Integrated Pest Management for Organic Growing

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Entomologist, Utah State University

Organic Growing Workshop, Wheeler Farm, SLC

March 29th, 2014

IPM: Integrated Pest Management

- Prevents pests & plant health problems
- Uses a combination of methods
  - Cultural
  - Mechanical
  - Biological
  - Chemical

Preferred Order

- Increases tolerance of plants to pests
- Avoids harm to human & environmental health
- Improves sustainability (environment, economics, and social)

Develop an IPM Program for your Organic Garden

Organic tools

Practical

Sustainable

1. Know Your Resources

Local & Online

Utah State University Extension

USU Extension Pest Management Team

Dr. Ricardo Ramirez
Entomologist

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Plant Pathologist

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IPM Project Leader

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IPM Coordinator

Ryan Davis
Arthropod Diagnostician
Utah Plant Pest Diagnostic Lab

Dr. Lori Spears
Entomologist
Invasive Pest Survey

Utah Pests Online Resources

www.utahpests.usu.edu

One-stop shopping for pest management information

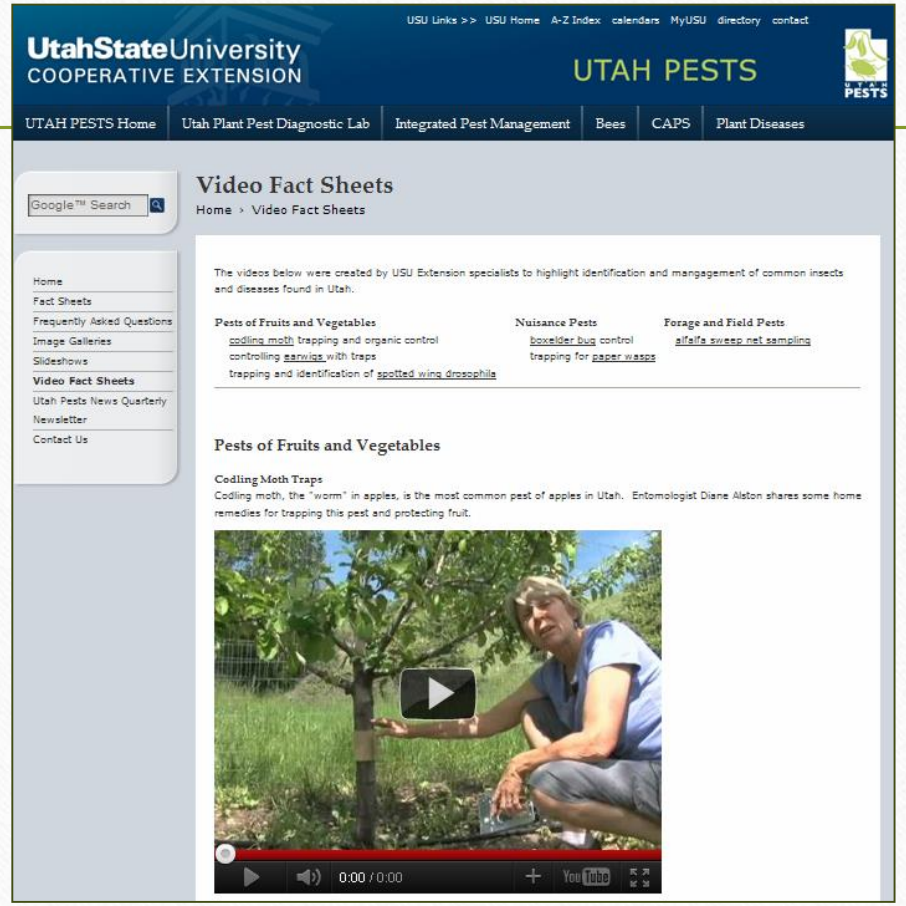
Fact Sheets

Arthropods and plant diseases:

232 fact sheets

Health-related
Forage & field crops
IPM (general)
Natural enemies
Nuisance
Ornamental
Pantry
Pollinators
Small fruit
Structural
Tree fruit
Vegetable

Video Fact Sheets



4-7 min how-to videos

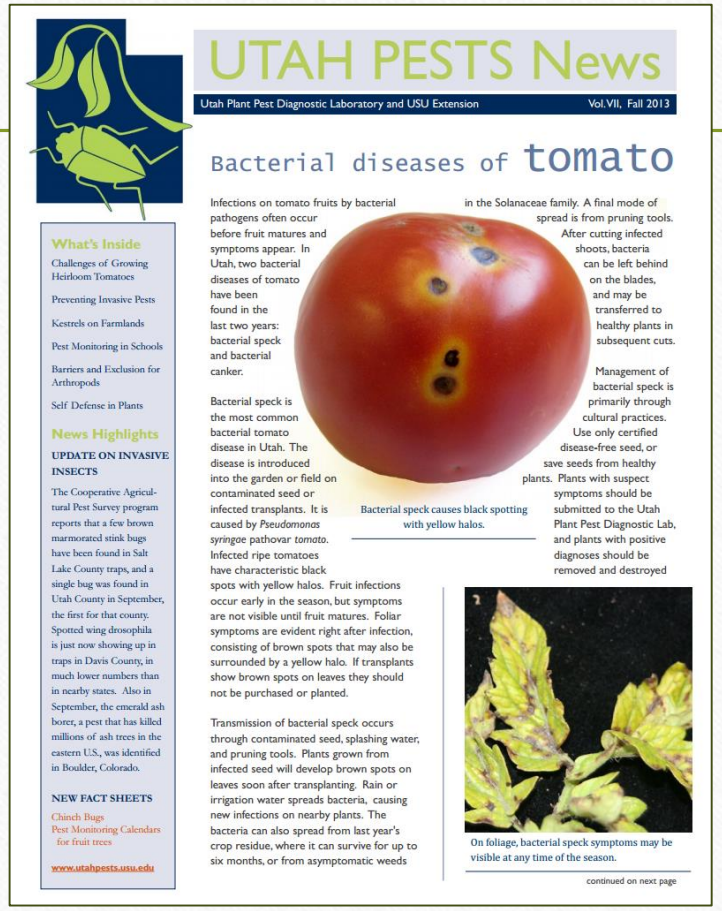
homemade insect traps

low toxicity pest management options

insect identification

insect monitoring

Utah Pests Newsletter



UTAH PESTS News

Utah Plant Pest Diagnostic Laboratory and USU Extension — Vol. VII, Fall 2013

Bacterial diseases of tomato

What's Inside

Challenges of Growing Heirloom Tomatoes

Preventing Invasive Pests

Kestrels on Farmlands

Pest Monitoring in Schools

Barriers and Exclusion for Arthropods

Self Defense in Plants

News Highlights

UPDATE ON INVASIVE INSECTS

The Cooperative Agricultural Pest Survey program reports that a few brown marmorated stink bugs have been found in Salt Lake County traps, and a single bug was found in Utah County in September, the first for that county. Spotted wing drosophila is just now showing up in traps in Davis County, in much lower numbers than in nearby states. Also in September, the emerald ash borer, a pest that has killed millions of ash trees in the eastern U.S., was identified in Boulder, Colorado.

NEW FACT SHEETS

Chinch Bugs
Pest Monitoring Calendars for fruit trees

www.utahpests.usu.edu

Infections on tomato fruits by bacterial pathogens often occur before fruit matures and symptoms appear. In Utah, two bacterial diseases of tomato have been found in the last two years: bacterial speck and bacterial canker.

Bacterial speck is the most common bacterial tomato disease in Utah. The disease is introduced into the garden or field on contaminated seed or infected transplants. It is caused by *Pseudomonas syringae* pathovar *tomato*. Infected ripe tomatoes have characteristic black spots with yellow halos. Fruit infections occur early in the season, but symptoms are not visible until fruit matures. Foliar symptoms are evident right after infection, consisting of brown spots that may also be surrounded by a yellow halo. If transplants show brown spots on leaves they should not be purchased or planted.

Transmission of bacterial speck occurs through contaminated seed, splashing water, and pruning tools. Plants grown from infected seed will develop brown spots on leaves soon after transplanting. Rain or irrigation water spreads bacteria, causing new infections on nearby plants. The bacteria can also spread from last year's crop residue, where it can survive for up to six months, or from asymptomatic weeds in the Solanaceae family. A final mode of spread is from pruning tools. After cutting infected shoots, bacteria can be left behind on the blades, and may be transferred to healthy plants in subsequent cuts.

Management of bacterial speck is primarily through cultural practices. Use only certified disease-free seed, or save seeds from healthy plants. Plants with suspect symptoms should be submitted to the Utah Plant Pest Diagnostic Lab, and plants with positive diagnoses should be removed and destroyed

Bacterial speck causes black spotting with yellow halos.

On foliage, bacterial speck symptoms may be visible at any time of the season.

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Free, quarterly newsletter

Current pest topics

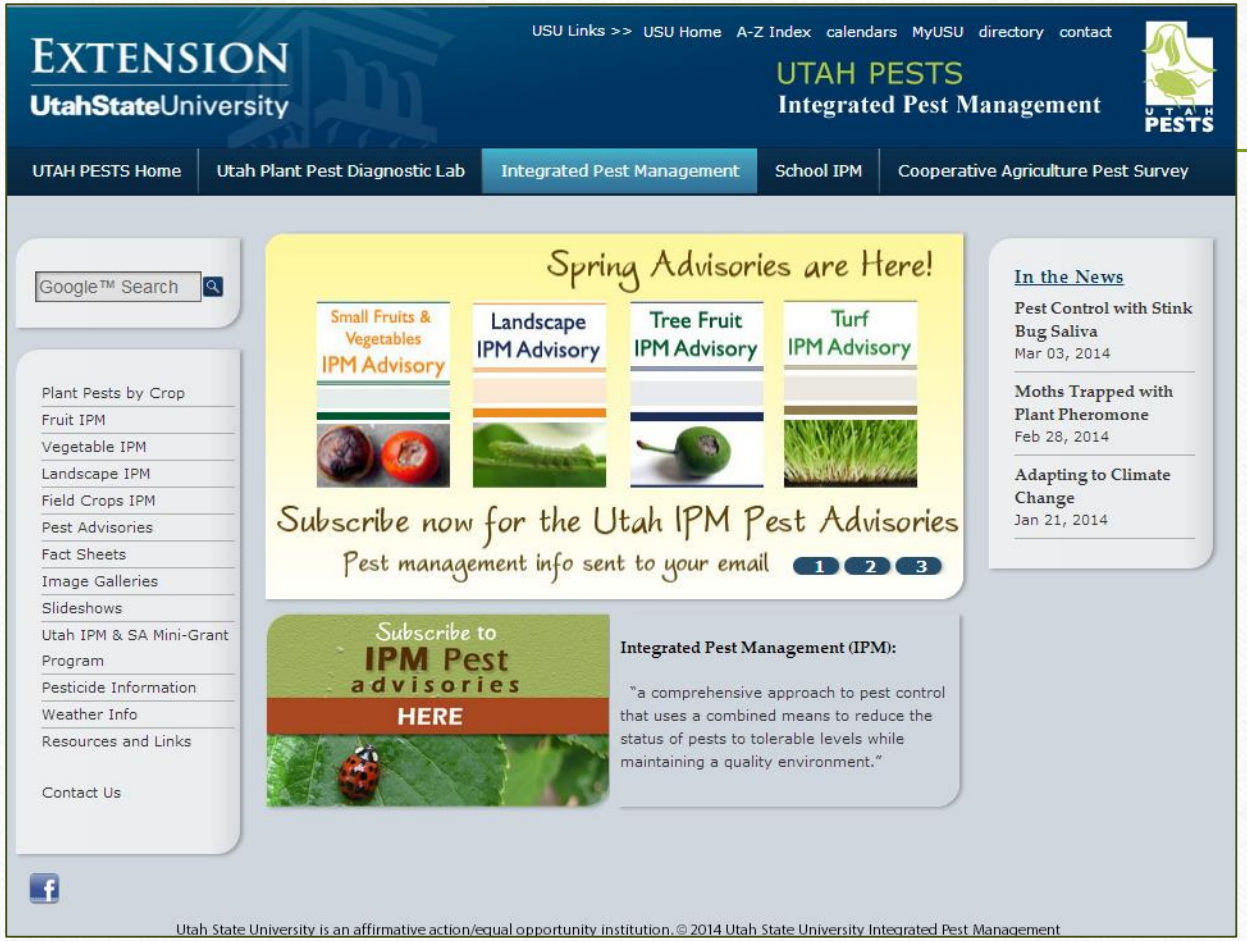
New research results

Useful resources

Sign up to subscribe at

www.utahpests.usu.edu

Pest Advisories



www.ipm.usu.edu

Free subscription: e-mail

Timely info on pest activity

- -insects
- -mites
- -diseases
- -nutrient deficiencies
- -environmental stress

Lots of images!

IPM recommendations

Effective pesticides

Pest Diagnostics

Utah Plant Pest Diagnostic Lab

www.uppdl.usu.edu

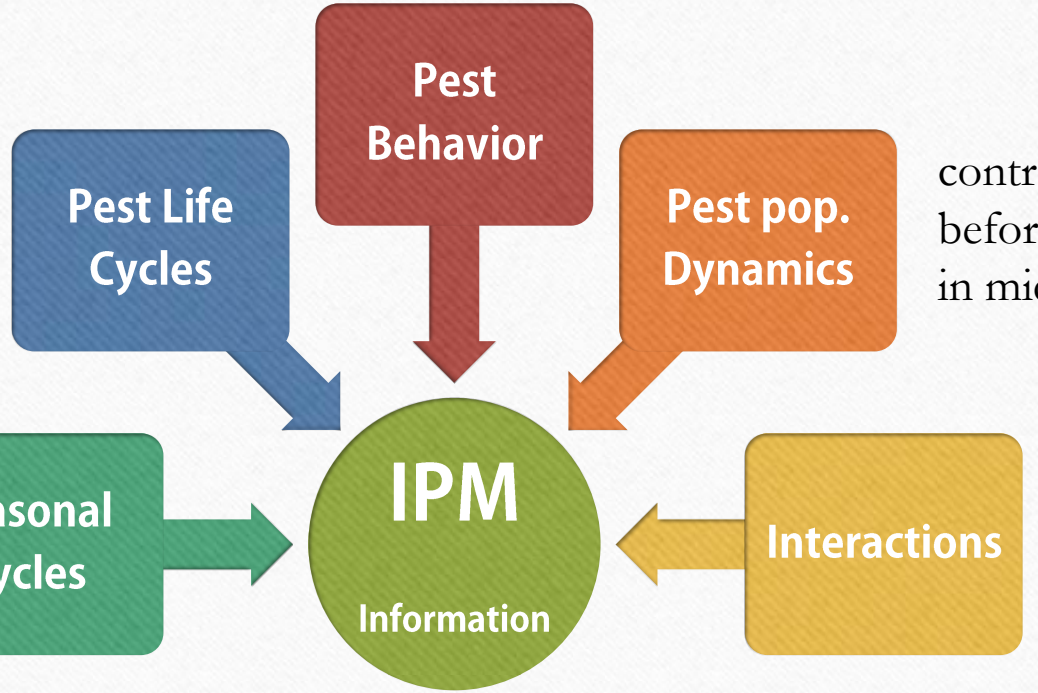
Look for this slideshow and others at utahpests.usu.edu

Over 100
slideshows posted

This one posted under
"Home Yard and Garden"

2. Know Your Plant & Pest Biology

European earwig is attracted to smelly baits



squash bug adults hide over winter; target eggs & hatching nymphs

control grasshoppers before their pops. Peak in mid- to late-summer

seedlings & fruiting plants are more attractive to pests

leaves with dust & powdery mildew are more attractive to spider mites

3. Pest Monitoring

- Look for big picture patterns of plant injury first
- Where to look?
  - new growth, undersides of leaves, on/in stems, inside fruits, on roots in soil, under bark, etc.
  - look at night with a light! - many insects are nocturnal
- Use a hand lens - most insects are small
- Dislodge insects onto a light-colored surface
- Use appropriate traps
  - sticky traps with attractant colors & baits
- Check for crown & root problems

Squash bug eggs & nymphs

Beating tray

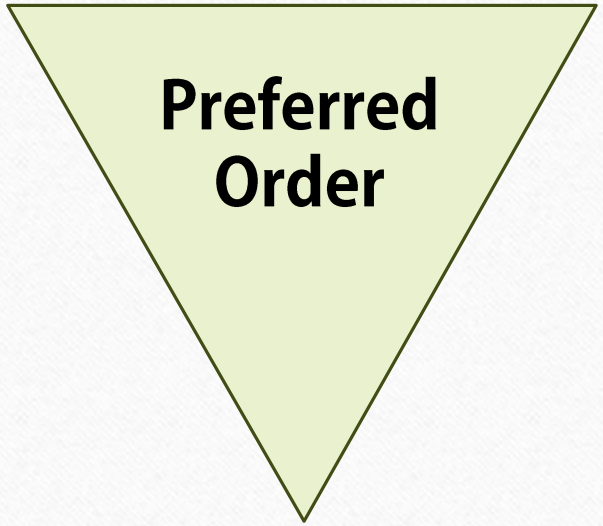
4. Treatment Thresholds

- **Develop personal guidelines**
  - vary with gardener & situation
    - value of plants, costs to manage
- **Invasive & quarantine pests may have lower thresholds**
- **Timing controls with degree-days**
  - what are DDs? - heat units
  - where to get DDs? - USU Ext. IPM Advisories

Traps for codling moth (above) & cherry fruit fly

5. IPM Tactics

- Cultural
- Mechanical
- Biological
- Chemical



Cultural Control:
"Best Practices for Healthy Plants

- Select plant species and cultivars adapted to the site
- Use good plant production practices
  - fertility, water, sunlight, etc.
- For annual plants, rotate location across years
  - avoid build-up of soil pests
- Stressed plants are more attractive and susceptible to pests

Cultural Control:
Enhance Landscape Biodiversity

- "Hides" host plants from pests
- Avoid large monocultures to reduce pest attraction
- Spreads the risk of plant injury (do not put all your eggs in one basket)
- Attracts beneficial insects - diverse food resources

Cultural Control:
Sanitation

- Pick up / chop up dropped fruit
- Remove structures / sites where insects may overwinter (wood piles, garden debris, etc.)
- Prune out diseased limbs (cankers)

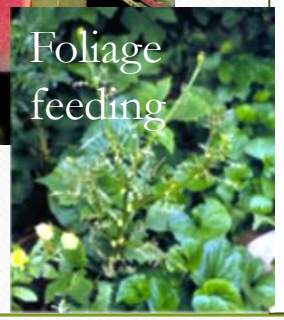
Mechanical Control:
Traps and Barriers

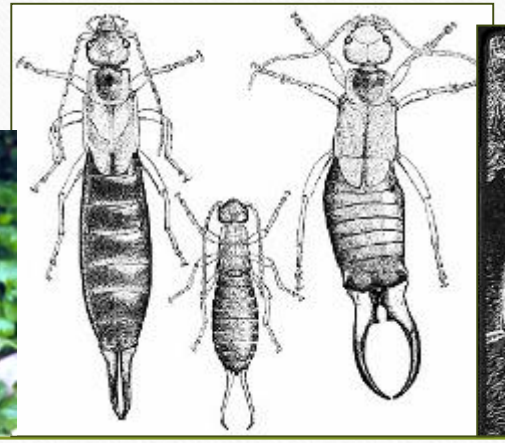
- **Traps**
  - yellow jacket wasps, slugs, spiders
- **Sticky bands**
  - trees and shrubs
- **Row covers**
- **Diatomaceous earth**

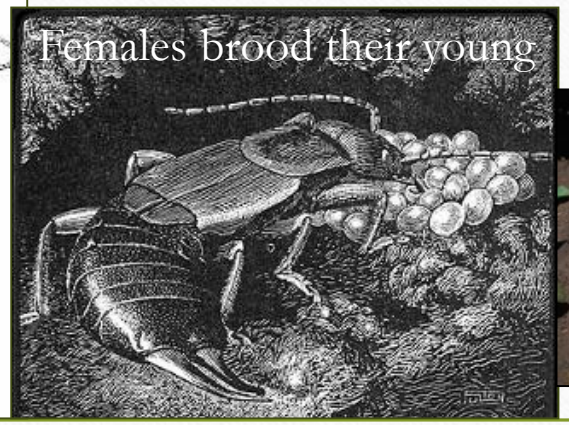
Mechanical Control:
Traps & Exclusion for Earwigs

- **Avoid overuse of mulch and damp debris (earwigs hide during the day)**
- **Traps: fat-based baits, protected refugia**
- **Exclusion: Tanglefoot on base of trunks, stems**

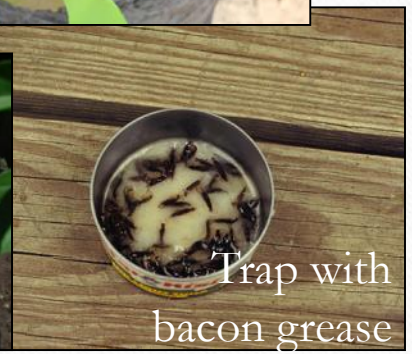

Fruit feeding


Foliage feeding




Females brood their young


Yogurt cup trap


Trap with bacon grease


Refuge trap


Sticky band

Mechanical Control:
Exclusion of Cabbage Worms

- Caterpillars chew large holes in leaves; produce abundant frass (excrement)
- Exclusion: Row cover fabric - cover plants to prevent egg-laying

Floating row cover

Imported cabbage butterfly

Cabbage looper

Mechanical Control:
Oil Sprays (Dormant and In-Season)

Aphids overwinter as eggs on their woody host plants (trees & shrubs)
Dormant oil applied at bud break targets hatching aphid young

San Jose scale overwinters on tree limbs

Biological Control:
Conserve Natural Enemies

- Enhance biodiversity
- Spatial diversity across the landscape
- Temporal diversity, throughout the season and from year to year
- Genetic diversity
- Needs to be the right kind of diversity!!

Beneficial Insects & Pollinators Need a Diverse Diet & Shelter

- **Protein and carbohydrate (sugar) food sources**
  - **Protein**
    - Insect prey, pollen, bird droppings
  - **Carbohydrate**
    - Nectar, plant nectaries, aphid honeydew
- **Shelter & varied habitat**

Flowering perennials & annuals
Trees & shrubs
Herbs
Wildflowers

Native Pollinators

Gardening for Pollinators & Beneficial Insects

www.utahpests.usu.edu – Fact sheets: Insects-Beneficial

UTAH PESTS fact sheet

UtahState University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-133-09 September 2009

Gardening for Native Bees in Utah and Beyond

James H. Cane
Research Entomologist, USDA ARS
Pollinating Insect-Biology, Management, Systematics Research

Linda Kervin
Logan, UT

Do You Know?

- 900 species of native bees reside in Utah.
- Some wild bees are superb pollinators of Utah's tree fruits, raspberries, squashes, melons and cucumbers.
- Few of our native bees have much venom or any inclination to sting.
- Our native bees use hundreds of varieties of garden flowers, many of them water-wise.
- A garden plant need not be native to attract and feed native bees.

Fig. 1. Carder bee (*Anthidium*) foraging at lavender (*Lavendula*: Lamiaceae).[1]

Utah is home to more than 20 percent of the 4,000+ named species of wild bees that are native to North America. Except for bumblebees and some sweat bees, our native bees are solitary, not social, many with just one annual generation that coincides with bloom by their favorite floral hosts. In contrast, the familiar honeybee is highly social, has perennial colonies, and was brought to North America by settlers from Europe. Regardless of these differences, however, all of our bees need pollen and nectar from flowers. The sugars in sweet nectar power their flight; mother bees also imbibe some nectar to mix with pollen that they gather. Pollen is fortified with proteins, oils and minerals that are essential for the diets of their grub-like larvae back at the nest.

Our flower gardens can become valuable cafeterias for local populations of diverse native bees. In our cities and towns, native plant communities have been displaced by pavement, buildings and lawns. In the countryside, grain and hay crops likewise

Fig. 2. A pollinator garden can also be water-wise. Purple *Penstemon strictus*, front, firecracker penstemon (*P. eatonii*), center, and blue flax (*Linum perenne*), background, combine to make a pleasing design. [1]

Garden Plant Recommendations for Wild Bees of North America

This table contains nearly 200 garden plant genera with species whose flowers are sought by wild bees of North America.

The **Code** column is useful for Utah gardeners. Some additional species not coded as G or U are suitable for Utah but only in the hot, southernmost climates (e.g. *Larrea* or creosote bush).

- **G** - grows in Utah
- **U** - Utah native
- **W** - water-wise
- **F** - food product

Form tells whether the usable species in the genus are

- **A** - annual
- **P** - perennial
- **S** - shrub
- **T** - tree

Plants in ***bold italic*** are great choices for Utah gardeners.

Genus	Family	Common Name	Code	Forms	Notes
Abelia	CAPRIFOLIACEAE	abelia		S	
Acacia	FABACEAE	acacia	W	ST	
Acer	ACERACEAE	maple	GU	T	
Achillea	ASTERACEAE	yarrow	GUW	P	*A. millefolium* weedy
Aconitum	RANUNCULACEAE	monkshood	GU	P	
Agastache	LAMIACEAE	hyssop	G	P	**see Fig. 10**
Ajuga	LAMIACEAE	carpet bugle	G	P	
Allium	LILIACEAE	ornamental onions	GUW	P	
Althea	MALVACEAE	hollyhock	G	P	not double-flowered
Amelanchier	ROSACEAE	serviceberry	GU	S	
Amorpha	FABACEAE	false indigo	G	S	
Anchusa	BORAGINACEAE	wild forget-me-not		AP	
Anethum	APIACEAE	dill	G	A	
Aquilegia	RANUNCULACEAE	columbine	GU	P	not double-flowered
Arctostaphylos	ERICACEAE	manzanita	GUW	S	

Chemical Control:
Organic Products

- **Derived from plant, animal, or naturally occurring rock or petroleum oil sources**
  - **Minerals (rock):**
    - Lime
    - Sulfur
    - Copper
    - Diatomaceous earth
    - Boric acid
  - **Natural petroleum sources (oil):**
    - Horticultural oils (dormant & in-season)
  - **Natural animal fats (animal)**
    - Fatty acids – insecticidal soaps

OMRI™
Listed
Organic Materials
Review Institute

Chemical Controls:
Organic Products

- **Organic insecticides:**
  - **Botanicals (Plant):**
    - pyrethrum, ryania, sabadilla, rotenone, nicotine
  - **Microbials:**
    - Bacteria (*Bacillus thuringiensis*, spinosyn)
    - Viruses (codling moth granulosis virus)
    - Fungi (*Beauveria, Metarhizium*)

OMRI™ Listed
Organic Materials Review Institute

Organic Insecticides

Active Ingredient	Brand Name(s)	Class	Mode of Action	Toxicity Class
azadirachtin	Aza-Direct, Bioneem, Azatin	Botanical	Growth Regulator	Caution
Bacillus thuringiensis (Bt)	Dipel, Javelin, Thuricide	Microbial Bacterium	Larvicide	Caution
Beauveria bassiana	Botanigard, Naturalis	Microbial Fungus	Larvicide	Caution
beneficial nematodes	*Steinernema, Bacteriophora*	Biological Nematode	Larvicide, Adulticide	Caution
capsaicin	Hot Pepper Wax	Botanical	Repellent	Caution

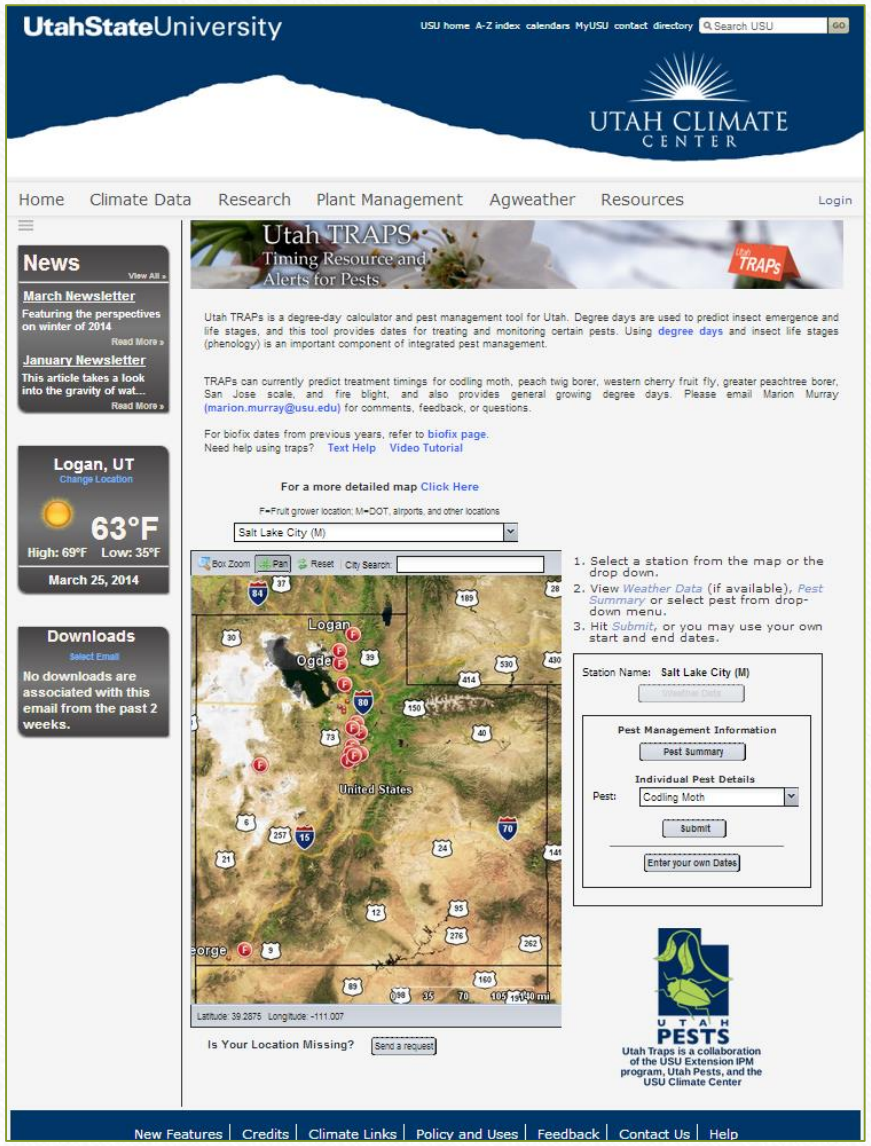
Organic Insecticides

Active Ingredient	Brand Name(s)	Class	Mode of Action	Toxicity Class
diatomaceous earth	Natural Guard	Inorganic	Disrupts cuticle	Caution
horticultural mineral oil (dormant & summer)	Sunspray, Ultrafine, Orchex, Volck	Petroleum distillate	Suffocate	Caution
insecticidal soap	Safer, M-pede	Fatty acids	Disrupts cuticle	Caution
iron phosphate*	Sluggo, Ecar-Go	Inorganic	Feeding arrestant	Caution
kaolin clay	Surround	Inorganic	Repellent	Caution

* Molluscicide (Snails & Slugs)

Organic Insecticides

Active Ingredient	Brand Name(s)	Class	Mode of Action	Toxicity Class
lime sulfur		Inorganic	Broad-spectrum	Danger (caustic)
pyrethrins, pyrethrum	Pyrellin, Pyganic	Botanical	Paralyze	Caution
rotenone		Botanical	Neurotoxin	Warning
spinosyn	Entrust	Microbial	Neurotoxin	Caution
sucrose octanoate ester	Sucrocide	Natural product	Disrupts cuticle	Caution
sulfur		Inorganic	Broad-spectrum	Caution



IPM Resources

Utah TRAPs
Timing Resource & Alerts for Pests

Select weather station location
Select pest or pest summary
Recommends mgmt. actions
Based on cumulative temperature
Degree-days (DDs)

UtahState University COOPERATIVE EXTENSION

Tree Fruit IPM Advisory

UTAH PESTS

Weekly Orchard Pest Update, Utah State University Extension, **May 17, 2013**

Spray Timing - Codling Moth

County	Location	Option A		Option B
		Apply oil	Apply first spray	Apply first spray
Box Elder	Perry	May 25	June 7	May 27
	Tremonton	May 25	June 5	May 27
Cache	River Heights	May 30	June 11	June 1
	Smithfield	June 2	June 14	June 4
Carbon	Price	May 29	June 9	May 31
Davis	Kaysville	May 24	June 4	May 26
Grand	Castle Valley	passed	May 22	passed
Juab	Tintic	June 2	June 15	June 4
Salt Lake	Holladay	May 17	May 29	May 20
	Taylorsville	May 22	June 6	May 24
Sevier	Monroe	May 21	June 3	May 23
Tooele	Erda	May 27	June 7	May 29
	Grantsville	May 21	June 2	May 23
Uintah	Vernal Airport	May 29	June 10	May 31
Utah	Alpine	May 30	June 11	June 2
	American Fork	May 25	June 5	May 27
	Genola	May 22	June 4	May 24
	Lincoln Point	May 25	June 7	May 27
	Orem	May 21	June 1	May 23
	Payson	May 24	June 4	May 26
	Provo	May 19	May 30	May 21
	Santaquin	May 25	June 6	May 27
	West Mountain	May 22	June 2	May 24
Weber	Pleasant View	May 21	June 1	May 23
Wasatch	Heber City	June 4	June 15	June 6
Wayne	Torrey	May 18	May 30	May 21

Choose either Option A or B when starting your codling moth sprays:

Option A uses horticultural oil (1%) as the first spray, followed by a regular insecticide at a later date. The oil kills eggs that have been laid on fruit up to that point. Good coverage of the oil (to dripping) is very important.

Option B is uses regular insecticide at the recommended date. Repeat at intervals until this advisory provides the end date for generation 1.

Tree Fruit IPM Advisory
is published weekly by Utah State University Extension

Editor: Marion Murray, marion.murray@usu.edu
click here for archived advisories

Pest Advisories

Interpreting pest mgmt. timing information