



WHAT'S BUGGING YOU MIGHT *NOT* BE BUGGING YOUR TOMATOES!

beneficials and pests

RESOURCES

- Growing Home Garden Tomatoes -

<https://extension.missouri.edu/publications/g6461>

- 2022 Midwest Vegetable Guide -

<https://mdc.itap.purdue.edu/item.asp?ItemNumber=ID-56>

- Slides: <https://bit.ly/39CG57C>



INTEGRATED PEST MANAGEMENT (IPM)

- A science-based approach that combines a variety of techniques to manage pests.
- Includes the study of insect life cycles and how pests interact with the environment.
- IPM professionals manage pests with current methods to improve management, lower costs, and reduce risks to people and the environment.
- Includes:
 - Altering surroundings
 - Adding beneficial arthropods
 - Growing plants that resist pests
 - Disrupting development of pests
 - Prevention of pest problem developing
 - Disrupting insect behaviors
 - Proper use of pesticides

What is IPM?

Integrated Pest Management is a science-based approach that combines a variety of techniques. By studying their life cycles and how pests interact with the environment, IPM professionals can manage pests with the most current methods to improve management, lower costs, and reduce risks to people and the environment.

IPM tools include:

- Alter surroundings
- Add beneficial insects/organisms
- Grow plants that resist pests
- Disrupt development of pest
- Prevention of pest problem developing
- Disrupt insect behaviors
- Use pesticides

1 IDENTIFY/MONITOR

Determine the causal agent and its abundance (contact your local extension agent for help).

2 EVALUATE

The results from monitoring will help to answer the questions: Is the pest causing damage? Do we need to act? As pest numbers increase toward the economic threshold further treatments may be necessary.

3 PREVENT

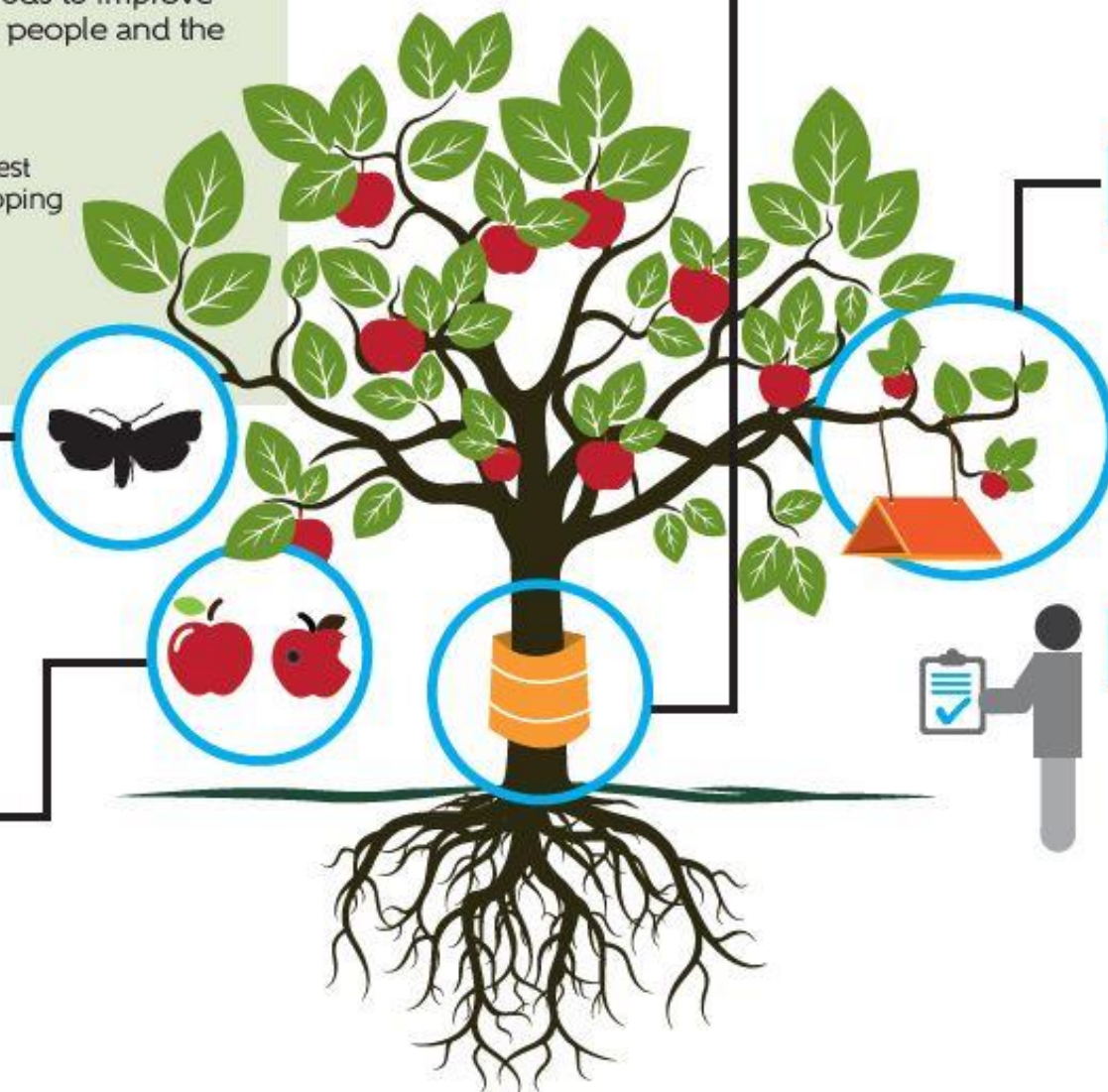
Some pest problems can be prevented by using resistant plants, planting early, rotating crops, using barriers against climbing pests, sanitation, and sealing cracks in buildings.

4 ACTION

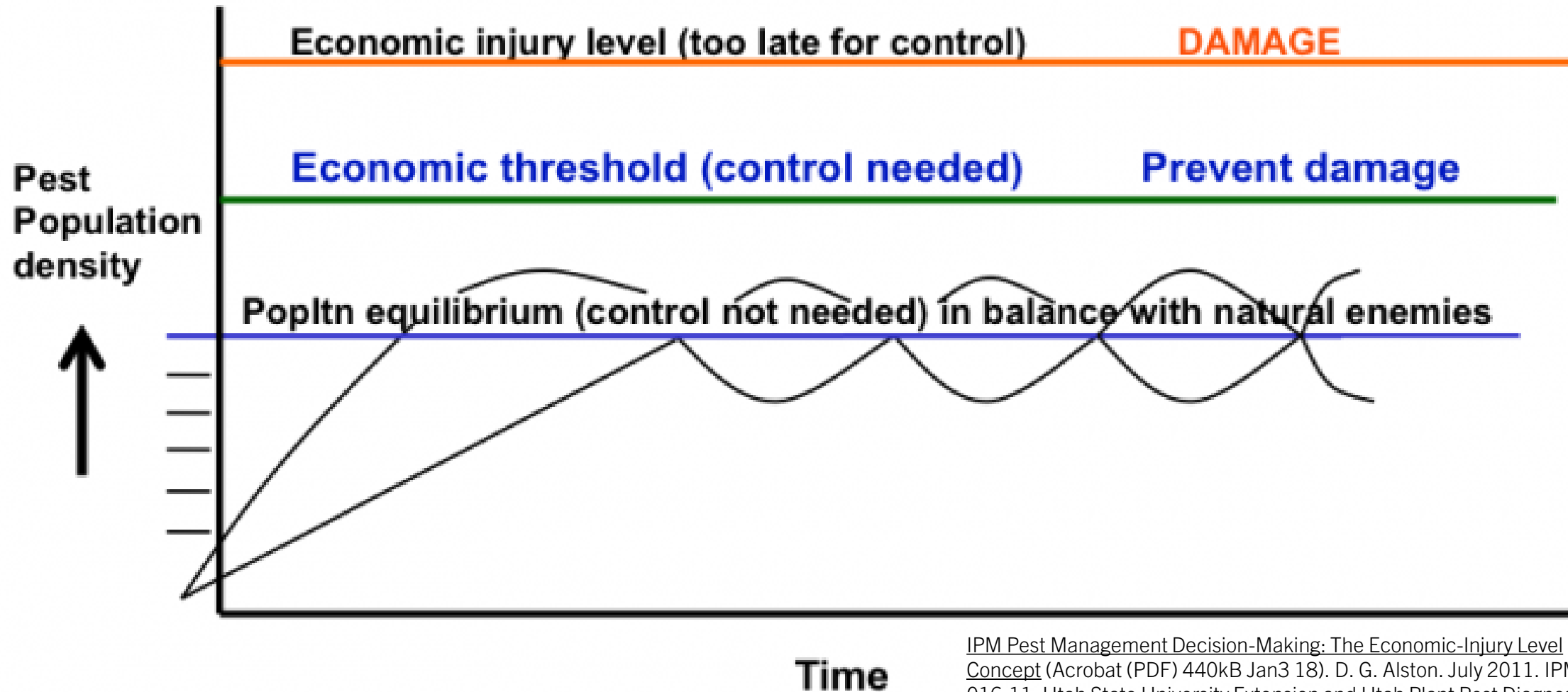
IPM uses multiple tools to reduce pests below an economically damaging level. A careful selection of preventive and curative treatments will reduce reliance on any one tactic and increase likelihood of success.

5 MONITOR

Continue to monitor the pest population. If it remains low or decreases, further treatments may not be necessary, but if it increases and exceeds the action threshold, another IPM tool should be used.



Integrated Pest Management (IPM)



IPM Pest Management Decision-Making: The Economic-Injury Level Concept (Acrobat (PDF) 440kB Jan3 18). D. G. Alston. July 2011. IPM 016-11. Utah State University Extension and Utah Plant Pest Diagnostic Laboratory

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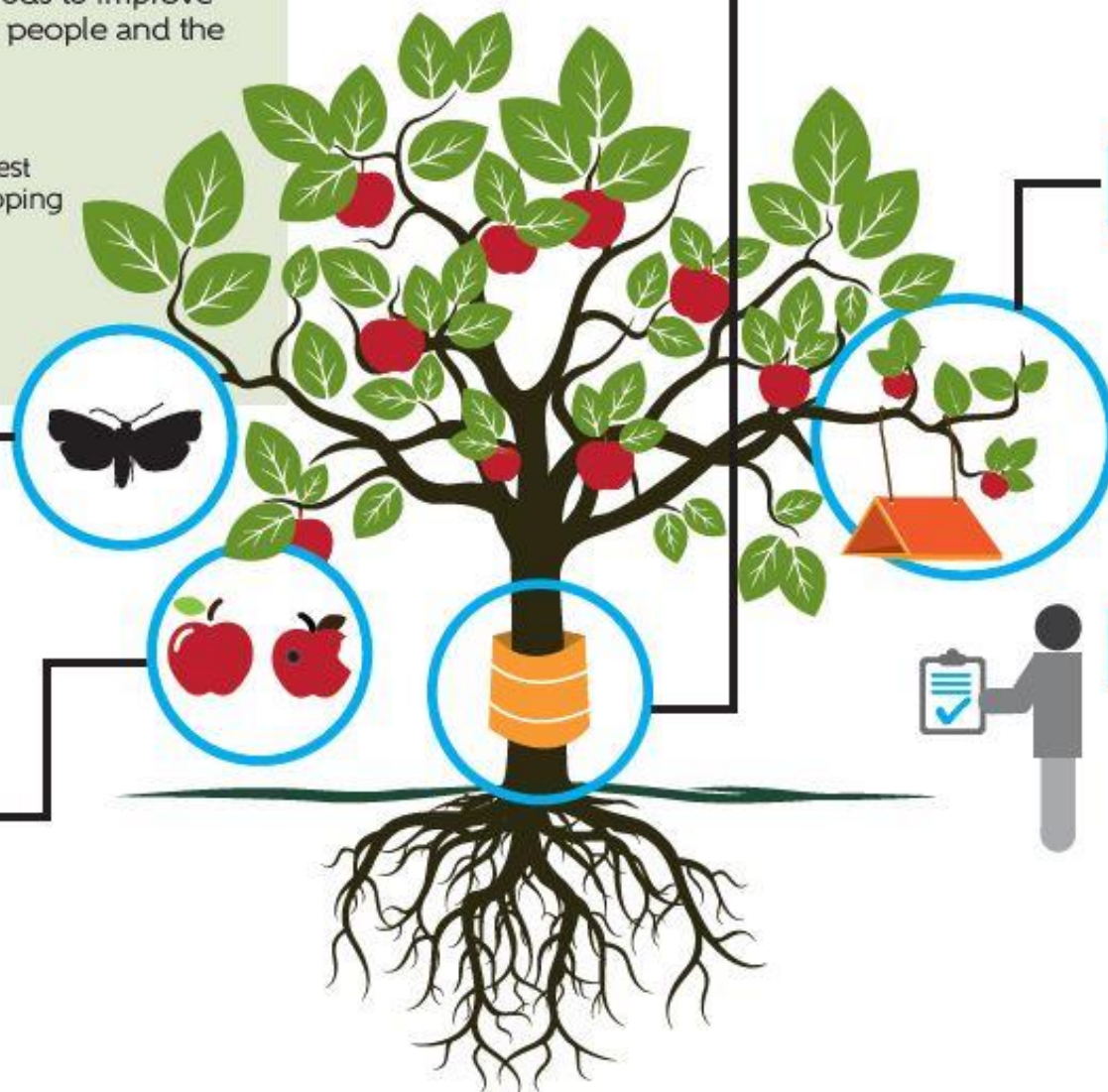
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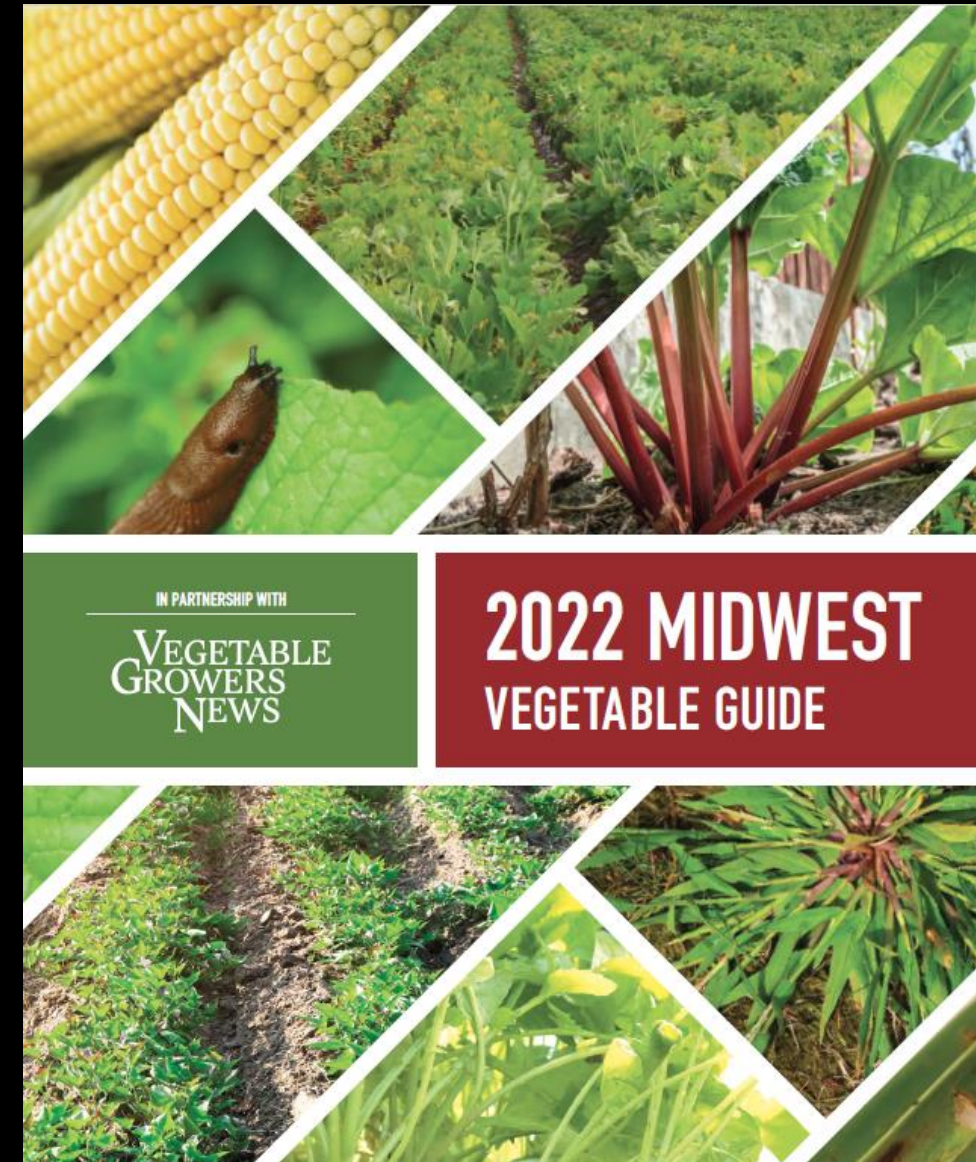
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FRIEND OR FOE

- White card = friend (beneficial)
- Blue card = foe (pest)



APHIDS



APHIDS

- Aphids transmit viral diseases.

- Home gardener

Insecticidal soaps, removing weeds, strong spray of water

- Greenhouse

Release the predatory midge *Aphidoletes aphidimyza*, lady beetles *Adalia bipunctata* and *Hippodamia convergens*, and lacewings *Chrysopa carnea* and *Chrysoperla rhyfilabris*.

Depending on the aphid species, co-release a parasitoid wasps like *Aphelinus abdominalis*, *Aphidius colemani*, *Aphidius ervi*, or *Aphidius matricariae*.

Avoid insecticides when deploying natural enemies.

Commercial pesticides

Actara (25WDG) (thiamethoxam), Admire Pro (4.6SC) (imidacloprid), Assail 30SG (acetamiprid), Beleaf (50SG) (flonicamid), Dimethoate 4EC (dimethoate), Pyganic EC 5.0 II (0.41) (pyrethrins) and others



ASSASSIN BUG



ASSASSIN BUG

- General predator
- They are common natural control agents and feed on caterpillars and many other plant feeding insects.
- Not sold commercially

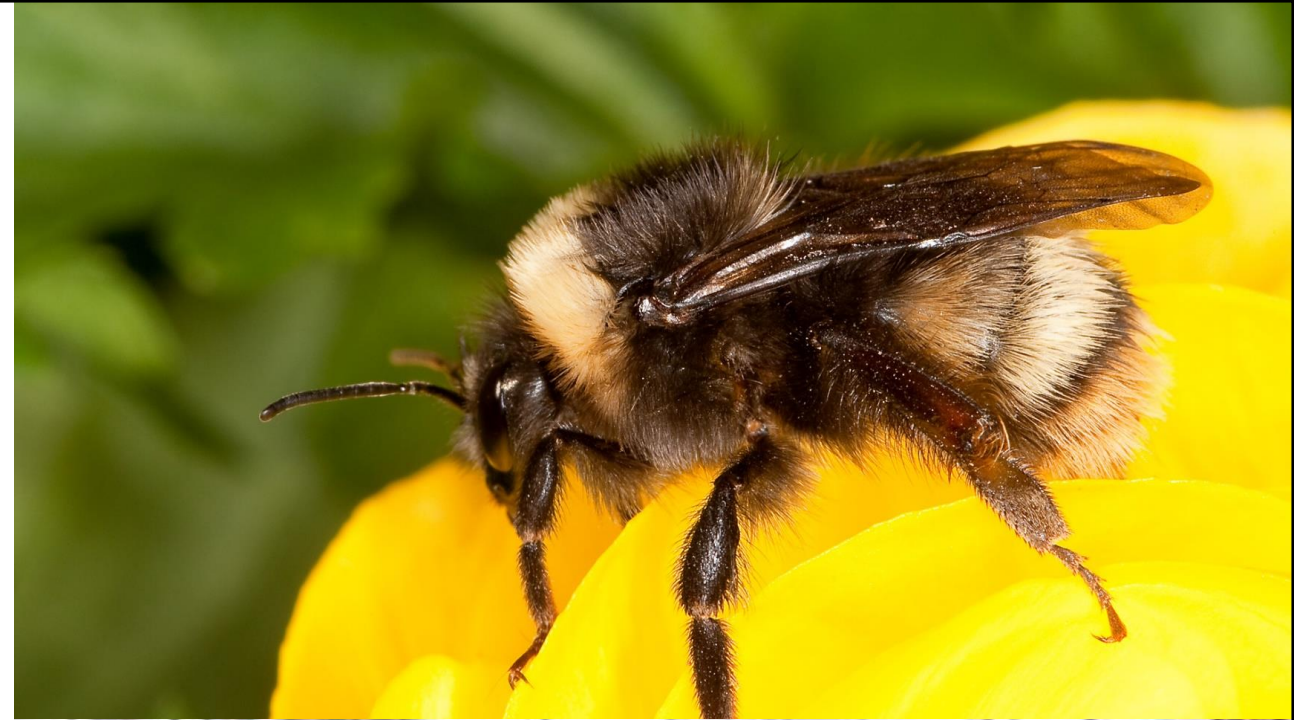


BEEES



B E E S

- Tomatoes are self-pollinating, but you get greater yields when bees visit the flowers
- Buzz pollination by bumblebees
- Home gardener
 - Provide habitat for native bee populations
- Commercial growers
 - Can purchase bumble bee colonies



BIG-EYED BUG



BIG-EYED BUG

- Oval and commonly black, brown, gray, or red with a wide head and bulging eyes.
- Adults range from about 1/8 - 1/4 inch long.
- Big-eyed bugs feed on bug nymphs, flea beetles, insect eggs, small caterpillars, and all stages of aphids, mites, and whiteflies.
- Big-eyed bugs also feed harmlessly on pollen, seeds, and plant juices and are not plant pests.
- Big-eyed bug abundance can be increased by planting flowering species that provide blossoms throughout the growing season.



CUTWORM



CUTWORM

- Several species
- Home gardeners
Hand pick, wax paper/cardboard collars, Bt
- Commercial growers
Disking the field, remove winter annual weeds, monitor at dawn to search for larvae
Pesticides - Bt, Brigade 2EC (bifenthrin), Diazinon AG500 (4ES) (diazinon), Entrust SC (2) (spinosad), Perm-Up 25DF (permethrin), Pyganic EC 5.0 II (0.41) (pyrethrins), and others



FLEA BEETLE



FLEA BEETLE

- Black or brown jumping bugs 1/16 inch long that attack young transplants
- Adult beetles chew numerous small holes in leaves, referred to as “shot holes”
- Home gardeners
 - Control weeds and remove old crop debris
 - Use row covers when seedlings are growing
 - Use trap crops to attract beetles. Spray the beetles on the trap crop
- Commercial growers
 - Same as home gardeners
 - Brigade 2EC (bifenthrin), Perm-Up 25DF (permethrin), Sevin XLR Plus (4SC) (carbaryl), Warrior II (2.08CS) (lambda-cyhalothrin), and others



HORNWORM



HORNWORM

- Large green worms up to 4 inches long that eat foliage and fruit.
- Usually a home gardener issue but can affect commercial fields.

- Home gardeners
Hand pick, Bt
- Commercial growers

Treatment is not usually necessary

Trichogramma spp. And *H. exigua* parasitoids, as well as general predators

Bt, Brigade 2EC (bifenthrin), Diazinon AG500 (4ES) (diazinon), Entrust SC (2) (spinosad), Perm-Up 25DF (permethrin), Pyganic EC 5.0 II (0.41) (pyrethrins), and others



LACEWING



LACEWING

- *Larvae and adults prey on aphids, whitefly, and thrips*
- *Chrysopa carnea and Chrysoperla rhytilabris.*



**LADY BIRD
BEETLE
(AKA LADYBUG)**



LADY BIRD BEETLE (AKA LADYBUG)

- *Larvae and adults prey on aphids, whitefly, and thrips*
- Recommended native spp. - *Adalia bipunctata* and *Hippodamia convergens*
- Over 450 species are found in North America. One of the most recognized biocontrol beneficial
- Field-collected convergent lady beetles are commercially available for use against crop pests, specifically aphids.



MINUTE PIRATE BUG



MINUTE PIRATE BUG

- Small ($\frac{1}{5}$ th of an inch) predacious insects with a distinct triangular head
- Prey on corn earworm eggs and small soft-bodied insects like aphids, whiteflies, and thrips
- Adults live for 3-4 weeks
- Some people do not consider these beneficial because they lay their eggs in plant tissue. But some people intentionally release these into greenhouses and fields to control pests

Images: Egg mass by Jonathan Lundgren (VA Cooperative Extension); Nymph feeding on aphid by Iowa State Extension; Minute pirate bug by William Ferguson (VA Cooperative Extension), Minute pirate bug photo by Jack Dykinga, Image Number K7549-8



PRAYING MANTIS



PRAYING MANTIS

- General predator
- Two species in US
- 2-4 inches long, green or brown.
- May be difficult to reliably use for biocontrol
- Egg masses may be available for purchase



SPIDERS



SPIDERS

- General predator
- Many species
- Not available for purchase



SPIDER MITES



SPIDER MITES

- Tiny tannish mite, barely visible to the naked eye, that causes many small yellow specks and fine webs.
- Home gardener
Forceful water sprays, insecticidal soaps or chemical sprays may be used for control.
- Commercial grower
Acramite 50WS (bifenazate), Agri-Mek SC (0.7) (abamectin), Pyganic EC 5.0 II (0.41) (pyrethrins), and others



Statewide IPM Project
Regents, University of California



IPM Project
University of California

STINK BUGS



STINK BUGS

- Brown, green or black shield-shaped bugs that give off a foul odor. They suck juices from the plant and cause hard whitish spots just under the skin of the fruit.
- Spined soldier bug is beneficial!
- Home gardeners
Hand pick, some pesticides
- Commercial growers
Azera (C) (azadirachtin, pyrethrins), Brigade 2EC (bifenthrin), Danitol 2.4EC (30.9) (fenpropathrin), and others



THRIPS



THRIPS

- Thrips transmit viral diseases, most importantly Tomato spotted wilt virus (TSWV)
- Home gardeners
- Commercial growers

Release the predatory mites *Amblyseius swirskii*, *Neoseiulus cucumeris* and *Stratiolaelaps scimitus*, minute pirate bug *Orius spp.* and beneficial nematode *Steinernema feltiae* to achieve pest suppression. *A. swirskii*, *N. cucumeris* and minute pirate bugs prey on life stages residing on the upper portion of the plant, *S. scimitus* and the beneficial nematodes attack the prepupae and pupae of thrips located in the soil or growing media.

Pesticides - Brigade 2EC (bifenthrin), Entrust SC (2) (spinosad), Transform WG (50) (sulfoxaflor), and others



TOMATO FRUITWORMS



TOMATO FRUITWORMS

- Green, brown or pink worm that eats holes in fruit and buds. AKA corn earworm.
- Sprays during June help control this insect.
- Make several applications.
- Home gardeners
Hand pick, Bt, some pesticides
- Commercial growers
Trichogramma spp. egg parasites and the larval parasite *Hyposoter exiguae*. Big-eyed bugs and minute pirate bugs can also be important.
Bt, Brigade 2EC (bifenthrin), Diazinon AG500 (4ES) (diazinon), Entrust SC (2) (spinosad), Perm-Up 25DF (permethrin), Pyganic EC 5.0 II (0.41) (pyrethrins), and others



WASPS



WASPS

- *Parasitoid wasps lay eggs in larvae or eggs.*
- *Larger wasps prey on caterpillars to provision nests for offspring*
- Recommended parasitoids (depending on the pest): *Aphelinus abdominalis*, *Aphidius colemani*, *Aphidius ervi*, *Aphidius matricariae*, *Encarsia formosa*, *Eretmocerus eremicus*, *Microctonus vittatae*



WHITEFLY



WHITEFLY

- Tiny (~1/16 inch) insect with yellowish body and white wings.
- Several species can infest tomatoes, but only 2 species are economically important

- Can vector diseases

- Home gardeners

Good sanitation practices, conserving natural enemies, monitor

- Commercial growers

Avoid infestation is the most effective IPM approach. Respecting host-free periods, planting tomatoes at least ½ mile upwind from infest crop, destroying and removing all crop residue asap

Release the predatory mite *Amblyseius swirskii*, lady beetle *Delphastus catalinae*, and mirid bug *Dicyphus hesperus*. Also consider co-releasing a parasitoid wasps like *Encarsia formosa*, or *Eretmocerus eremicus*.

Avoid insecticides when deploying natural enemies.

Pesticides - Brigade 2EC (bifenthrin), Knack (0.86) (pyriproxyfen, Transform WG (50) (sulfoxaflor), and others



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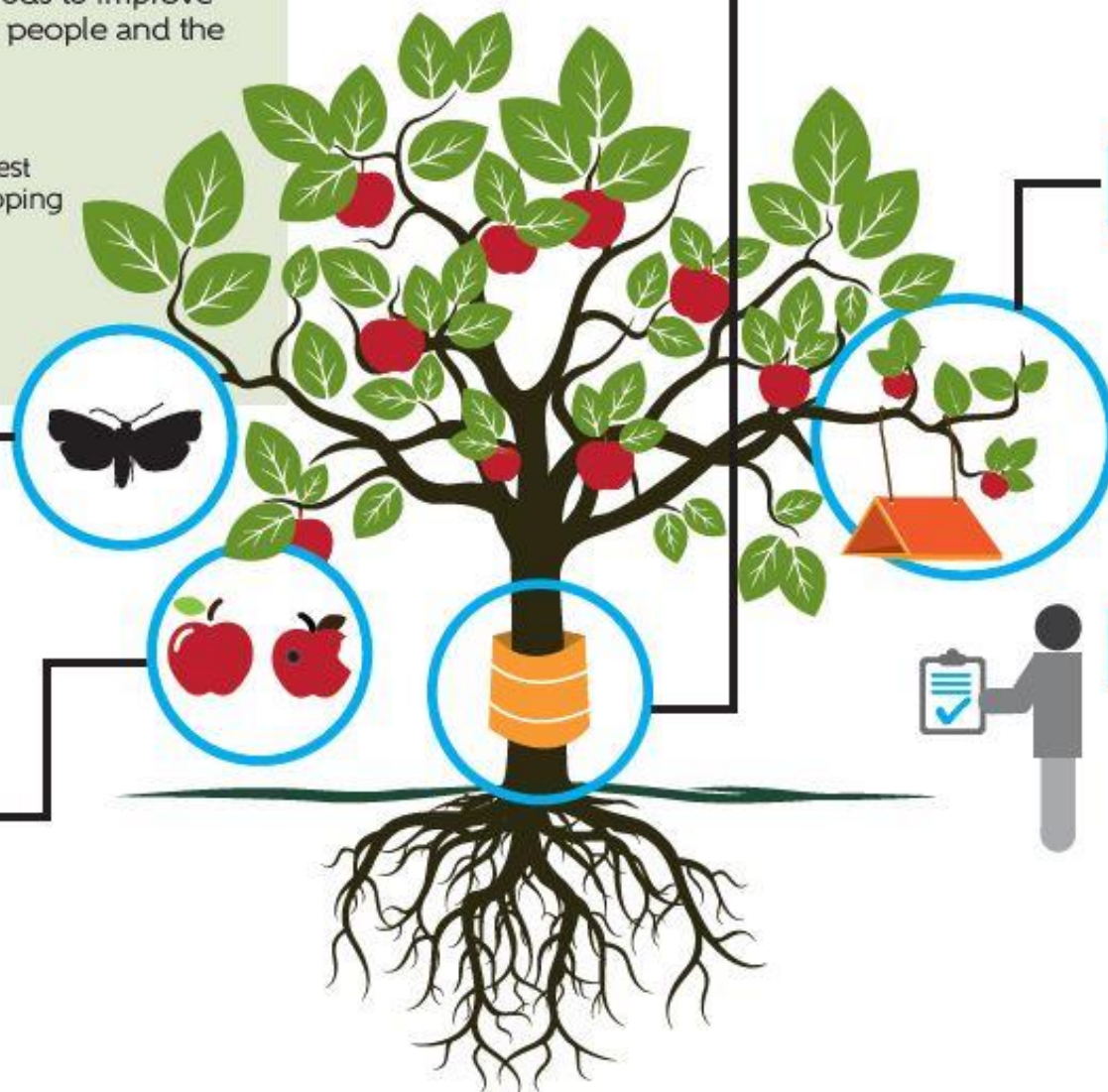
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PESTS ON TOMATOES

- Aphids
- Cutworm
- Flea beetles
- Hornworm
- Stink bugs
- Spider mites
- Thrips
- Tomato fruitworms
- Whitefly



BENEFICIAL ARTHROPODS

- Assassin bug
- Bees
- Big-eyed bug
- Lacewing
- Lady bird beetle (aka ladybug)
- Minute pirate bug
- Praying mantis
- Spiders
- Wasps
 - Braconid wasp
 - Paper wasp
 - Trichogramma wasp
 - Other wasps



HOW TO ATTRACT BENEFICIALS

- Create habitat
 - Plant flowers
 - Create nesting space
- Intercrop
 - Cilantro has been shown to increase beneficial diversity and decrease pests. Other herbs may be helpful, too.
 - Marigolds have been shown to increase beneficial diversity and decreases some pests.
- Reduce or eliminate pesticides



PLEASE NOTE:

- There are other arthropods you will come across as you grow tomatoes!
- Most are beneficial or neutral, and there are additional pests.
- Identify the organism before taking any action.
- MU Extension can help.

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QUESTIONS

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Slides: <https://bit.ly/39CG57C>