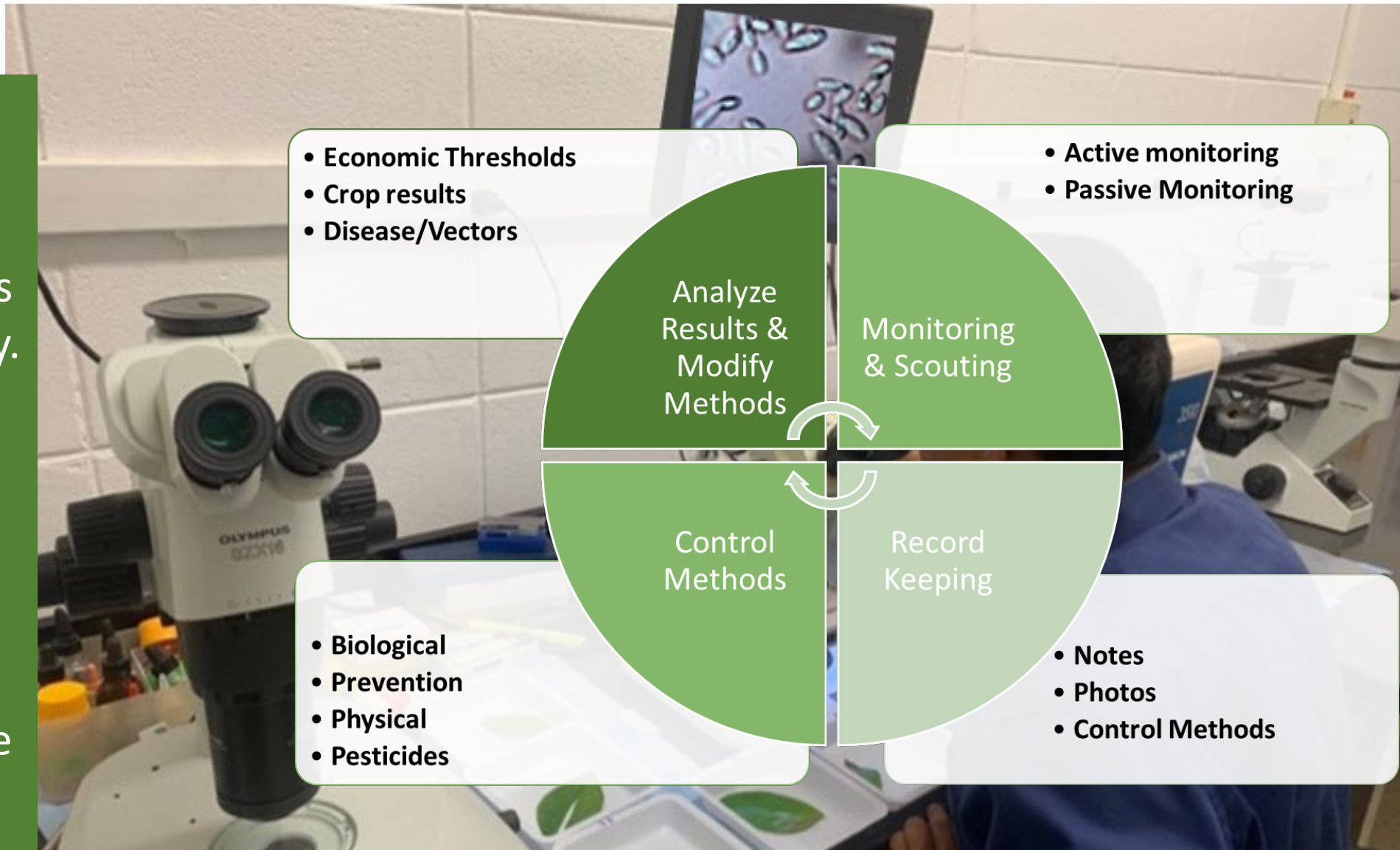
Imagine trying to treat a broken arm without knowing that your arm is broken. What types of mistakes could you make?



Identification: Overview & Considerations

It takes time, money, and expertise to identify most problems and organisms properly.

The crucial step is to know who to ask for expertise, and to also become the expert in your own system by following the IPM cycle constantly.

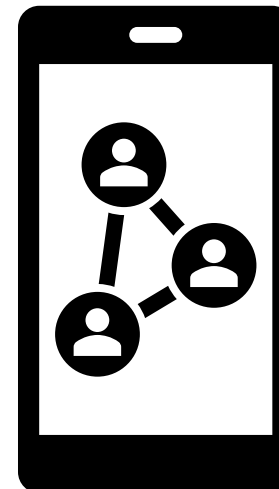


Identification: Overview & Considerations

Careful where you get information when trying to identify a problem or organism...



Smartphone identification applications may get you close, but may also give you false information.



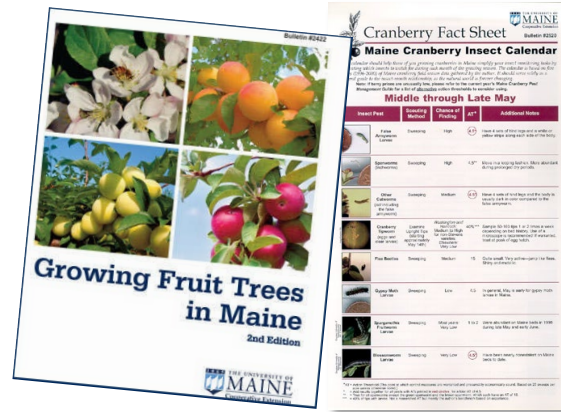
Anyone can post on social media, blogs, and forums. Ensure claims are backed by scientific evidence.

Identification: Toolbox for DIY Identification

Good Quality Online Resources



Crop Specific Growing/Pest Guides



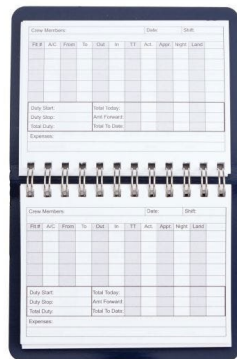
Forceps



Containment



Past Records



Hand Lens and Simple Microscope



Phone or Camera

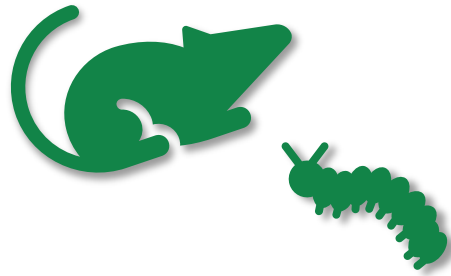


Education & Courses





Identification: What to look for... and make note of!



Features of the organism (if seen)



Damage to buildings or crops,
Sick Animals, Lost Yield



Biological Evidence



Changes in environmental conditions,
care routines, or new pesticide use

A good recordkeeping system ensures you (and your employees)

make note of what is going on.

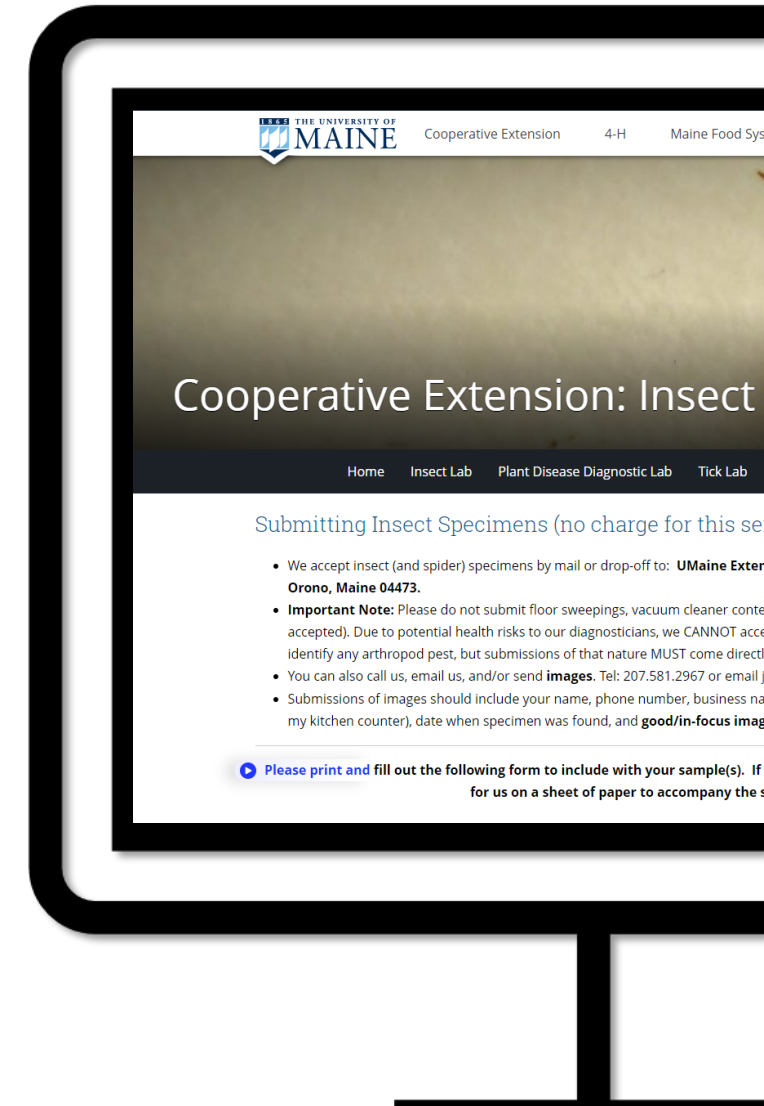
Photo evidence is important!

Identification: Submitting insect specimens

How to properly submit an insect specimen for identification:

- All insects (excluding butterflies and moths) should be placed in a small leak-proof container with just enough rubbing alcohol to cover specimen for preservation.
- Butterflies and moths should be packed in tissue or cotton for best possible preservation.
- You can mail or drop off specimens at your local County Extension Office or at the Pest Management Unit's Insect ID Lab.

Important Note: Please do not submit floor sweepings, vacuum cleaner contents or specimens from the body (although ticks, suspected nits and lice will be accepted). Due to potential health risks to our diagnosticians, we CANNOT accept bodily fluids or other human debris. We are happy to work with a physician to identify any arthropod pest, but submissions of that nature MUST come directly from a physician.

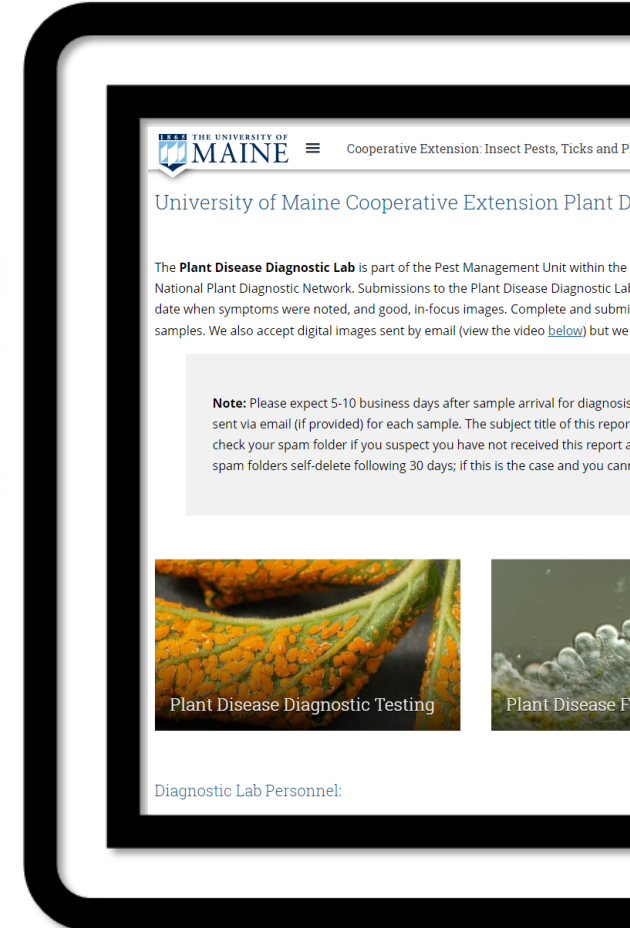
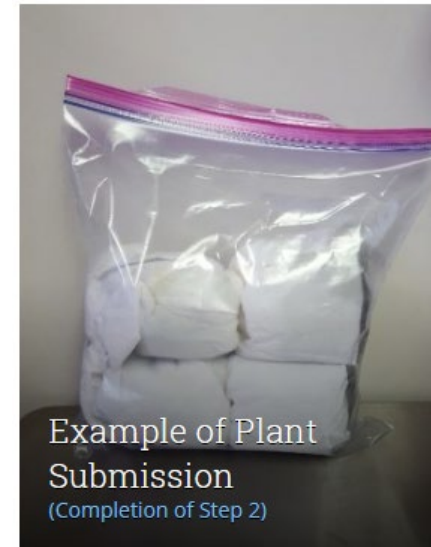


Identification: Submitting plant specimens

How to properly submit a plant specimen **summarized!!!**

Complete instructions found [here](#), and a [video found here](#):

1. Examine all plant parts and determine the parts which you believe to be diseased. Ideally the whole plant should be sent when possible.
2. Place root ball in a plastic bag with some soil and tie it so the soil doesn't contaminate the foliage. Wrap the plant in a barely damp paper towel or newspaper and place the entire plant in a sealed plastic bag.
3. Samples should be packaged and sent as quickly as possible. If mailing, try to mail early in the week so samples will not sit over the weekend.
4. All samples must be sent with a completed [Plant Disease Diagnostic Submission Form](#). Provide complete information on the form and keep the form separate from the sample. Limit sample information to one (1) sample per form and indicate which form goes with each sample.

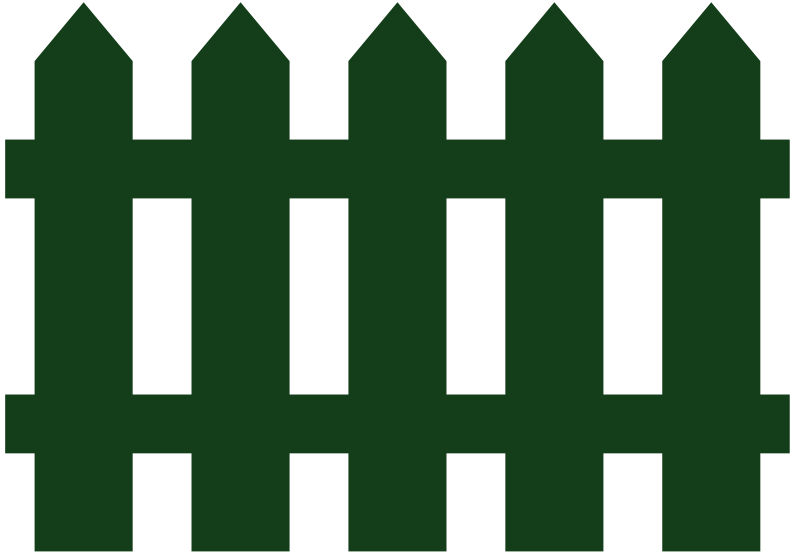


Identification: Resources in Maine & Online

Resource	What they can help with...
County Extension Office (Gardening)	<ul style="list-style-type: none">• Ask your gardening questions, including assistance with identifying plants, insects, and plant diseases.
UMaine Extension Diagnostic and Research Lab	<ul style="list-style-type: none">• Submit insect specimens for identification free of charge
UMaine Extension Plant Disease Diagnostic Lab	<ul style="list-style-type: none">• Accepts samples of plants with symptoms of disease or possible disease by mail or by digital submission form
Crop Specific Guides	<ul style="list-style-type: none">• UMaine Extension Online Publications• Northeast IPM Center Crop Profiles• Northeast IPM Center Pest Management Strategic Plans
Online Insect ID Resources	<ul style="list-style-type: none">• Gotpests.org – Maine-specific website with click-through photos and factsheets. A great place to get started!• UMaine Extension – Insect ID with click through photos and factsheets• Bugguide.net – Free resource with verified photos of insects

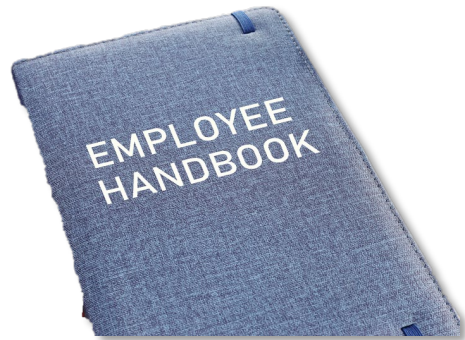
Identification: Resources in Maine & Online

Resource	What they can help with...
UMaine Extension Crop-Specific Pests	<ul style="list-style-type: none">• Grains, Pulses & Oilseeds - Weed and Disease Factsheets• Potatoes – Insect and Disease Factsheets and Publications• Blueberries – extensive resources on the UMaine blueberry IPM website including pest factsheets, a weed ID tool, and disease resources• Cranberries – cranberry IPM site including insects, weeds, diseases, and pest reports• Tree Fruits – including insect pests, disease, and wildlife damage• And more!
Maine Organic Farmers and Gardeners Pest Reports	<ul style="list-style-type: none">• A compilation of short discussions of pests and diseases either working the fields or soon to be seen. Website includes a link to sign up for emails.

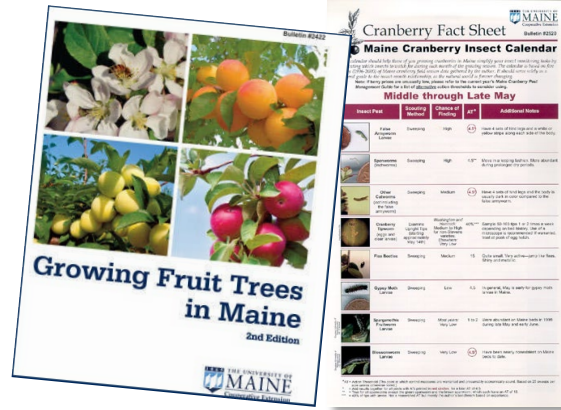


Prevention

Prevention: Toolbox (*generalized*)



Well communicated expectations for sanitation



Crop Specific Growing/Pest Guides (set your crop up for success!!!)



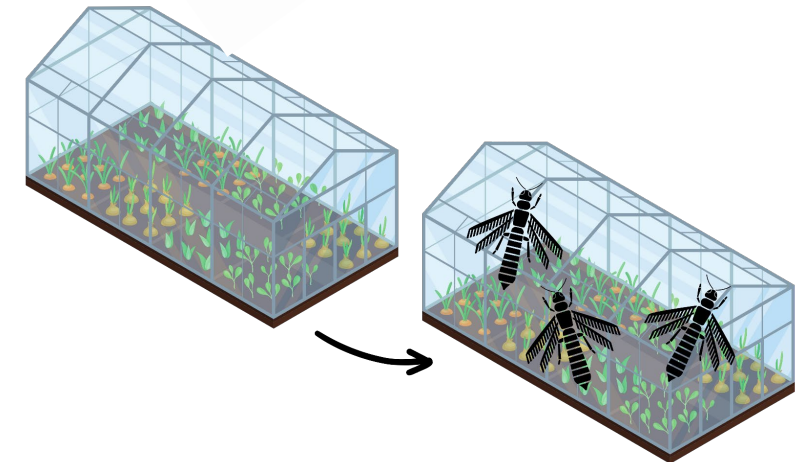
Regular Cleaning Schedule & SOPs (including outdoors!)



Shears for pruning, thinning, etc. (clean between use!)



Weeding (many methods depending on crop and situation)



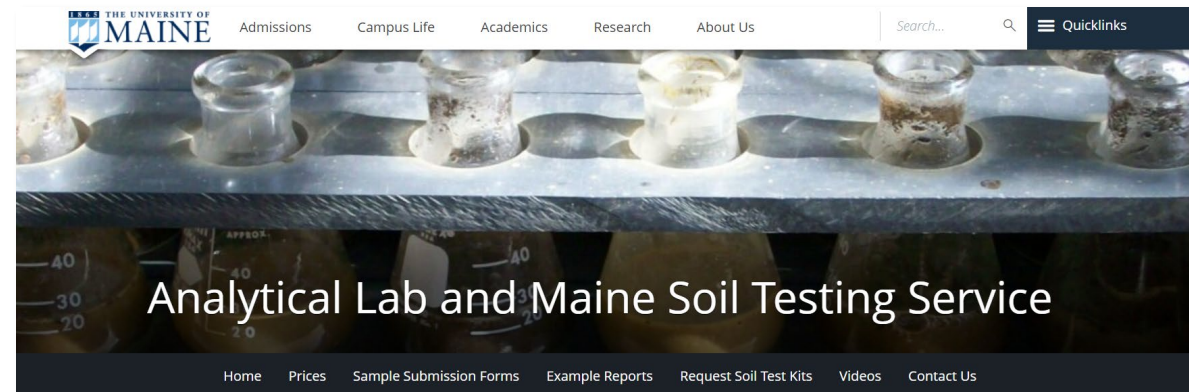
Move from areas with low pest to high pest density – prevent spread!

Ensure the best growing conditions to minimize plant stress

Soil:

UMaine Soil Lab – Submit soil test (and conduct a lead test for safety)

[Total Sorbed Metals Test](#) is a great option.



Inspect weeds and naturally growing plants – avoid areas with wetland plants and moisture-loving weeds

Prevention: Resources in Maine & Online



Resource	What they can help with...
UMaine Extension County Offices	<ul style="list-style-type: none">• Get soil test kits and support interpreting soil test reports.• Borrow the hay/forage quality analysis sampler and testing kits.
Crop Specific Guides	<ul style="list-style-type: none">• UMaine Extension Online Publications• Northeast IPM Center Crop Profiles• Northeast IPM Center Pest Management Strategic Plans
UMaine Analytical Lab and Maine Soil Testing Service	<ul style="list-style-type: none">• Analyzes soil, plant tissue, compost, manure, irrigation water, wood ash, fertilizers, organic residuals and other materials for nutrient content, organic matter, lead and other trace elements.
Environmental Conditions	<ul style="list-style-type: none">• Drought - Resources and information from UMaine Extension for monitoring and preparing
Soil & Nutrients	<ul style="list-style-type: none">• Maine Lime Directory (UMaine Extension)• Maine Compost School (2024 sessions: June 10-14, October 7-11)• UMaine Precision Agriculture Resources (site-specific farming)• UMaine Extension Soil Health Resources

Prevention: Resources in Maine & Online



Resource	What they can help with...
UMaine Extension Crop-Specific Information	<ul style="list-style-type: none">• Grains, Pulses & Oilseeds – Variety Trial Data, seed and planting, and soil and fertility management factsheets• Potatoes – Production factsheets including nutrient management, seed cutting and handling, and harvester calibration• Blueberries – extensive resources on the UMaine blueberry IPM website including nutrient management, irrigation, and weather and crop modeling tools• Cranberries – cranberry IPM site including management calendars, and tissue testing• Tree Fruits – including tree spacing, planting information, thinning, pruning, fertilization, and winter preparation• And more!

Mechanical Control: Resources in Maine & Online

Resource	What they can help with...
UMaine Extension Soil Health	<ul style="list-style-type: none">Resources for cover cropping, no-till, and reduced tillage
UMaine Extension Crop-Specific Information	<ul style="list-style-type: none">Blueberries – blueberry pruning, burning, and mowing information including a cost calculator in “Blueberry Tools.”And more!



Further resources for mechanical control



Monitoring & Recordkeeping



Monitoring & Recordkeeping: Toolbox



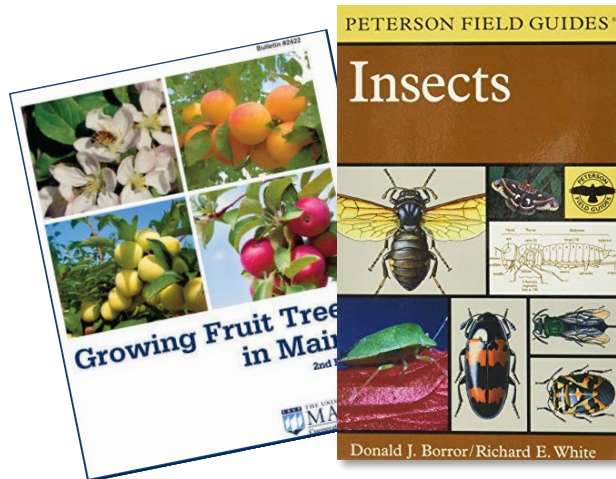
Logbook or System



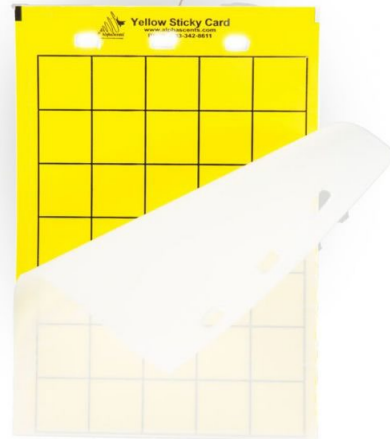
Hand Lens with LED



USB Microscope



Identification Guides & Understanding of Your Crop!



Yellow Sticky Cards



Smartphone

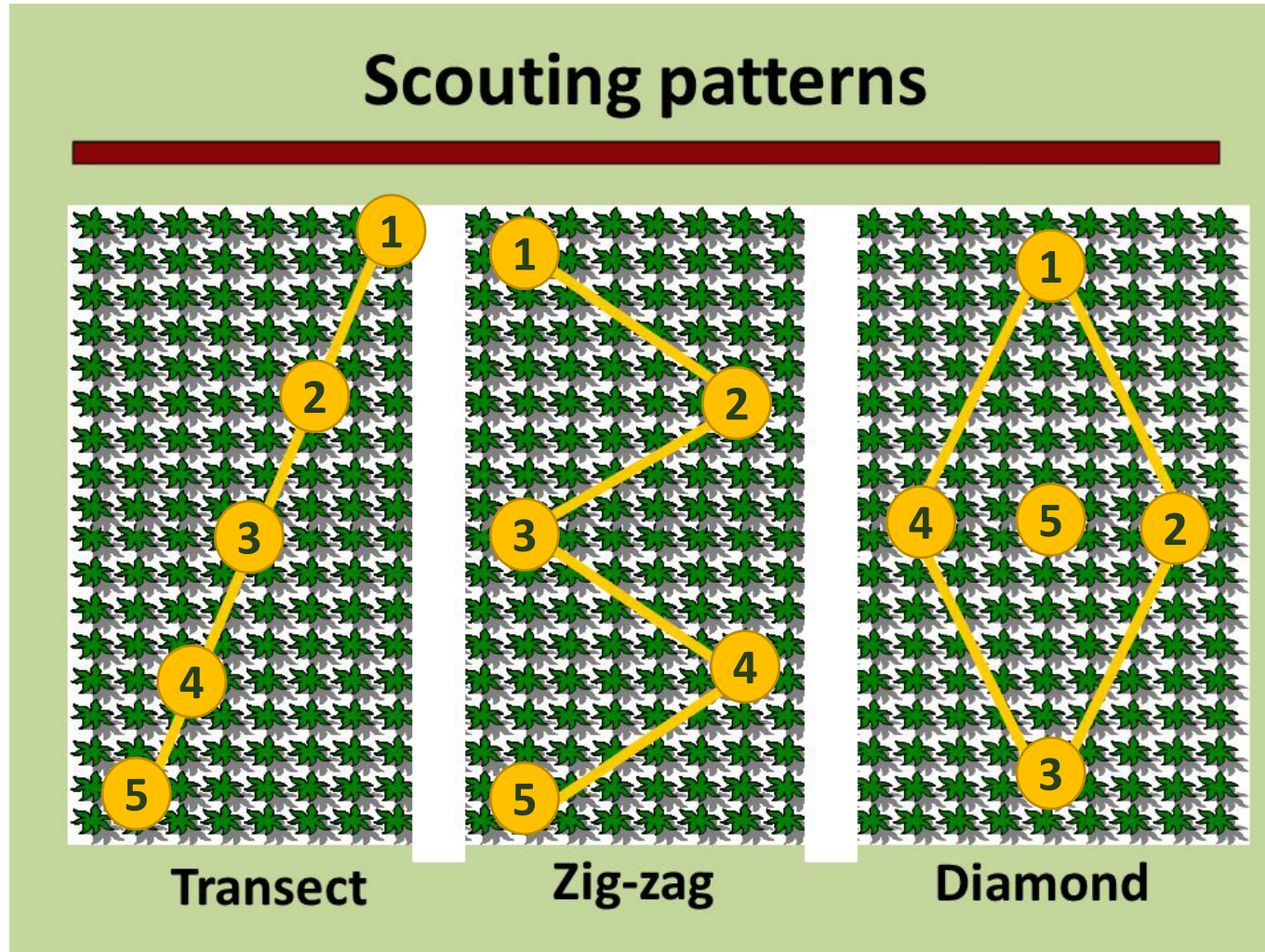


Monitoring & Recordkeeping: Scouting

Active/Visual/Scouting Monitoring *Systematic Sampling = Useful Results*

Examine 5-10 plants at each of 5-10 spots per field

Look for damage, pests, natural enemies, plant growth / shape / color





Monitoring & Recordkeeping: Scouting

Passive Monitoring *Systematic Sampling = Useful Results*

- Hang cards on plants (and below plants if in pots indoors)
- Replace cards at intervals that work for you (weekly preferable)
- Inspect cards for potential pests (hobby microscope helpful)
 - Counts
 - Averages
 - Estimates (e.g., % of card) for large volume
- KEEP DATA RECORDS

Monitoring cards/devices are for monitoring – NOT for trying to capture all pests (they never will).

May be more suited for indoor use.



\$145 hobby microscope



This is a method I came up with for collecting many yellow sticky cards at one time

Come up with what works for you!

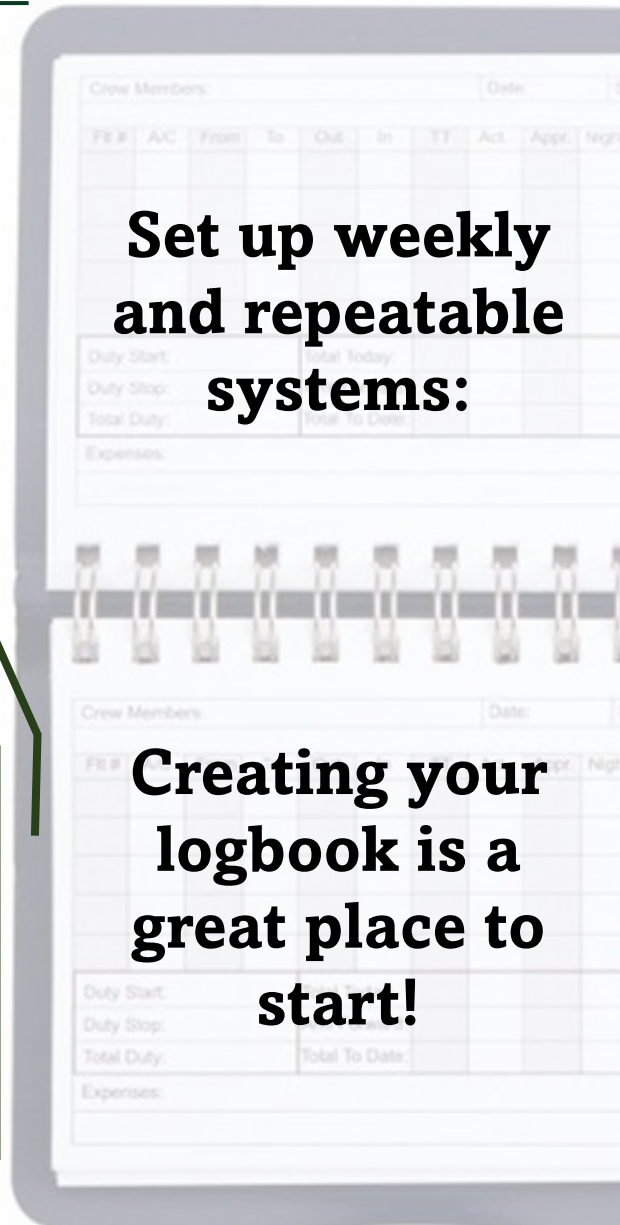




Monitoring & Recordkeeping: Scouting

Date	Time	Initials	Crop Location	Observation Type	Description	Many options...

- Visual scouting – a big box to write in all pests seen *or* many columns with pest species
- Passive Monitoring – cards with unique identifiers, and columns with pest species
- Control methods – keep track of biocontrol releases, fertigation, watering, planting dates...etc!

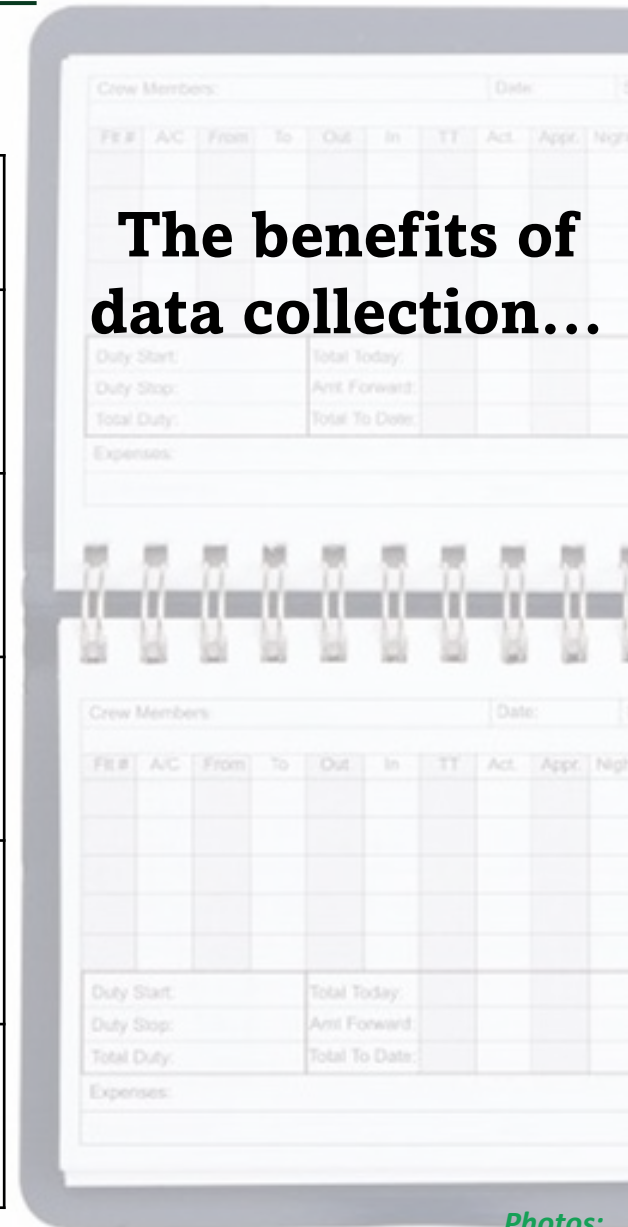




Monitoring & Recordkeeping: Scouting

Date	Time	Initials	Crop Location	Observation Type	Description	# Thrips
8/10/2022	10:00 AM	HMP	R1	YSC		100
8/17/2022	11:00 AM	HMP	R1	YSC		50
8/24/2022	10:00 AM	HMP	R2	YSC	Card covered in dirt	0
8/31/2022	2:00 PM	DPM	R1	YSC		20
9/7/2022	6:00 PM	DPM	R1	YSC		15

The benefits of data collection...





Monitoring & Recordkeeping: Scouting

Step 2: Select PivotChart

The screenshot shows the Microsoft Excel interface with the 'Insert' tab selected. The 'PivotChart' icon in the 'Charts' group is circled in green. Below the ribbon, a data table is visible, with a green border around the data range from A1 to H6.

	A	B	C	D	E	F	G	H
1	Date	Time	Initials	Crop Location	Observation Type	Description	# Thrips	# Plants with Silvered Leaves
2	8/10/2022	10:00 AM	HMP	R1	YSC and Visual		100	10
3	8/17/2022	11:00 AM	HMP	R1	YSC and Visual		50	5
4	8/24/2022	10:00 AM	HMP	R2	YSC and Visual	Card covered in dirt.	0	10
5	8/31/2022	2:00 PM	DPM	R1	YSC and Visual		20	2
6	9/7/2022	6:00 PM	DPM	R1	YSC and Visual		15	5
7								

I am a huge excel fan and I am not afraid to show it.

Step 1: Select Data

The 'Create PivotChart' dialog box is shown with the following settings:

- Choose the data that you want to analyze:**
 - Select a table or range
 - Table/Range: Sheet1!\$A\$1:\$H\$6
 - Use an external data source
 - Use this workbook's Data Model
- Choose where you want the PivotChart to be placed:**
 - New Worksheet
 - Existing Worksheet
 - Location: [Empty]
- Choose whether you want to analyze multiple tables:**
 - Add this data to the Data Model

Step 3: Just use default selections (places in new worksheet)

Let me show you the magic of pivot tables!



Monitoring & Recordkeeping: Scouting

PivotChart Fields

Choose fields to add to report:

Search

- Date
- Time
- Initials
- Crop Location
- Observation Type
- Description
- # Thrips
- # Plants with Silvered Leaves
- Months

Step 4: Drag and drop!!!

Drag fields between areas below:

Filters

Legend (Series)

Axis (Categories)

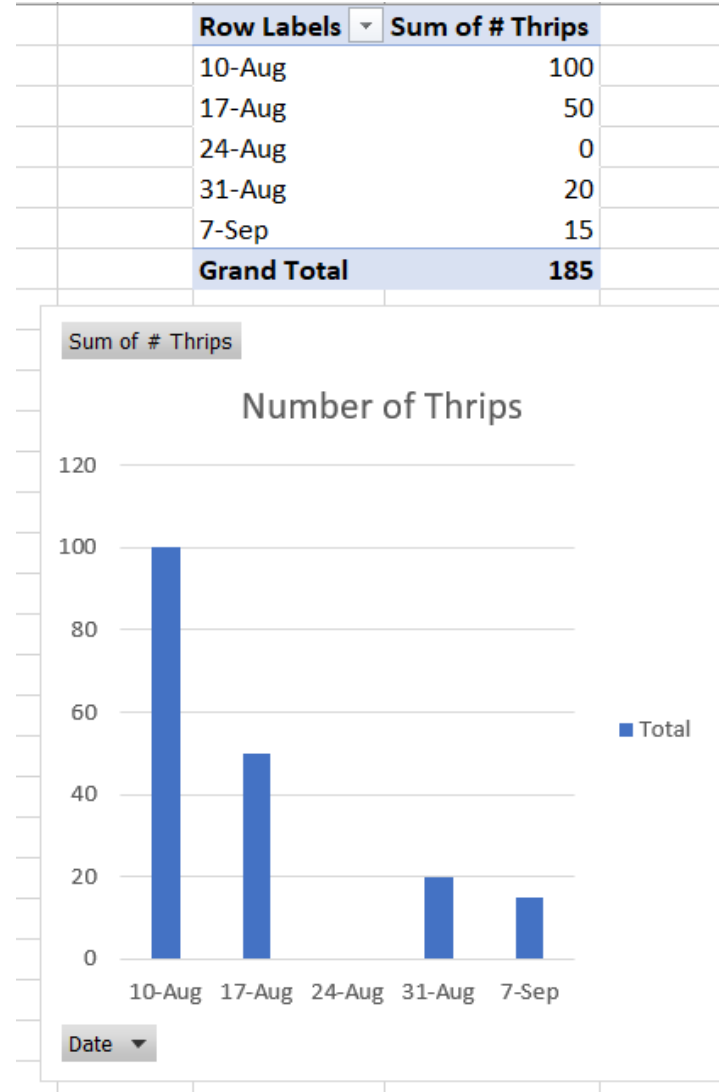
Date

Σ Values

Sum of # Thrips

Defer Layout Update

Update



I am a huge
excel fan and I
am not afraid to
show it.

Let me show you
the magic of
pivot tables!



Monitoring & Recordkeeping: Scouting

Date	Time	Initials	Crop Location	Observation Type	Description	# Thrips	# Plants with Silvered Leaves
8/10/2022	10:00 AM	HMP	R1	YSC and Visual		100	25
8/10/2022	10:00 AM	HMP	R2	YSC and Visual		10	0
8/10/2022	10:00 AM	HMP	R3	YSC and Visual		1	0
8/17/2022	11:00 AM	HMP	R1	YSC and Visual		250	30
8/17/2022	11:00 AM	HMP	R2	YSC and Visual		10	0
8/17/2022	11:00 AM	HMP	R3	YSC and Visual		0	0
8/24/2022	10:00 AM	HMP	R1	YSC and Visual	Card covered in dirt	350	25
8/24/2022	10:00 AM	HMP	R2	YSC and Visual		10	0
8/24/2022	10:00 AM	HMP	R3	YSC and Visual		1	0
8/31/2022	2:00 PM	DPM	R1	YSC and Visual		425	25
8/31/2022	2:00 PM	DPM	R2	YSC and Visual		10	1
8/31/2022	2:00 PM	DPM	R3	YSC and Visual		1	1
9/7/2022	6:00 PM	DPM	R1	YSC and Visual		600	1
9/7/2022	6:00 PM	DPM	R2	YSC and Visual		0	0
9/7/2022	6:00 PM	DPM	R3	YSC and Visual		10	0

I am a huge excel fan and I am not afraid to show it.

Let me show you the magic of pivot tables!

As you gather more data, you can learn more!



Monitoring & Recordkeeping: Scouting

PivotChart Fields

Choose fields to add to report: ⚙️

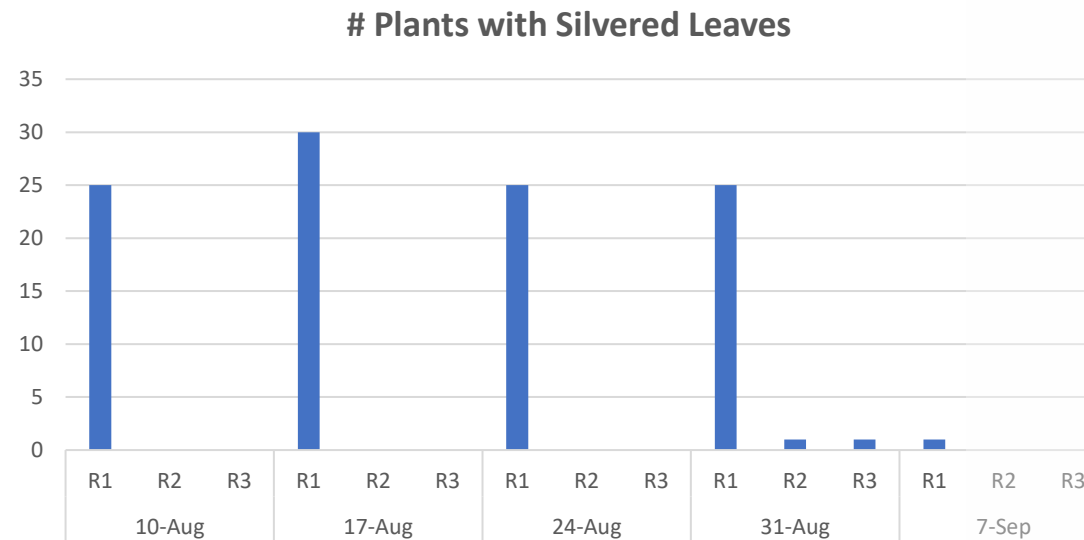
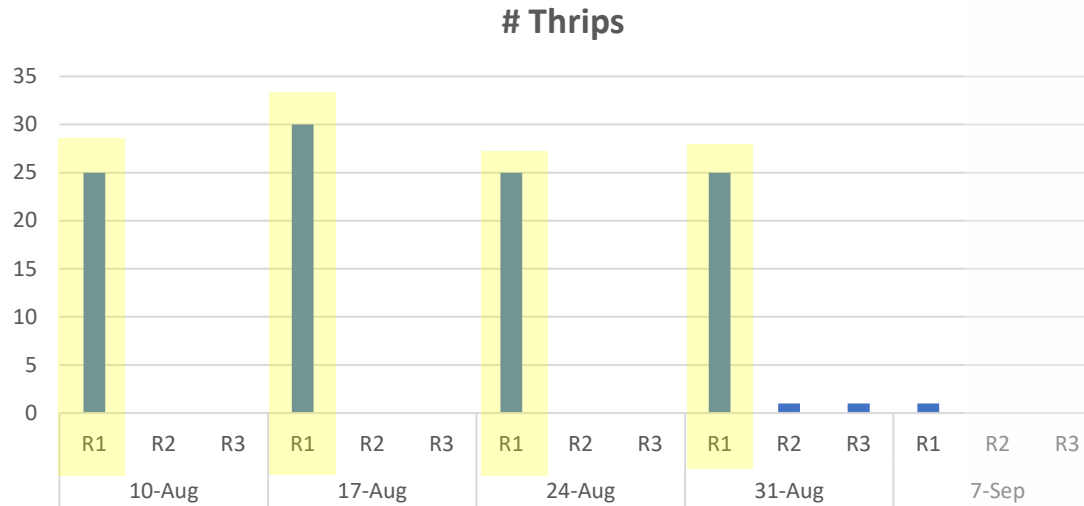
Search

- Date
- Time
- Initials
- Crop Location
- Observation Type
- Description
- # Thrips
- # Plants with Silvered Leaves
- Months

Drag fields between areas below:

Filters	Legend (Series)
Axis (Categories)	Σ Values
Date <input type="text"/>	Sum of # Thrips <input type="text"/>
Crop Location <input type="text"/>	

Defer Layout Update Update



Crew Members: Date:

FE #	AC	From	To	Out	In	TY	Act	Appr	Notes

Duty Start: Total Today:

Duty Stop: Amt Forward:

Total Duty: Total To Date:

Expenses:

I am a huge excel fan and I am not afraid to show it.

Crew Members: Date:

FE #	AC	From	To	Out	In	TY	Act	Appr	Notes

Duty Start: Total Today:

Duty Stop: Amt Forward:

Total Duty: Total To Date:

Expenses:

Let me show you the magic of pivot tables!



Monitoring & Recordkeeping: Scouting

Another option for record keeping: Pre-made programs and tools.

- [Google Forms \(free\)](#) – create your own custom forms for filling out data in the field (Google sheets output -> excel)
- [Crop-Scanner](#) – tool by BioBest
- [Koppert iPM](#) – tool by Koppert Biological Systems
- [Greenhouse Management Software](#) – tool by Redbud
- [Pocket IPM Greenhouse Scout Mobile App](#) – tool by Cornell



These are just a few examples of the types of programs that exist on the market.

Inclusion is not an endorsement of these pieces of software.

**Pre-made tools
can be expensive
and not very
customizable to
your specific
situation.**

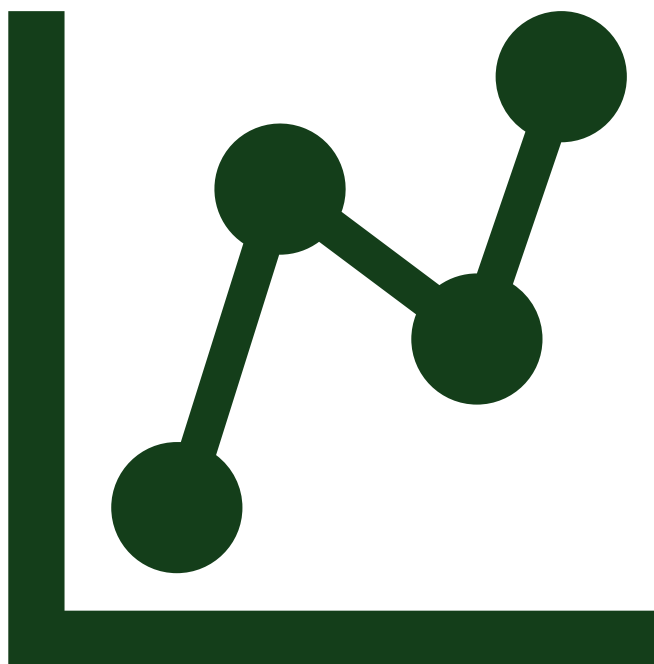
**I recommend
starting with a
simple solution
to assess your
needs.**



Monitoring/Recordkeeping: Resources in Maine & Online



Resource	What they can help with...
UMaine Precision Agriculture Team	<ul style="list-style-type: none">• Data Management
UMaine Extension Crop-Specific Information	<ul style="list-style-type: none">• Potatoes – IPM website includes regional scouting reports, insect scouting reports, disease forecasts, and more• Blueberries – extensive resources on the UMaine blueberry IPM website including pest monitoring data and how-to guides for monitoring for SWD• Cranberries – IPM guides including specific monitoring information for some species• And more!

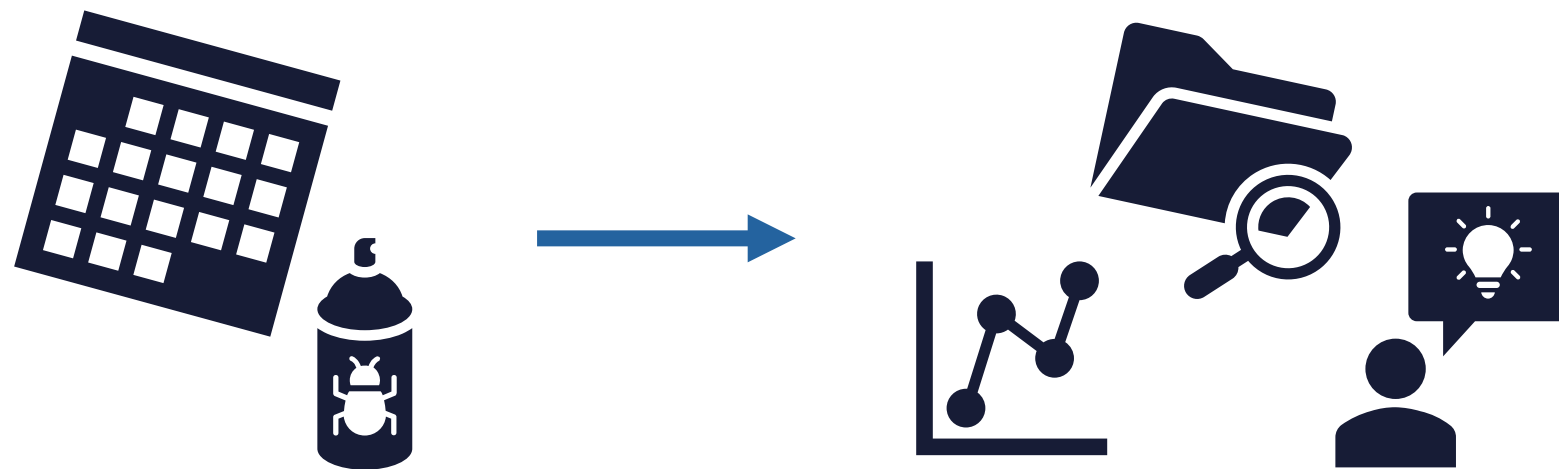


Action Thresholds



Action Thresholds: Overview

“Decide ... the level of pests/damage when you will implement a management action to control the pest population.”





Action Thresholds: Overview

“Decide ... the level of pests/damage when you will implement a management action to control the pest population.”

Site-specific self-determined thresholds



Industry Monitoring & Action Threshold Standards

Low Value Crop

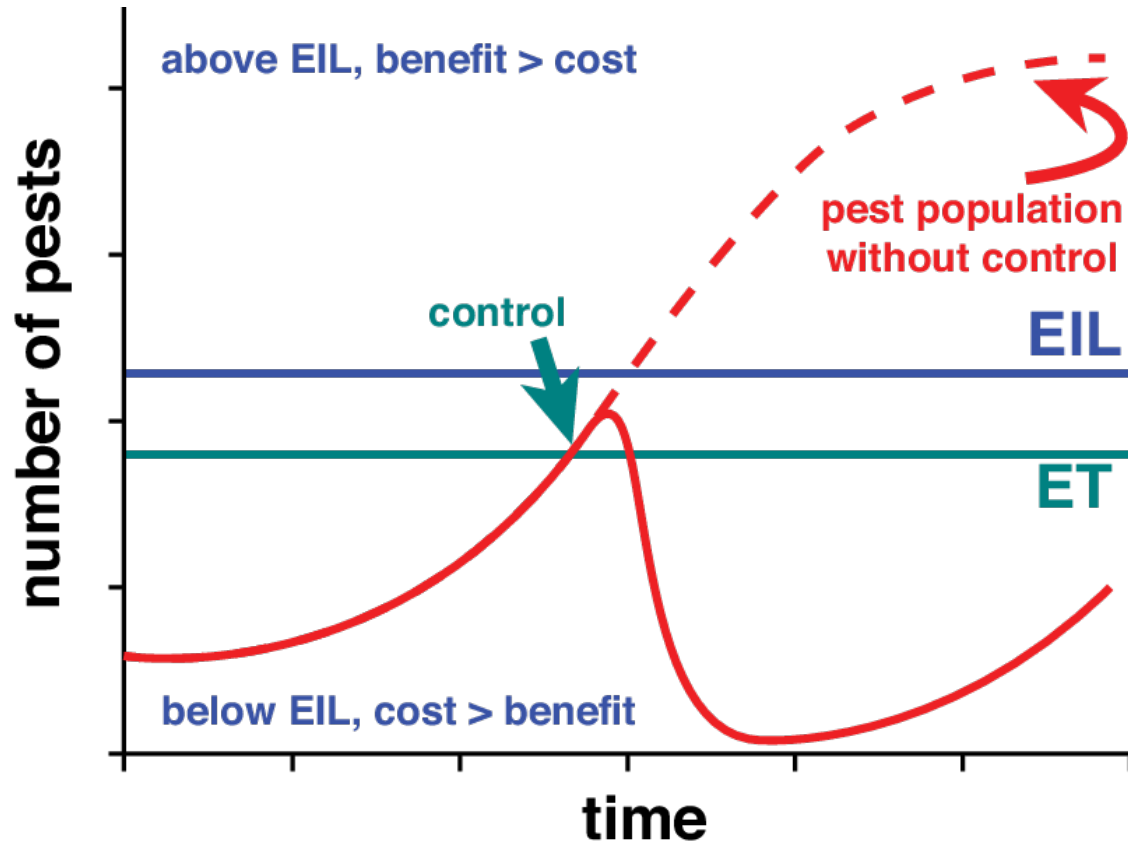


High Value Crop





Action Thresholds: Overview



Economic Injury Level

Crop loss is more expensive than controlling the pest

Economic Threshold

Pest abundance or damage level that will exceed EIL if not treated





Action Thresholds: Maine Blueberries

The data is based upon three traps/field edge, BUT the thresholds can be based upon any number of traps in a field.”



Table 1. ACTION THRESHOLDS. Data from 2012-2017 that show the frequency (# fields) of cumulative SWD male captures in fields that the following week had infested fruit.

CUMULATIVE <u>MALE</u> SWD FLIES CAPTURED (average from three traps/field)	Probability of NOT having infested fruit the following week
0.25	99.9%
0.5	99.5%
1.0	99%
2.0	95%
3.5	90%
7.0	75%
16.0	50%

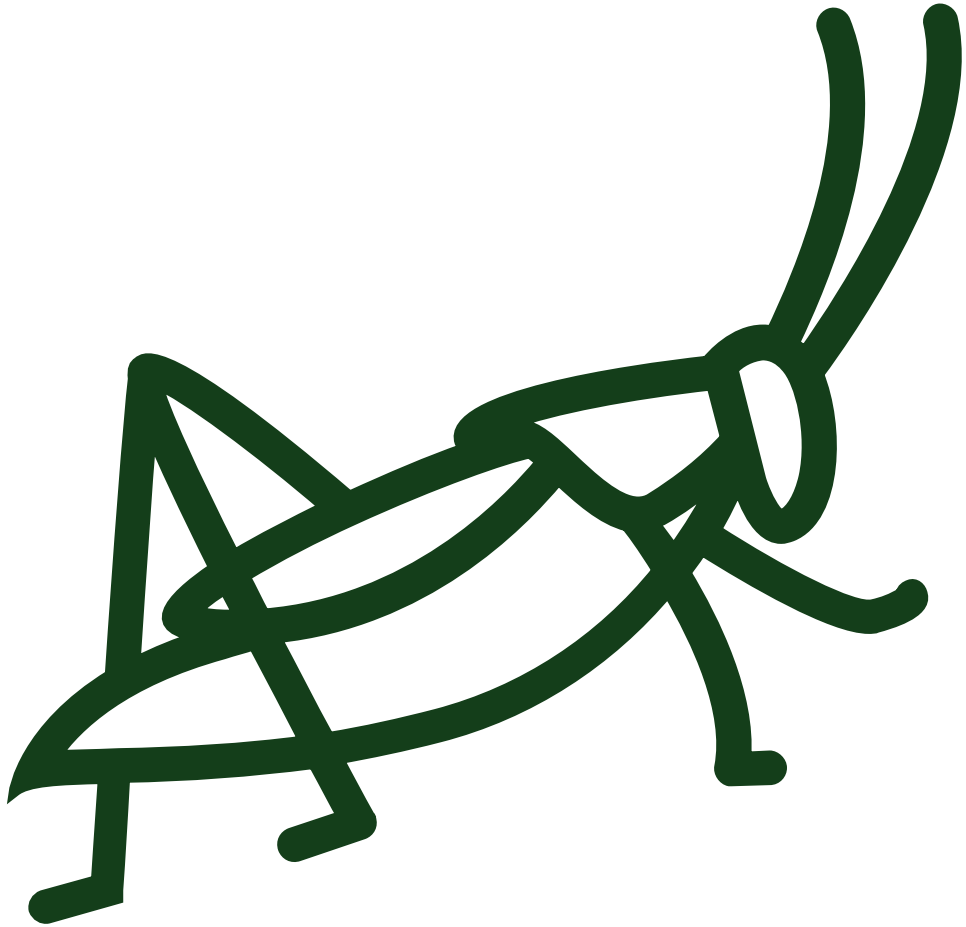


Action Thresholds: Maine Cranberries

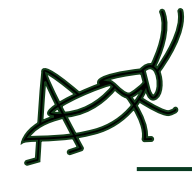
Percent out-of-bloom is monitored in cranberries to assist in the management of the cranberry fruitworm.

TABLE RECOMMENDED (for all practices) TO DETERMINE NECESSITY OF ADDITIONAL SPRAYING FOR CRANBERRY FRUITWORM:

Number of Acres	Number of Berries Checked	Number of Viable Eggs Needed to Trigger Spray during profitable berry prices	Number of Viable Eggs Needed to Trigger Spray during very low berry prices (< \$0.30 per lb.)
0-5	200-250	1	2
6 or 7	251-350	2	4
8 or 9	351-450	3	6
10 or 11	451-550	4	8
for each additional 2 acres	add 100 berries	add 1 egg	double the number determined at left

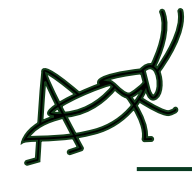


Biological Control



Biological Control: Overview





Biological Control: Overview

Often Insects or Other Non-Insect
Arthropods

Entomopathogens

Predators

e.g., rove beetles

Parasitoids

e.g., larval parasitoids

Fungi

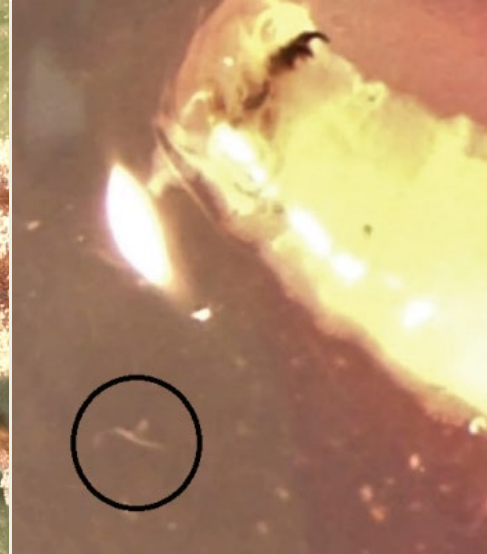
e.g., Beauveria bassiana

Nematodes

e.g., Oscheius onirici

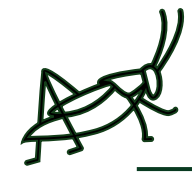
Bacteria & Viruses

e.g., Bacillus thuringiensis (Bt)



Generalist

Specialist



Biological Control: Overview

Conservation Biocontrol



Ground beetles feed on pests and weed seeds in several crops

Augmentative Biocontrol

Aphidius species released in greenhouses for control of aphids

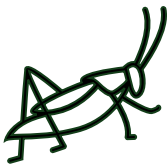


Classical Biocontrol

Ganapsis brasiliensis releases in Maine for Spotted Wing Drosophila



Learn more – [2022 Ag Trades Talk on Berries & Biocontrol](#)



Biological Control: Overview

Check the Maine Unrestricted List

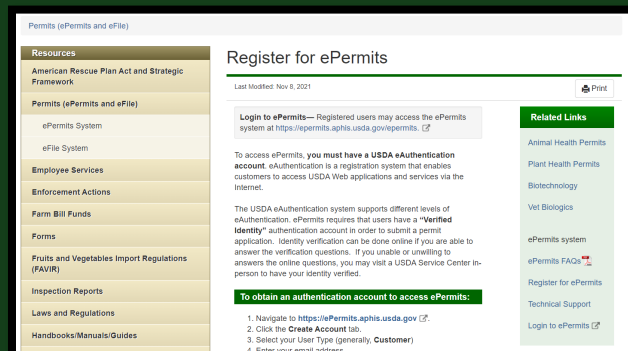
“Maine law allows the Department to maintain a list of species of fish and wildlife, including tropical fish and invertebrates, which do not require an importation, exhibition, or possession permit”

UNRESTRICTED SPECIES	
Actinopterygii (Ray-finned Fishes)	
Atheriniformes (Silversides)	
Scientific Name	Common Name
<i>Bedotia geayi</i>	Madagascar Rainbowfish
<i>Melanotaenia boesemani</i>	Boeseman's Rainbowfish
<i>Melanotaenia maylandi</i>	Maryland's Rainbowfish
<i>Melanotaenia splendida</i>	Eastern Rainbow Fish
Belontiiformes (Needlefishes)	
Scientific Name	Common Name
<i>Dermogenys pusilla</i>	Wrestling Halfbeak
Characiformes (Piranhas, Leporins, Piranhas)	
Scientific Name	Common Name
<i>Abramites hypselonotus</i>	Highbacked Headstander
<i>Acestrorhynchus falcatus</i>	Red Tail Freshwater Barracuda
<i>Acestrorhynchus falcistris</i>	Yellow Tail Freshwater Barracuda
<i>Anostomus anostomus</i>	Striped Headstander
<i>Anostomus spiloclistran</i>	False Three Spotted Anostomus
<i>Anostomus ternetzi</i>	Ternetz's Anostomus
<i>Anostomus varius</i>	Checkerboard Anostomus
<i>Astyanax mexicanus</i>	Blind Cave Tetra
<i>Boulengerella maculata</i>	Spotted Pike Characin
<i>Carnegiella strigata</i>	Marbled Hatchetfish
<i>Chalceus macrolepidotus</i>	Pink-Tailed Chalceus
<i>Charax condei</i>	Small-scaled Glass Tetra
<i>Charax gibbosus</i>	Glass Headstander
<i>Chilodus punctatus</i>	Spotted Headstander

[Link to the Unrestricted List](#)
[Link to Learn More](#)

Get a permit from APHIS

“Under the authority of the Plant Protection Act of 2000, a Plant Protection and Quarantine (PPQ) 526 permit is required for the importation, interstate movement and environmental release of biological control organisms of plant pests and weeds.”



[Link to register for ePermits](#)

Get a permit from the Maine Department of Inland Fisheries and Wildlife

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE
353 Water Street, 41 SHS Augusta, ME 04333
Phone 207-287-5261

**Wildlife Importation Permit Application
For Category 1 Restricted Species**

In accordance with the provisions of the Revised Statutes, Title 12, Section 12152, 3-D.A. I hereby apply for a permit that allows me to import wildlife that is threatened or endangered, or that presents a risk to humans into the State.

Application Fee: \$250
Permit Fee: \$27

Name of Company/Facility: _____
Name of Owner/Manager: _____ Date of Birth: ____/____/____
Mailing Address: _____ (P.O. Box/Street/Apt#) (City/Town) (Zip Code)
Physical Address: _____ (Number, Street/Road Name/Apt#) (City/Town) (Zip Code)
Email Address: _____ Phone Number: (____) _____

List species you request to import below (Please note: you must provide a certification of veterinary inspection valid for the entire time animal(s) will be in the State, as well as other required documentation - see next page for details)

Common Name	Scientific Name	Gender	Number

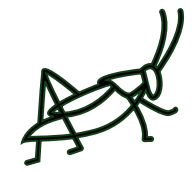
Do you possess a current Wildlife Exhibition Permit for the Category 1 Restricted Species listed above? Yes OR No

Date of Import: _____ Import Method: _____
Source (only one source per application): _____ (Name) (Address: Street, City, State, Zip)

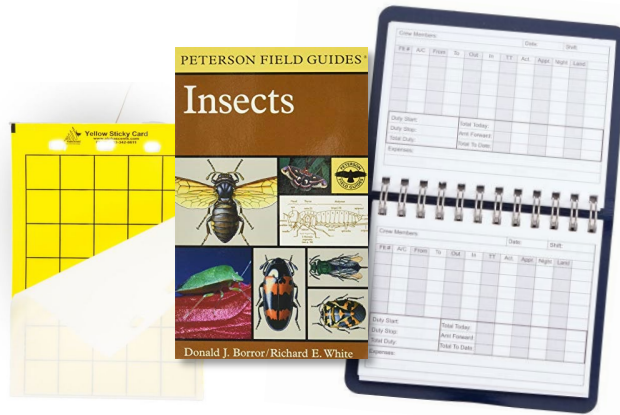
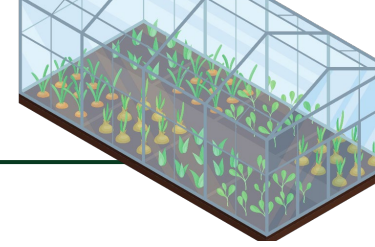
Are species listed on CITES Appendix 1, or the USFWS Endangered Species list? Yes or No

Describe your experience handling species listed above: _____

[Link to the Wildlife Importation Permit Application](#)



Biological Control: Toolbox (*Augmentative!*)



**IPM System (Especially Scouting)
Already Set in Place**



**Magnification
on the Go**



USB Microscope



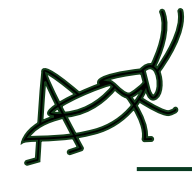
**Deployment Plan &
Tools**



**Good relationship with
biocontrol sales rep**



**Patience & Managed
Expectations**



Biological Control: Considerations

Indoors, Purchase, and Release

- *KNOW* your pest species first – great guidelines by the [Association of Natural Biocontrol Producers](#)
- Determine if biocontrols to be released are compatible with other control measures
- Purchase from trustworthy sources – many guides are available online through the [Association of Natural Biocontrol Producers](#)
- Keep records of release information – date, amount, control achieved



Greenhouses and Interiorscapes		predatory mites	14
		predatory insects	31
	leafminers	parasitic wasps	52, 55
	mealybugs	predatory insects	25, 41, 42
		parasitic wasps	54
	mites	predatory mites	19-24
		predatory insects	28, 33
	scales	predatory insects	30
		parasitic wasps	46
	thrips	predatory mites	14, 18, 20
		predatory insects	31
	whiteflies	predatory insects	26, 35, 41, 42
parasitic wasps			

Any organisms to be released in Maine must be on the IF&W unrestricted list.

***Predatory mite
Phytoseiulus
persimilis***





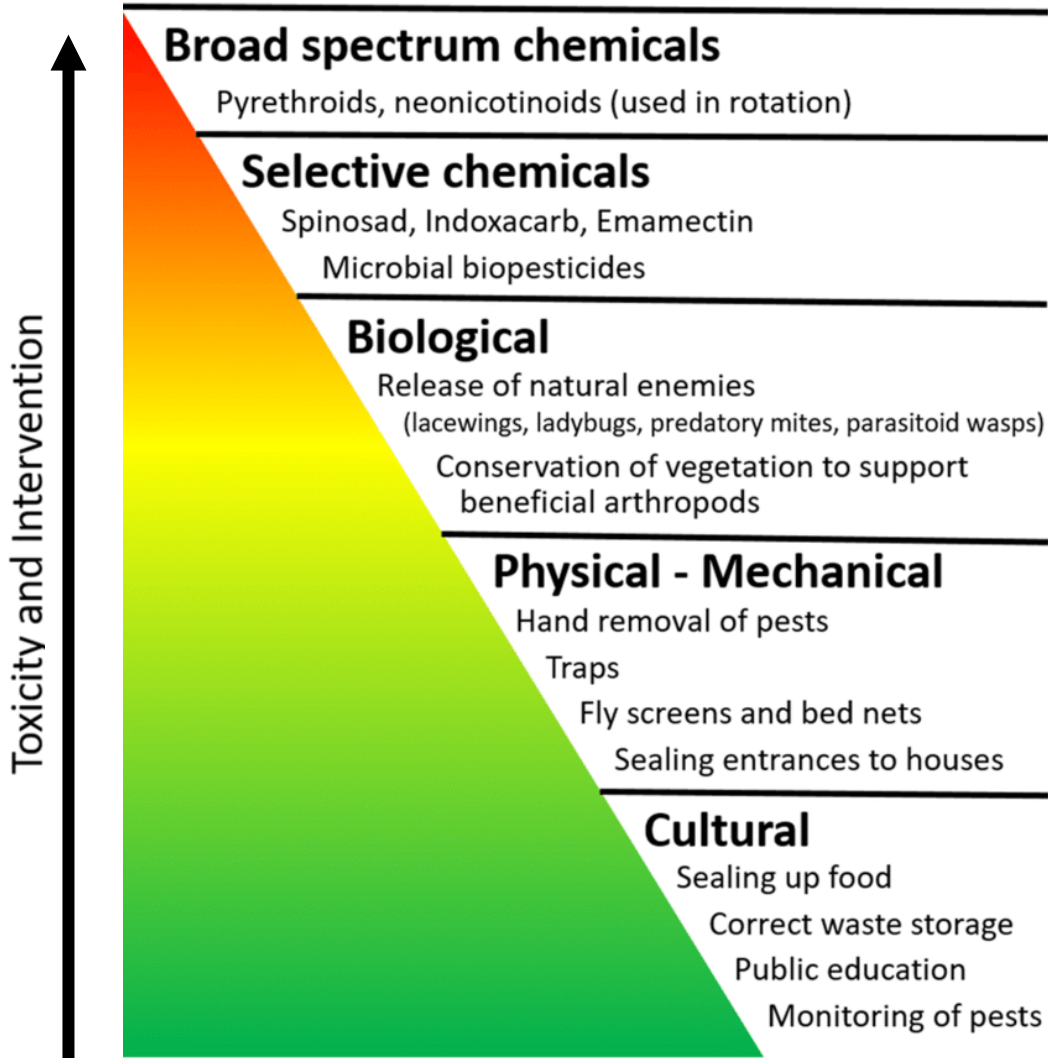
Pesticide Control: What is a pesticide?

Under Maine Law, a pesticide is any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest and includes disinfectants, insecticides, herbicides, fungicides, plant regulators, defoliants and plant desiccants.





Pesticide Control: Overview & IPM



Importance of identification – pesticides need to target the correct species AND life stage!



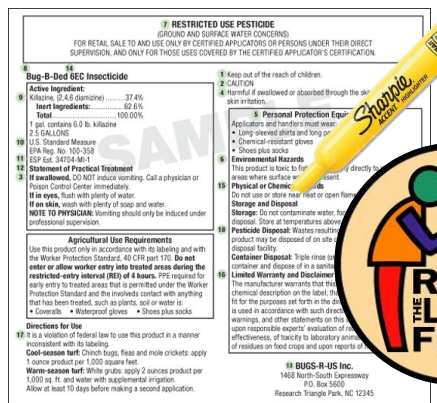


Pesticide Control: Toolbox



License	Brief Description
Agricultural Blank Applicator	For growers who annually sell more than \$1,000 of plants or plant products intended for human consumption and who use only general-use (over-the-counter) pesticides on property owned or leased by them. These include: <ul style="list-style-type: none"> • Growers of fruits, vegetables, herbs and grains for human consumption. • Growers of the above crops who make bread, jam, french fries, wine, cider, juice, etc., or who sell produce to be processed into these products, and • Greenhouse growers selling fruit, vegetable and herb seedlings.
Private Applicator	For medical marijuana growers that intend to control, report or mitigate any pest (insect, mite, plant disease, weed or rodent) or use rooting hormones or other plant growth regulators must be licensed to apply any product to the crop or the growing media. Private Applicators or Dispensaries must have at least one owner or employee licensed who will supervise the application of any pesticide. https://www.maine.gov/dep/water/pesticides/pesticides.html
Commercial Applicator	For those wishing to purchase and use restricted-use (as well as general-use, pesticides in typically include: <ul style="list-style-type: none"> • Farmers • Greenhouse and nursery operators • Orchardists • Christmas tree growers • Foresters
Commercial Applicator-Operator	For professionals using any pesticide in a variety of occupations. A commercial license is required in all of the following situations: <ul style="list-style-type: none"> • Application of any restricted-use pesticide for purposes other than producing an agricultural commodity. • Use of any pesticide as a service for which compensation is received. Examples include lawn and shrub-care; tree and shrub care; tree and shrub pest control. • Use of any pesticide in a licensed home or nursing establishment. • Use of any pesticide in connection with duties as an official or employee of federal, state or local government, including multiple agencies, schools, universities and housing authorities; and • Use of any pesticide on non-agricultural sites open to public use, property is public, user is fee charged for such use. Examples include office and apartment buildings and grounds, golf courses, campgrounds and other outdoor recreation facilities, hospitals and nursing homes, retail and commercial centers.

Proper pesticide applicator license and credits



Pesticide label (fully read)



PPE (the label will guide you)



Calibrated equipment (and a calibration plan!)



Proper pesticide storage

Use the Three C program to handle pesticide spills:
Control the spill,
Contain the spill,
Clean up the spill.



Emergency plans

Rodenticides kill wildlife

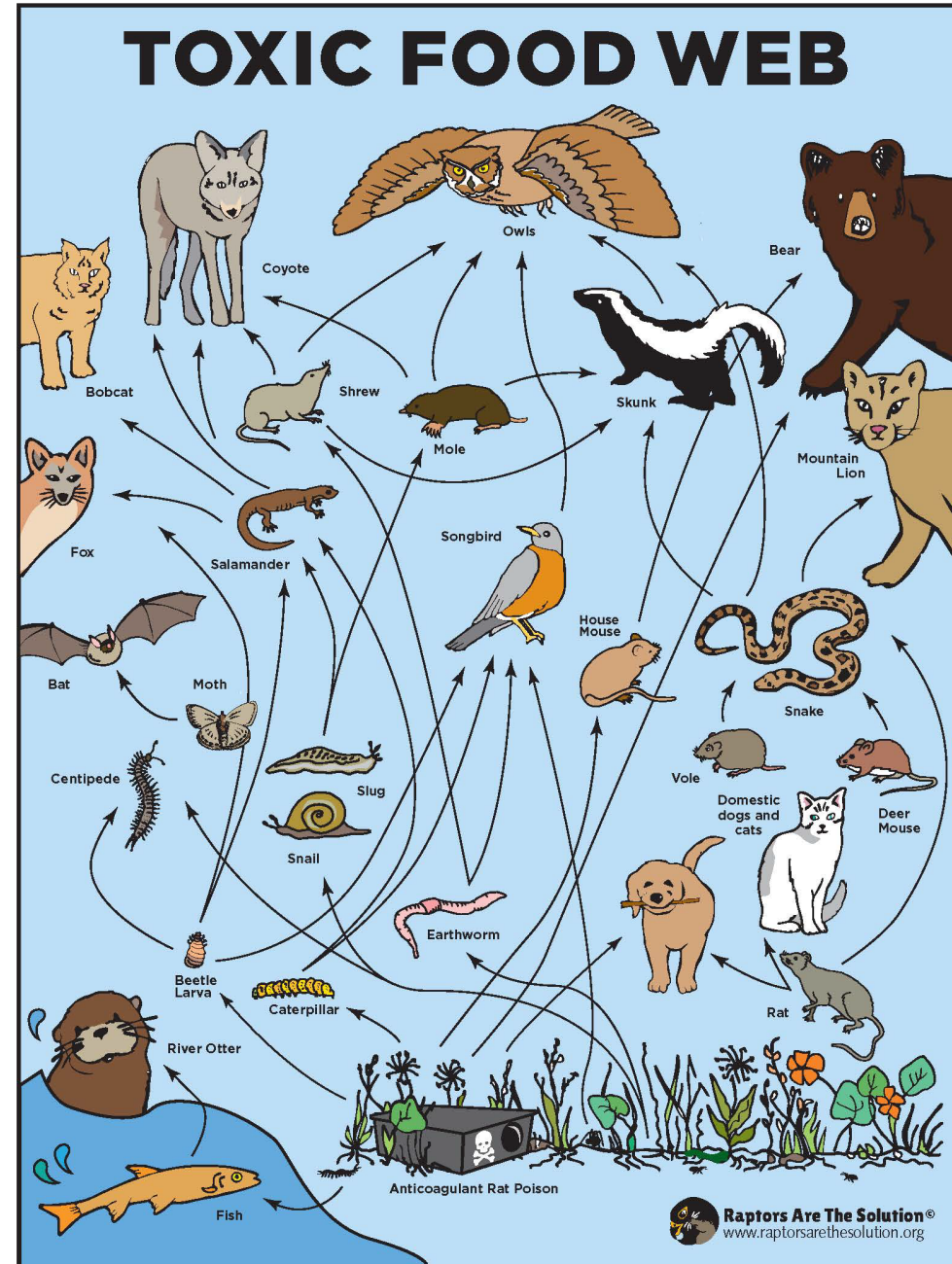
Exposure pathways of anticoagulant rodenticides to nontarget wildlife

John E. Elliott • Sofi Hindmarch •
Courtney A. Albert • Jason Emery •
Pierre Mineau • France Maisonneuve

Rodenticides detected in liver samples of Norway rats at both baited and non-baited farms.

Also detected in a vole, song sparrow, carrion beetles.

A house sparrow was seen entering bait stations and feeding on bait.



The carrion beetle was from an unbaited farm.



Carrion Beetle:
[University of Wisconsin](http://www.raptorsarethesolution.org)
Free Poster Download:
[Raptors are the Solution](http://www.raptorsarethesolution.org)



Pesticide Control: Site Specific Farming

- Consider the spatial and temporal variability within your farm (even from a “low tech” perspective)
- Satellite imagery and small flying units (drones and raptors) have shown promising results to detect the difference between nutrient deficiencies and insect/weed problems
- Site-specific farming requires farmers to think ahead and think differently than conventional farm practices do. It involves some important steps that must be followed properly:
 1. Finding your location using Global Positioning System (GPS) receivers, Global Information System (GIS) mapping, ground-based sensors, and/or satellite imagery
 2. Evaluating your location by gathering information
 3. Applying variable-rate inputs



Text DIRECTLY from this excellent article on Site Specific Farming: [UMaine Extension](#)

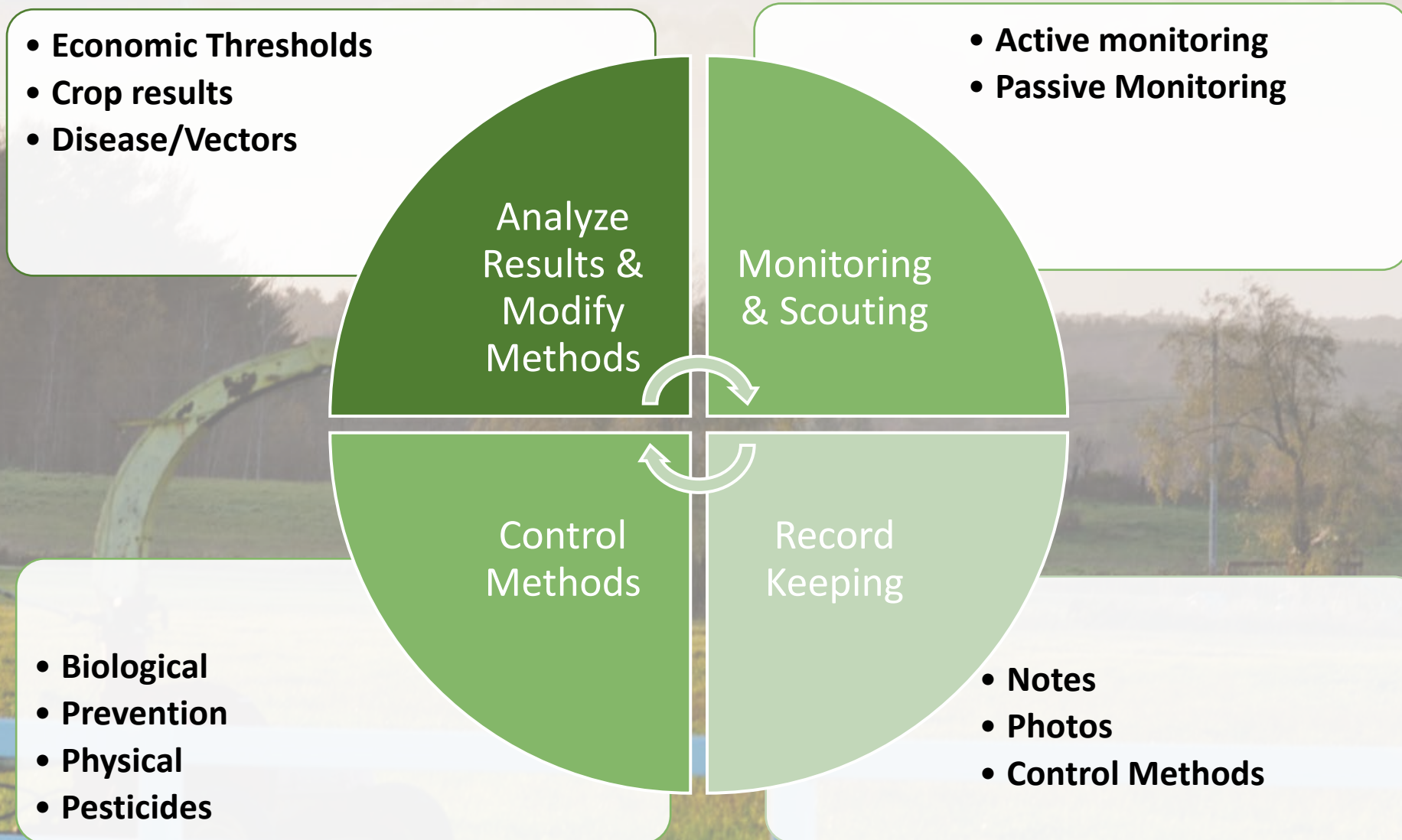


Pesticide Control: Resources in Maine & Online



Resource	What they can help with...
Maine Board of Pesticides Control	<ul style="list-style-type: none">• Applicator registration, credit calendar and trainings, search for Maine Registered Products, “Ask the Expert” contact list, and more!• Calibration resources
UMaine Precision Agriculture Team	<ul style="list-style-type: none">• Reducing unnecessary insecticide/herbicide applications in areas where no insect/weed problem exists
UMaine Extension Crop-Specific Information	<ul style="list-style-type: none">• Potatoes – Pest Control Guide; a list of recommended chemicals labeled for use on potatoes in Maine• Blueberries – IPM website with publications and several tools including pesticide charts• Cranberries – Pest management updates and recommendations• And more!

The IPM Cycle – putting it all together





Further Education: Resources in Maine & Online



IPM is ultimately a learning process & a puzzle

This is what makes well-thought out pest management fulfilling & interesting

BENEFITS OF LIFELONG LEARNING

- NURTURES CURIOUS MINDS**
- BUILDS NEW SKILLS, IMPROVES THOSE YOU ALREADY HAVE**
- OPENS MINDS AND INCREASES WISDOM**
- IMPROVES MEMORY AND INCREASES SELF-CONFIDENCE**



Further Education: Resources in Maine & Online



Search

2 unavailable videos are hidden

Pruning Why, When & How we prune woody plants

Jan Letter
jls95@cornell.edu

Cornell Cooperative Extension Putnam County

What's Bugging You? First Fridays

NYSIPM
38 videos 7,484 views Updated 4 days ago

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▶ Play all **↻ Shuffle**

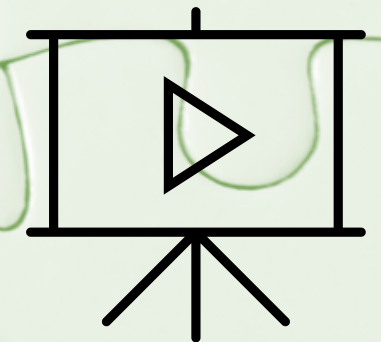
These videos are recorded as part of the What's Bugging You First Fridays virtual series. To see the schedule of events and attend live meetings, visit the event page <https://nysipm.cornell.edu/whats-bugging-you/first-friday-events/>

- Winter Tree & Shrub Pruning | 2023 First Friday Recap**
NYSIPM • 84 views • 7 days ago
- 2023 What's Bugging You First Friday Year in Review**
NYSIPM • 95 views • 2 weeks ago
- Houseplant IPM | Firewood pests 12/1/2023**
NYSIPM • 232 views • 1 month ago
- Getting your garden ready for winter | Keep doing tick checks this fall 11/3/2023**
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- Invasive Jumping Worms | Roof Gutter Pests 10/6/2023**
NYSIPM • 867 views • 3 months ago
- Right Plant, Right Place | Transplanting Trees and Shrubs 9/1/2023**
NYSIPM • 321 views • 4 months ago
- Woodchucks | Bats 8/4/2023**
NYSIPM • 514 views • 5 months ago

Spotted Wing Drosophila | Spiders 7/7/2023

There are many good quality webinars available free online. Look for good quality webinars from:

- IPM Centers
- Government Accounts
- University / Extension Accounts





Further Education: Resources in Maine & Online

umaine extension

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Decentralized Work Application

Example scenario:
- A major accident has happened at an industrial site, leading to a spread of chemicals into the surrounding environment. In order to take measurements of several critical variables, a number of agents with different types of sensors are needed at the site within a specified time frame.
- There is no time to spare.

Fatality Interviews

- Where were you born? How long did you live there?
- Where have you spent the most time? How long were you there?
- Where do you now call home? How long have you lived there?
- Where are you as you survey? How long have you been there?

106 videos

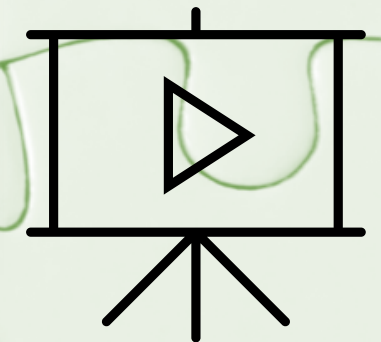
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There are many good quality webinars available free online. Look for good quality webinars from:

- IPM Centers
- Government Accounts
- University / Extension Accounts





Further Education: Resources in Maine & Online

Resource	What they can help with...
Maine Organic Farmers and Gardeners Association	<ul style="list-style-type: none">Farmer resources including pest reports and many useful training events online and in-person under “Farmer Resources” and “Trainings”.
Crop-Specific Groups	<ul style="list-style-type: none">Maine Pomological Society – nonprofit comprised of apple orchards throughout Maine.Wild Blueberry Commission of Maine - supporting the development of promotional opportunities and other activities related to the wild blueberry industry.Maine Potato Board - represents over 300 growers statewide.
DACF Grower Resources	<ul style="list-style-type: none">Horticulture Program – Invasive plants, MELeaf Newsletter, DACF Resource LibraryIPM Council & Maine IPM ProgramGotpests.org – Pest identification resource with factsheets
Free online webinars!	<ul style="list-style-type: none">First Friday Series from New York State IPM, archived online, and upcoming events