



UTAH PESTS News

Utah Plant Pest Diagnostic Laboratory and USU Extension

Vol. X, Winter 2016

What's Inside

USU Extension
Demonstration Teaching
Gardens at Wheeler Historic
Farm

Advantages of Using
Certified Seeds

Plant Disease Outbreaks in
Utah

Biopesticides: From Nature
to Nature

Vole Activity and Injury

An Alfalfa Weevil From the
Underground

New Invasive Fruit Pest
Detected in Utah

Two New Invasive
Agricultural Pests in the
United States

National IPM News

News Highlights

NEW PUBLICATIONS

Raspberry Crown Borer

Rose Stem Girdler

utahpests.usu.edu



Utah Orchard Leafroller Survey

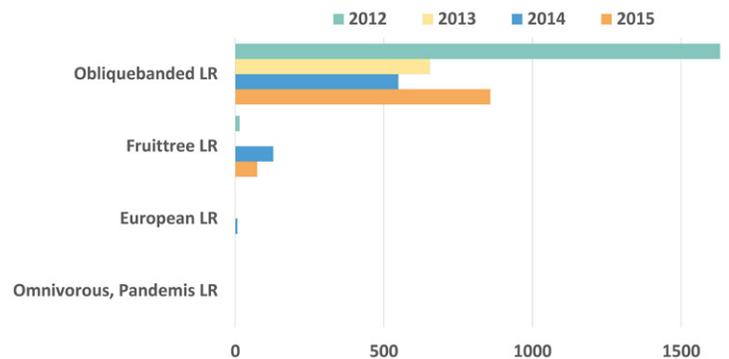
Leafrollers are a type of moth-caterpillar (Lepidoptera: Tortricidae) that may roll or tie leaves together to form a protective shelter, from which they feed on the leaves and fruits of plants. This group contains many economically important pests that attack fruits, vegetables, and ornamentals. The need for an orchard leafroller survey was prompted by an outbreak of leafroller caterpillars in Utah County tart cherry orchards just before harvest in July 2012.

We surveyed for five species that commonly occur in western U.S. orchards. The survey included five counties of northern Utah from late spring through early fall in 2014 (21 orchards) and 2015 (20 orchards). We used pheromone traps for moths, and feeding injury inspections and beating tray sampling for larvae. In 2014, 11 of the orchards received minimal management, such as limited insecticides, pruning, and irrigation. The remaining orchards were commercially managed.

Our objectives were to determine the species of leafrollers present, types of orchards at greatest risk for infestation, leafroller phenology (timing of moth flight and caterpillar activity), and validate an existing temperature-based (degree-day) model that predicts timing of leafroller treatments.

Obliquebanded leafroller (OBLR) was the primary species caught in the pheromone

Total Leafroller (LR) Trap Catches



The survey showed that OBLR is the most common leafroller species in Utah, followed by FTLR.

traps, followed distantly by fruittree leafroller (FTLR), as shown in the graph above. We detected very few European leafroller (ELR) moths, and no omnivorous or pandemis leafrollers. In more limited surveys in 2012 and 2013, OBLR numbers were very high in 2012, the season of the larval outbreak in tart cherries. OBLR moth capture in 2015 increased over those in 2013 and 2014, and although several orchards had high trap captures, the overall catch in 20 orchards was not as high as the total catch in 2012 (6 orchards). Growers were notified when OBLR numbers were high, and populations will be monitored in 2016 to prevent another outbreak.

UTAH PESTS Staff

Diane Alston

Entomologist
diane.alston@usu.edu
435-797-2516

Bonnie Bunn

Vegetable IPM Associate
bonnie.bunn@usu.edu
435-797-2435

Ryan Davis

Arthropod Diagnostician
School IPM Associate
ryan.davis@usu.edu
435-797-2435

Marion Murray

IPM Project Leader
Editor, Utah Pests News
marion.murray@usu.edu
435-797-0776

Claudia Nischwitz

Plant Pathologist
claudia.nischwitz@usu.edu
435-797-7569

Ricardo Ramirez

Entomologist
ricardo.ramirez@usu.edu
435-797-8088

Lori Spears

USU CAPS Coordinator
lori.spears@usu.edu
801-668-4056

Utah Plant Pest

Diagnostic Lab

BNR Room 203
Utah State University
5305 Old Main Hill
Logan, UT 84322

UTAH PESTS News
is published quarterly.

To subscribe, [click here](#).

All images © UTAH PESTS and USU
Extension unless otherwise credited.

utahpests.usu.edu

Leafroller Survey, continued from previous page

The orchards in the survey included apple, sweet cherry, and tart cherry. OBLR trap catch was similar across the three orchard types. We also included unmanaged orchards in the 2014 survey.

The majority of OBLR were caught in commercially managed orchards in southern Utah County (the primary commercial tree fruit growing district); whereas the majority of FTLR were caught in Weber and northern Utah counties in orchards with low to minimal management intensity (see graph, top right).

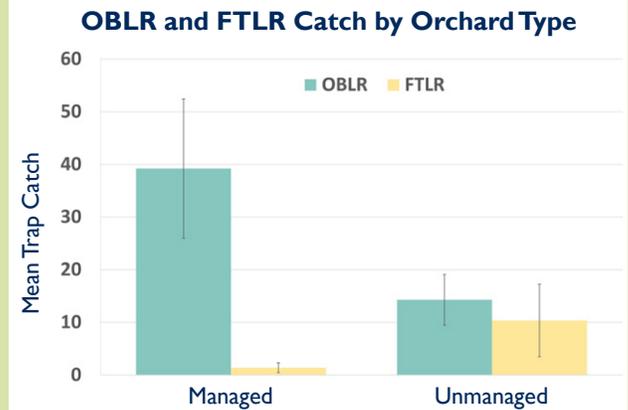
Of the 1,407 OBLR moths caught in the two years, 54% were caught using the OBLR lure while the remaining 46% were caught with the ELR lure (see graph, lower right). The two pheromone lures

share common compounds. This information could provide trap and cost savings in future surveys where ELR lures could be used to target both OBLR and ELR moths.

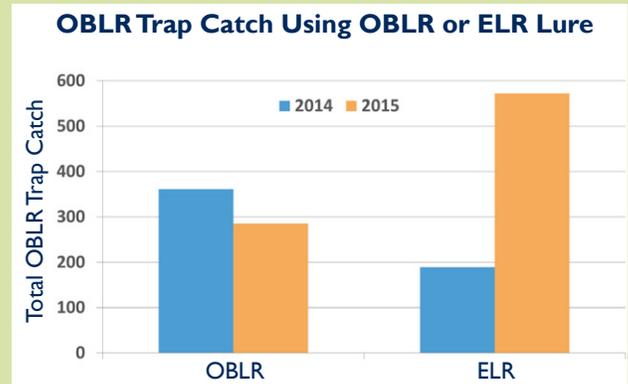
We also compared the standard OBLR lure to a lure formulated specifically for western OBLR populations. Total number of moths caught was similar; however, the western lure was slightly more attractive during the 1st OBLR generation in June, whereas the standard lure was more effective during the 2nd generation in August and early September.

OBLR moth flight was compared to a predictive model developed for Washington state. Moth emergence of the 1st generation matched the model, but the 2nd generation moths emerged an average of 300 degree days earlier than predicted. This shows that we can continue to use the model for the more economically important 1st generation, and that adjustments will need to be made to the model for the 2nd generation moth flight.

Larval sampling did not yield any specimens, likely due to increased pesticide applications to prevent an infestation similar to 2012. Data on timing of OBLR moth flight will be collected again in 2016, and the degree-day model adjusted to better fit activity patterns observed in Utah. These results will help improve the accuracy of leafroller management timing provided by the Utah Tree Fruit IPM Advisory and Utah TRAPs resources.



Most of the OBLR occurred in the managed orchards, while most FTLR occurred in the unmanaged orchards.



The lure for European leafroller (ELR) was similar in attraction to OBLR as the OBLR lure.

USU Extension Demonstration Teaching Gardens at Wheeler Historic Farm

Katie Wagner is a USU Extension Horticulture Faculty in Salt Lake County. She has been instrumental in providing educational opportunities for the urban and organic agricultural communities, and publishes the organicforecast.org.

The Meals Plus Harvest Garden provides weekly shares of produce that are delivered to approximately 160 homebound Meals on Wheels clients. This garden is also used as a teaching tool for the public.

USU Extension is developing two demonstration teaching gardens at the Historic Wheeler Farm located in central Salt Lake County. The farm was settled by Joseph Hammond in 1853 and was later acquired by the Wheeler family in 1887.

The intact 89-acre property was sold to Salt Lake County Parks and Recreation in 1969 and today is the only agriculture living history museum and outdoor recreation site housed in urban Salt Lake County. The farm receives over 450,000 visitors annually who come for school field trips, event rentals, the Wasatch Front farmers market, festivals and events, summer camps, or just to stroll around and see the many animals and historic buildings housed at the farm.

In 2012, USU signed a memorandum of understanding with Salt Lake County to develop a half-acre demonstration teaching garden located in the heart of the park. The garden will provide USU Extension faculty and Master Gardener volunteers a space to conduct educational outreach and will also showcase garden design ideas to visitors. The unifying focus of the garden design is to teach the public about integrated pest management practices they can use in their own yard and gardens. The demonstration garden is broken into several segments including a raised bed demonstration garden, a beneficial insect garden, a pollinator garden, and a botanical garden walk featuring Utah native plants. IPM signage is being developed by the Utah Pests team to educate visitors on ways they can incorporate biological, cultural, and mechanical pest control methods in their garden management decisions at home.

Construction of the demonstration garden would not have been possible without funding support from multiple agencies

including Western SARE; Fire, Forestry and State Lands; and Salt Lake County. The garden has also benefitted from generous in-kind contributions from local garden businesses. Last but not least, Master Gardener volunteers donated over 1,000 hours of service time at the garden creating pathways, laying irrigation lines, placing hardscape, prepping planting beds, planting trees, and much, much more! The USU Extension Demonstration Teaching Garden will be completed by spring 2016.

The second demonstration garden located at Wheeler Farm is the Meals Plus Harvest Garden. The Meals Plus Program was launched in 2014 and is a partnership between the Salt Lake County Adult and Aging Services Meals on Wheels program and USU Extension. This innovative program delivers weekly community supported agriculture (CSA) style 'shares' of fresh fruits, vegetables, and herbs to approximately 160 homebound Meals on Wheels clients. Master Gardener volunteers plan, plant, maintain, and harvest the 1/8th acre Meals Plus Harvest Garden to provide produce to support the program. Other community partners that contribute to the Meals Plus Program include the Salt Lake County Jail Horticulture Program, The Green Urban Lunchbox, Bell Organic, and Mountain Valley Seed (seed donation).

In 2015, the Meals Plus Program delivered over 10,000 pounds of fresh produce to recipients valued at over \$27,500; the Meals Plus Harvest Garden grew one-fifth of this donation total. The garden also provides an excellent venue to teach Master Gardener volunteers about IPM practices important for edible gardening. Management practices utilized in the Meals Plus Harvest Garden include drip irrigation (weed control), cover crops (soil fertility and weed control),

continued on next page

Wheeler Farm Demonstration Garden, continued from previous page



In 2015, the Meals Plus Harvest Garden grew more than 25 different vegetables and herbs, and includes informative signage. Master gardener volunteers donated more than 1,500 hours of service time to develop, maintain, and harvest the garden.



and flowers intermixed with garden plants (attraction of pollinators and natural enemies) among many others.

With the help of volunteers, USU Extension faculty populate the blog organicforecast.org which follows the Meals Plus Harvest Garden throughout the growing season, which at times includes content on IPM. This impactful program has been recognized by multiple community organizations including the Salt Lake County Council, and was a 2015 Select 25 grant recipient through Select Health. The Meals Plus Program greatly benefits from volunteers; since its start, Master Gardeners have donated over 1,500 hours of service time at the Meals Plus Harvest Garden! Due to the tremendous commitment and dedication from all its partners, the Meals Plus Program will expand in 2016 to deliver fresh produce to several senior centers located throughout Salt Lake County in addition to serving its current Meals on Wheels clients.



The demonstration gardens include a raised bed garden, beneficial insect garden, pollinator garden, and Utah native plant walk.

PLANT PATHOLOGY NEWS AND INFORMATION

Advantages of Using Certified Seeds

To prevent certain plant diseases such as viruses, the Utah Pests group recommends planting certified seed. But what exactly does this mean?

Some plant pathogens can survive on seeds, and can cause disease later in the plant's life, affecting an entire crop if all seeds are affected. Some pathogens survive in a resting state on the seed surface, and in this case, the seed is considered contaminated. Some pathogens can survive inside the seed, and these are considered "seed-borne" pathogens.



continued on next page

Certified Seed, continued from previous page

The most common pathogen group to contaminate seeds are fungi; when seeds are contaminated, plant infection will depend upon conducive temperature and moisture conditions. Pathogens that cause seed-borne diseases are typically bacteria or viruses. These organisms lie dormant in the seed, and as the plant grows, they are spread through the vascular system of the plant, causing what is known as a systemic infection. The seed produced from these plants will contain the pathogen, completing the cycle of spread.



Spinach seed infected with verticillium wilt.

- *Pure seed.* Certified seed has a very high standard for varietal purity, meaning that a single specific crop variety is guaranteed.
- *Seed quality assurance.* Certified seed is inspected in the field and at the processing plant. Strict quality requirements have been met.
- *Traceability.* Some markets demand that crops can be traceable and verifiable. Using certified seed gives documentation that the product is legitimate.

USING CERTIFIED SEEDS

Seeds that are certified mean that good agricultural practices have been followed at every step from the planting of a crop through the harvesting and processing. Although certification does not guarantee that the seeds are disease-free, it certifies that the seeds have met the standards of the certification agency. The number one method for sterilizing seed is to treat it with either wet or dry heat, which penetrates to the core of seed. Heat kills the majority of bacterial and fungal pathogens, and bacterial pathogens are particularly sensitive to heat. Wet heat, in the form of hot water, is more effective than dry heat, and thus the most common method for treatment of seed disease is hot water of 122°F (50°C) for 20-25 minutes.

Unfortunately, viral pathogens are generally not susceptible to heat, although dry heat has been shown to have some efficacy against certain tomato viruses. In general, though, viral pathogens are quite difficult or impossible to remove from seed, and thus virus-free seed is only harvested from clean plants.

Certified seed is not only healthy, but have been assessed using set standards for varietal purity and vigor. Planting with disease-free certified seeds with high standard vigor helps plants withstand other diseases in the field. This is especially helpful for the organic growers who do not use synthetic methods of disease control.

GENERAL ADVANTAGES OF CERTIFIED SEED

- *Clean seed.* The certification process includes strict limitations on the amount of weed and other kinds of crop seed allowed.

- *Efficient use of inputs.* The disease-free quality and genetic purity of certified seed allows growers the best chance for the highest yields, making best use of other inputs and resources.

USING TREATED SEEDS

Certified seed is more expensive than general seed or farmer-collected seed. But the risk of pathogens in non-certified seed is an unknown. Growers who do not want to spend the additional cost can purchase treated seeds or sterilize their own seeds. General seed treatments, however, cannot eliminate the pathogens that reside inside the seed (bacteria or viruses).

Contaminated seed are treatable by surface application of anti-microbial agents, such as bleach, acid, trisodium phosphate, or other commercial products. Fungicides are labeled for seed treatment, and they not only kill pathogens on the seed, but also provide protection against soilborne pathogens during seed germination. Some of these ingredients are thiram, captan, thiabendazole, mefenoxam, and azoxystrobin. Rarely do they ensure 100% sterilization, but they can greatly reduce levels of pathogens.

Organic growers must use certified organic seeds, where the use of synthetic chemical seed treatments is not allowed. New options are on the horizon for organic farmers to treat their own seed, including microbials, plant extracts, and other substances of natural origin.

-Marion Murray, IPM Project Leader

Plant Disease Outbreaks in Utah, Summer 2015

CANDIDATUS LIBERIBACTER SOLANACEARUM



Candidatus Liberibacter solanacearum was identified in potatoes for the first time in 2013 in Utah. This bacterium is the causal agent of zebra chip disease. In 2014, it was detected in peppers and in 2015, we identified it for the

first time in tomatoes. This non-culturable bacterium is transmitted by potato psyllids. The only control option is managing the psyllids with insecticides. Once a plant is infected with the bacteria there is no cure.

PINYON BLISTER RUST



Pinyon blister rust (*Cronartium occidentale*) was identified on currants. Like most rusts, this fungus has a complex life cycle in that it requires two hosts: *Ribes* spp. (currants, gooseberry) and pinyon pine. The spores that are produced in the summer (urediniospores) on currants are bright orange and can re-infect currant leaves. When the weather gets cold, a second type of spore (teliospore) is produced on the currants for overwintering in fallen leaves. The fruiting structures for the teliospores look like little horns on the underside of the leaves. In spring, the teliospores produce another type of spore called basidiospores. The basidiospores can only infect pinyon pine. Once the rust has infected the pinyon pine it

produces a spore called aeciospore. The aeciospores are yellow to orange in color and can be seen on the branches.

The rust only causes foliar spots on currant but trunk infections on pinyon pine cause swelling, branch dieback and trees can be killed.

The general recommendation is to not plant *Ribes* spp. near pinyon pine, but spores from these shrubs can be blown by wind for miles so this practice may not completely prevent infections. Any infected branches on pinyons should be pruned as soon as the infection is noticed to prevent the dispersal of spores to currants.

TOBACCO STREAK VIRUS (TSV)

TSV was identified in stunted zucchini plants. The leaves showed yellowing and a mosaic pattern resembling watermelon mosaic virus. A typical symptom which we did not see is leaf distortion and a fern leaf pattern. TSV is thought to be transmitted by thrips, but the exact path of

is unknown. The virus has many hosts, including weeds. It is not common on squash and the strain infecting squash is different than other TSV strains. Because little is known about the virus, management is difficult. Good weed control to reduce overwintering hosts is important.

GENERAL IPM INFORMATION

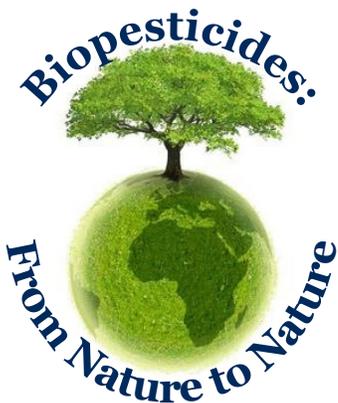
Disease Outbreaks, continued from previous page

ALFALFA MOSAIC VIRUS (AMV)



AMV has been seen in peppers grown near alfalfa fields and in 2015, was found on tomatoes and potatoes in Utah. In tomatoes, leaves show tiny black spots and the green fruit turns dark brown or is bumpy and has brown stippling under the skin. On potatoes, the foliage shows a bright yellow mosaic pattern. Depending on the AMV strain, potato plants can be stunted and stems and tubers can have

necrotic lesions. AMV is transmitted by many species of aphids including the green peach aphid. Aphids transmit the virus in a non-persistent manner which means they have to feed on an infected plant first before they can transmit it to a healthy plant. The best way to avoid AMV in vegetables and potatoes is to avoid planting near alfalfa and clover fields.



Biopesticides are materials derived from natural sources such as animals, plants, bacteria, and minerals. For example, canola oil and baking soda have pesticidal applications and are considered biopesticides. As of September 2015, there are 436 registered biopesticide active

ingredients and 1,401 active biopesticide product registrations.

CLASSES OF BIOPESTICIDES

Microbial pesticides

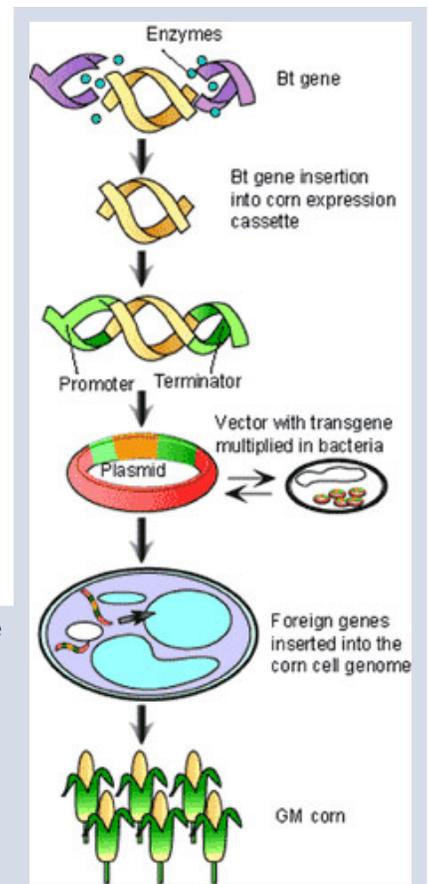
These consist of a microorganism (for example a bacterium, fungus, virus, or protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests (insects, diseases, weeds, etc.) although each separate active ingredient is relatively specific for its target pest(s). For example, there are fungi that control certain weeds and other fungi that kill specific insects.

Examples of Active Ingredients in Microbial Pesticides

- *Bacillus thuringiensis* (various Bt strains)
- Bacteriophages
- *Coniothyrium minitans*
- *Pseudomonas* spp.
- *Saccharopolyspora spinosa*
- *Streptomyces* spp.
- *Trichoderma* spp.

Plant-Incorporated-Protectants

PIPs are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists can take the gene for the Bt pesticidal protein and introduce the gene into the plant's own genetic material. Then the plant, instead of the Bt bacterium, manufactures the substance that destroys the pest.



Bt corn is one example of plant-incorporated-protectants (PIPs). The corn has the gene for the Bt pesticidal protein, allowing it to produce its own insecticide.

continued on next page

Biopesticides, continued from previous page

Biochemical pesticides

These are naturally occurring substances that control pests by non-toxic mechanisms. They include insect kairomones and pheromones, and natural insect growth regulators, repellents, baits, and enzymes. Pheromones can be used to interfere with mating, such as insect sex pheromones, or, along with scented plant extracts, can attract insect pests to traps.

Caution: Products that are biopesticides are not always approved for organic production. Always check product labels to verify if products are certified for organic production.

EXAMPLES OF BIOPESTICIDES

Bacillus thuringiensis (Bt)

Bacillus thuringiensis is one of the more common biopesticides used on vegetable plants. Bt is the first and still most widely used microbial pesticide. It is a bacterium that naturally occurs in soil and makes proteins that are toxic to larvae (caterpillars), and must be eaten by the larvae to be effective.

Bt produces a protein that binds to larval gut receptors. This paralyzes the cells in the gut, interfering with normal digestion and triggering the insect to stop feeding on host plants. Bt spores can then invade other insect tissue, multiplying in the insect's blood, until the insect dies. Death can occur within a few hours to a few weeks of Bt application, depending on the insect species and the amount of Bt. In contrast, when people eat the same toxins, the toxins are not activated and no harm occurs.

There are different strains of Bt, each with specific toxicity to particular types of insects: Bt *aizawai* (Bta) is used against wax moth larvae in honeycombs; Bt *israelensis* (Bti) is effective against immature mosquitoes, blackflies and some midges; Bt *kurstaki* (Btk) controls various types of lepidopterous insects (caterpillars), including the gypsy moth and cabbage looper.

Spinosad

Spinosad is a metabolite created by a naturally occurring soil bacterium that is toxic to some insects. It is a mixture of two chemicals called spinosyn A and spinosyn D. It is active by both contact and ingestion. Spinosad affects the insect's nervous system and leads to involuntary muscle contractions, tremors, and paralysis resulting in a rapid cessation of feeding. Spinosad is slow-acting, taking one to two days to kill the target insect. It is relatively low in toxicity to mammals and birds and is not phytotoxic.

Examples of Insect Pests Controlled by Spinosad

Common name	Scientific name
European corn borer	<i>Ostrinia nubilalis</i>
Tomato fruitworm	<i>Helicoverpa zea</i>
Cabbage looper	<i>Trichoplusia ni</i>
Diamondback moth	<i>Plutella xylostella</i>
Leafminers	<i>Liriomyza</i> spp.
Melon thrips	<i>Thrips palmi</i>
Fall armyworm	<i>Spodoptera frugiperda</i>
Colorado potato beetle	<i>Leptinotarsa decemlineata</i>
Imported cabbageworm	<i>Pieris rapae</i>
Tomato hornworm	<i>Manduca quinquemaculata</i>
Western flower thrips	<i>Frankliniella occidentalis</i>

ADVANTAGES OF USING BIOPESTICIDES

- They are usually less toxic than conventional pesticides.
- They generally affect only the target pest and closely related organisms, thus, conserving beneficial insects.
- Biopesticides often are effective in very small quantities and often decompose quickly, resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly reduce the use of conventional pesticides, while crop yields remain high.
- They have short or no re-entry and pre-harvest intervals.

DISADVANTAGES OF USING BIOPESTICIDES

- The high specificity of biopesticides means that several types of materials may be needed to deter all pests.
- Some are only effective against a certain life stage so correct timing of application is crucial.
- Most have a short shelf life, and must be protected from exposure to UV light and excessive heat.
- Some have delayed effects or mortality rates, making them unsuitable if a pest is an immediate threat.
- Some materials are costly due to time-consuming preparation or are not conducive to large-scale production.

Biopesticides can be a great alternative to conventional pesticides, and perform best when used within an integrated pest management program. The use of biopesticides continues to increase as researchers, manufacturers, and consumers are realizing their benefits.

-Bonnie Bunn, Vegetable IPM Associate

Vole Activity and Damage



Suzanne Britton, iStockphoto.com

Voles are a frequent pest of turf, ornamental plantings, orchards, hay, and pasture in Utah. They are active throughout the year and damage can occur at any time. Winter can be a particularly hard time for voles to locate preferred food sources, and instead will feed on the lower bark of woody plants, girdling them beneath the snow line.

Damage during the rest of the year includes burrowing and feeding in turf, and root damage to vegetables, tubers, grass pasture, and alfalfa hay fields, where production can be reduced by 10 to 50% by vole activity. Voles can also play minor roles in disease cycles and occasionally enter homes. They are listed as non-game animals in Utah and are protected, though controls can be implemented when voles are causing damage.

VOLE BIOLOGY

There are five vole species in Utah, but the meadow vole (*Microtus pennsylvanicus*) is the most common. The biology and control methods for all voles are similar, and the focus of this article is the meadow vole.

Voles range in size from 4 to 7 inches with tails that span $\frac{3}{4}$ inch to 4 inches. Their average weight is 3 to 4.5 oz. They are stocky rodents with short legs, small ears and a blunt nose. They are typically brown to gray mixed with black hairs. Younger voles may be darker with nearly black feet.

Voles are active year-round, and do not hibernate. Their populations vary from year to year, depending on environmental factors. In epidemic years, they can number over 400 per acre! Voles are prolific breeders, and produce an average of 3 to 5 litters per year in outdoor locations. If food is plentiful, the number of yearly litters can soar to 17.



natureglobe/istock.com/mammals/rodents/meadow-vole

Meadow voles often nest in groundcover.

Litter size ranges from 1 to 11 individuals, and is also affected by the quality and quantity of food and the environment. Peak breeding occurs in early spring with another spike in the fall. Voles live from 2 to 18 months, with predation being the top killer; up to 88% in some cases.

Voles are difficult to observe during the day, as they tend to be most active in the morning, evening, and night. Signs of activity include gnaw marks at the base of trees or on roots, measuring about 1/8-inch wide and 3/8-inch long. The presence of 2-inch wide runways in turfgrass, and burrow openings about 1.5 inches wide in fields or cultivated areas, are all indicators of voles. Runways often include multiple borrows and can be littered with vegetative clippings, feces, and soil.

continued on next page

Voles, continued from previous page



North Central Research Station - USDA Forest Service
bugwood.org

The damage that meadow voles causes include runways in turf (top), and feeding injury to tree bark.

Voles love low cover. Groundcovers and thick litter provide perfect nesting habitat. Often, runways can be seen leading from turf into areas with low-growing vegetation where the burrow or nest is located. Voles prefer to stay close to home if food is readily available, but territory can range from 0.5 to 1.5 acres.

Control of voles begins with monitoring for signs of activity. Search for runways, burrows, feces, plant clippings, gnaw marks, and damage. Locating areas of high activity is particularly important for implementing control strategies. These areas include runways that are wide and worn, active burrows, and other areas where ample feces or signs of activity can be seen.

VOLE CONTROL FOR THE HOMEOWNER

Standard mouse snap traps with expanded triggers can be used to kill voles. Unlike mice, traps for voles do not need

to be baited, but a peanut butter-oat mix or apples will attract them. Expanded-trigger snap traps can be placed directly in vole runways near burrows or areas of high activity. Because voles memorize runways, traps laid at right angles, flush with the bottom of the burrow will catch voles as they accidentally run over the triggers. Traps should be attached to the ground with a wire or chain, to prevent predators from removing them. Indoors, traps should be placed in sets, 1 inch apart, along baseboards with expanded triggers facing the wall. Check traps and remove dead voles daily. Specific trap options are multiple-catch traps in runways and Sherman live traps (10"x3"x3") next to walls. Due to possible disease transmission, always handle rodents with rubber gloves and bury dead voles.

Excluding voles from gnawing on shrubs or trees can be accomplished by using 1/4-inch hardware cloth around the stem. The mesh should be buried to a depth of 6 inches and extend 6 inches out of the ground, or to the possible snow line. Hardware cloth can also be used on a small scale to exclude voles from garden beds or other areas. To keep voles from accidentally invading the home, install properly fitted door sweeps, door seals, and plug any access points into the home with metal flashing, hardware cloth, or a product like Xcluder.

Modify the habitat by removing low groundcover or low shelter. Prune trees, shrubs and branches away from the ground, mow the lawn short, remove weeds or tall grasses in turf and around trees, remove mulch from around root collars, and remove other objects under which voles may nest or harbor.

Rodenticides may be needed in conjunction with non-chemical techniques to bring vole populations under control. There are three general-use anticoagulant vole baits registered in Utah that contain diphacinone: Ramik Green, Ramik Green Mini Bait Packs, and Ramik Mini Bars. The bait should be placed in areas of high rodent

Anticoagulant baits for the consumer market have recently been restricted, excluding the sale of pelletized baits to homeowners. Diphacinone is a slower-acting active ingredient that allows for safer homeowner use, and time to administer an antidote (vitamin K) if a pet should accidentally consume the anticoagulant bait. To protect pets and other animals from bait poisoning, deliver baits directly into burrows, or in tamper-resistant bait stations. Always keep baits fresh and dry. [Visit this web page](#) for more information on the consumer rodenticide regulations.

continued on next page

Voles, continued from previous page

activity and burrows. Tamper-resistant bait stations must be used for any above-ground application or any application to which non-target animals or children may have access. Ramik Green can not be used more than 100 feet away from a home or structure. Always follow the label when applying any pesticide.

VOLE CONTROL FOR COMMERCIAL OR AGRICULTURAL SETTINGS

Using snap traps for large-scale vole control is impractical. Individual trees in an orchard may be protected using hardware cloth. Eliminating or reducing protective habitat is critical to vole management. Vegetative cover can be managed by burning ditch banks, pits, and fence lines. Weed-free zones or cultivated areas may be established around crop areas. For alfalfa, grazing or mowing in the late fall when active plant growth is not taking place can reduce vole habitat and food sources, stressing winter vole populations.

Rodenticides plus non-chemical techniques are necessary for large-scale vole management. Zinc phosphide products (restricted-use) can be used by licensed pesticide applicators. It can be broadcast or placed directly into burrows or bait stations. Application sites and methods may vary according to the product. Consult the label prior to making an application to make sure the correct product is selected for your site and situation.

Anticoagulant baits may also be used on a large scale. Like zinc phosphide, anticoagulants are commonly hand-applied as spot treatments or broadcast applied. Read and follow these nuanced product labels prior to application. Most anticoagulants registered for use on voles in Utah are restricted-use products and include diphacinone (Ramik Brown; Ramik Green) and chlorophacinone (Borderline; Rozol Vole Bait).

Vole populations can be reduced by promoting raptors and owls with nest boxes and perches, as described [in this fact sheet](#). Capsaicin-based feeding deterrents or repellents can be effective, but have short-lived activity in protecting plants.

-Ryan Davis, Arthropod Diagnostician

References:

- Corrigan, R.M. 2001. Rodent Control: A Practical Guide for Pest Management Professionals. Pgs. 69-72.
- Gunn, D., Hirnyck, R., Shewmaker, G., Takatori, S., and Ellis, L. 2011. Vole Management. Idaho Hay and Forage Conference Proceedings. February 22-23.
- McNeely, S. 2011. Handbook of Pest Control: The Behavior, Life History, and Control of Household Pests. Chapter 17, Vertebrate Pests, pgs. 1141-1143.
- West, B.C., and Messmer, T.A. 2010. Voles. Utah State University Extension fact sheet. 3 pp.

ENTOMOLOGY NEWS AND INFORMATION

An Alfalfa Weevil From the Underground

Most growers are familiar with alfalfa weevil, as it is a major pest of alfalfa early in the season. However, a more cryptic weevil, the clover root curculio, can also be an important yet overlooked pest of alfalfa.

Unlike alfalfa weevil larvae that feed above ground on foliage, clover root curculio larvae feed below ground on roots and root nodules. They notch off lateral roots and scar taproots, resulting in yellowing and stunting or slow green-up. The root damage and yield losses are thought to be exacerbated by secondary infection of pathogens, like root and crown rots, which enter through exposed feeding sites from clover root curculio larvae. Overall, damage from larvae can lead to reduced stand longevity.



The clover root curculio can also be an important yet overlooked pest of alfalfa.

continued on next page

An Alfalfa Weevil From the Underground, continued from previous page

Clover root curculio is not a new pest to alfalfa and it is found throughout the U.S. For many decades, it has been kept at low populations by application of the older broad-spectrum insecticides including organophosphates and carbamates, once used for general alfalfa insect management. The recent change to shorter residual pyrethroids and phase-out of older chemistries, including a ban of Furadan, are thought to have contributed to a rise in clover root curculio problems. Unfortunately, there are no registered insecticides for the soil-dwelling larval stages and management is limited to cultural practices.

Much of what is known about clover root curculio comes from research done in the 1980s or previously, and from the eastern U.S. At Utah State University, research is being conducted to determine the life history of clover root curculio in the Intermountain West. After evaluating samples collected in 2012-2013 from a number of fields in northern Utah, adult clover root curculio activity was primarily found from mid- to late-summer with peak activity occurring in August. It was also determined that insecticide applications for alfalfa weevil, whose adult and larval stages occur above ground, do not affect clover root curculio adults. Given the opposing adult activity of each of these weevils—alfalfa weevil in the early spring and clover root curculio in the late fall—this result was not necessarily surprising.

In 2015, effort was placed on sampling below ground and larvae were collected from numerous soil core samples. These initial soil samples revealed that most larvae were present in early spring and it is presumed that clover root curculio overwinter as eggs and adults.

Management for alfalfa growers with persistent clover root curculio pressure consists of:

- Crop rotation to a non-host crop which include corn and small grains.
- When re-establishing alfalfa, plant in spring to miss adult and egg laying activity in the fall.
- Avoid plant stress by maintaining proper irrigation and fertilization to improve the recovery and reduce the negative effects of root damage.

Currently there are no economic thresholds developed for clover root curculio. While insecticides are available for adults, the benefits are not evident below ground as larval numbers appear to be unaffected. The mobility and widespread activity of the adult weevils are thought to be a component of the lack of response to insecticide applications.



Steven Price, USU



Steven Price, USU

Top: Clover root curculio larvae are legless, cream-colored, and have a dark brown head.

Bottom: Semi-circle leaf notching is characteristic of adult clover root curculio leaf feeding. Adult feeding does not cause major damage to alfalfa, unless they are feeding on seedlings from a new stand.

With the recent elevated pest status of clover root curculio, investigations of alternative management strategies are being evaluated, including biological control tactics with insect pathogens and incorporation of soil amendments to deter and disrupt clover root curculio activity.

-Ricardo Ramirez, Extension Entomologist

Reference:

Wenninger, E.J. and G.E. Shewmaker. 2014. Clover root curculio in alfalfa: identification, biology, and management. Pacific Northwest Extension Publication, University of Idaho, PNW-663.

New Invasive Fruit Pest Detected in Utah

The Utah Plant Pest Diagnostic Lab has confirmed a new invasive fruit pest in Utah. In September 2015, the African fig fly (*Zaprionus indianus*) was discovered in traps used for monitoring spotted wing drosophila in wild habitats, backyard fruit gardens, and commercial orchards of northern Utah.

The African fig fly is native to tropical Africa, the Middle East, and Eurasia, but has expanded its range to South and Central America, where it is mainly a pest of figs. The first U.S. report occurred in Florida in 2005, and it has since been found as far north as Michigan, and as far west as California.

African fig flies are slightly larger than other *Drosophila* flies, and have a pair of silver-white stripes on the top of the head and thorax, outlined on both sides by black. It has the potential to infest late season fruits, such as raspberries and strawberries, but females are thought to lay eggs only in overripe or previously damaged fruit (they lack the serrated ovipositor of spotted wing drosophila).

It is not known yet whether the African fig fly can overwinter in northern Utah or if it must recolonize the area each year. Monitoring efforts will continue next season, and any future developments will be communicated to the grower community. Please contact Dr. Lori Spears (lori.spears@usu.edu) or your county Extension office if you find a suspect specimen.

-Lori Spears, USU CAPS Coordinator



African Fig Fly

Additional Resources:

[African Fig Fly](#) (website maintained by Dr. Douglas Pfeiffer, Virginia Tech)
van der Linde, K. 2012. [Zaprionus indianus distribution in the United States](#).

Two New Invasive Agricultural Pests in the United States

Two new invasive insects have been detected in the U.S. The first pest, the spotted lanternfly (*Lycorma delicatula*), is a plant hopper that is native to parts of Asia and feeds on a variety of plant hosts, including grapes, fruit trees, and hardwood trees. It was first found in the U.S. in Pennsylvania in 2014. So far, Pennsylvania is the only known location of this pest in the U.S.

The second pest is the old world bollworm moth (*Helicoverpa armigera*), also referred to as the cotton bollworm. It is thought to be native to areas of Europe, Asia, Africa, and Australia, and is closely related to the corn earworm (*H. zea*), a common pest of corn in the U.S.

Old world bollworm is considered the world's single worst insect pest of agriculture because of its generalist feeding behavior and its ability to tolerate a wide range of environmental conditions. It can attack many plant species, including corn, cotton, small grains, fruit, alfalfa, peppers, tomatoes, and some forest trees. Old world bollworm was first found in the U.S. in Florida in 2015, and is regularly intercepted at U.S. ports of entry.

The Utah Cooperative Agricultural Pest Survey (CAPS) program has been conducting monitoring surveys for old world bollworm for many years (and will continue to do so), and in the future, will also include the spotted lanternfly.

-Lori Spears, USU CAPS Coordinator



Spotted Lanternfly



Old World Bollworm

Additional Resources:

[Spotted Lanternfly](#) – Penn State Extension
[Spotted Lanternfly](#) – Pennsylvania Department of Agriculture
[Old World Bollworm USDA Pest Alert](#)
[Old World Bollworm](#) – Florida Department of Agriculture and Consumer Services

In the National News

HOPE FOR THE CITRUS INDUSTRY

Citrus greening is a deadly disease of citrus trees, and has resulted in a loss of 100,000 acres and \$3.6 billion in revenue in Florida. After a decade of research, University of Florida's Institute of Food and Agricultural Sciences have developed genetically modified citrus trees that show enhanced resistance to greening, and have the potential to resist canker and black spot, as well. The new variety defends itself against the bacterium through systemic acquired resistance. The commercial availability of the new varieties will be several years away.

NATURAL MOSQUITO CONTROL VERSUS DEET

To help consumers decide which mosquito repellent they should buy, researchers at New Mexico State University tested 10 products for their effectiveness at repelling two mosquito species (the yellow fever mosquito, *Aedes aegypti* and the Asian tiger mosquito, *Aedes albopictus*). The results were published in the *Journal of Insect Science*. Three of the products contained DEET (Repel 100 Insect Repellent, OFF Deep Woods, and Cutter Skinsations Insect Repellent) and seven of the products did not (Cutter Natural Insect Repellent, EcoSmart Organic Insect Repellent, Cutter Lemon Eucalyptus Insect Repellent, Avon Skin So Soft Bug Guard, Avon Skin So Soft Bath Oil, Victoria's Secret Bombshell perfume, and Mosquito Skin Patch, containing vitamin B1). All the DEET products repelled both mosquitoes. For *Aedes aegypti*, the only non-DEET product that worked for the 240-minute test was Cutter Lemon Eucalyptus Insect Repellent. The Avon bath oil and Victoria's Secret perfume repelled mosquitoes for 120 minutes. For *Aedes albopictus*, both the Avon Bug Guard and Victoria's Secret perfume repelled for 120 minutes.

MEASURING PLANT STRESS

Lack of water or low temperatures are examples of conditions that lead to obvious symptoms in plant, such as wilting. But milder plant stressors may take years to show symptoms. Ecologists and spectroscopists out of the University of Twente have discovered a way to measure the milder forms of stress. Their study reveals that plants show signals in a part of the electro-magnetic spectrum that has been very little studied for plants. The stressed plants change their emissivity (which determines how much energy a surface radiates) to a part of the infrared spectrum called thermal infrared. This means that plants manage their resources to some extent by changing how much energy they lose in the form of thermal infrared radiation, which can in turn, influence how plants respond to climatic change.

PLANTS GROWN TO DECONTAMINATE LAND MAY RESIST PESTS

Plant biologists at the University of Montreal examined genetic material (RNA) from greenhouse willow trees growing in media contaminated with heavy metals or petroleum by-products. They employed a new field in biology that looks at genetic sequences of all interacting organisms as a single, dynamic biological entity. In other words, when genetic information such as RNA is examined from any plant tissue, information can also be found from fungi, bacteria, insects, and arachnids. They found that 99% of RNA from spider mites on the willows was in higher abundance in trees growing in the clean soil. This suggests that the willow tree's defense against contamination, which is an abiotic stress, improves resistance to spider mites, a biotic stress.

INDUCING RESISTANCE IN PLANTS TO REPLACE PESTICIDES

Plants have natural self-defense mechanisms that kick in when they are infested with pests. This defense mechanism can be switched on using chemicals that do not harm the environment and are not toxic to the insects or their natural enemies. New research out of Zhejiang University in China identifies five chemicals that trigger rice plants to fend off a common pest – the white-backed planthopper, *Sogatella furcifera*. The next step for the research will be to explore how effective the chemicals are at boosting the plants' defenses and controlling planthoppers in the field, preventing the need for insecticides.

TRENDS IN ENTOMOLOGY PUBLICATIONS

A review paper published in *American Entomologist* examined the changing trends in insect publications over the last 60 years. One example is that in 1959, there were 1.5 ant publications per week, in 1974 it was 5.2 publications per week, and in 2009, it rose to 34.9 ant publications per week. The insects that were the subjects of the most scholarly articles per week were mosquitoes (45.3), butterflies (20.3), aphids (19.4), moths (17.5), weevils (14.6), and honey bees (12.7). Other trends the review found were that articles have become longer with more authors and more citations.

PROTECTION FROM DUTCH ELM DISEASE

Researchers in Madrid, Spain led a European research team to study the nutritional niche of endophytic fungi as compared to the pathogen that causes Dutch Elm Disease (DED). Endophytic fungi live within a plant without causing disease. Some are beneficial by secreting



Featured Picture of the Quarter

This soldier fly (*Hedriodiscus binotatus*) is a large and showy fly that pollinates very small flowers, such as mints and plants in the carrot family. The larvae are aquatic, lazily floating in shallow running or standing water. They feed on decaying organic particles as they pass by. Mature larvae are sometimes called leatherjackets. Soldier flies in the genus *Hedriodiscus* occur throughout the western U.S. They get their common name from the stripes found on the abdomen that resemble military stripes.

-Image by Bonnie Bunn,
Vegetable IPM Associate

In the National News, continued from previous page

substances harmful to pathogens or pest organisms, thereby making the host more resistant. Results showed that some endophytic fungi compete with the DED pathogen by preventing the access of the carbon nutrients it needs. This could help to limit the growth of the DED pathogen, and thus protect the tree.

ZOMBIE PLANTS DEMYSTIFIED

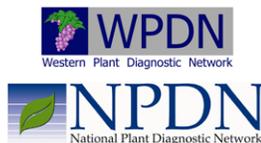
Scientists from Jena University in Germany shed light on the molecular reasons for how phytoplasmas destroy the life cycle of plants and inflict a "zombie" existence on them. Plants affected with the phytoplasma only form vestigial leaf structures and only serve the spread of the bacteria, becoming the "living dead."

They discovered that one of the main culprits is a protein called SAP54 that comes from the phytoplasma. According to the authors, the study results will not help to prevent the disease, could be useful for further fundamental research, such as gaining a better understanding of the genesis of blossoms in the course of evolution.

New Publications and Websites

- A [survey of northeastern hop pests and beneficials](#) has been published by the University of Vermont.
- A [summary of the scientific evidence about the effects of neonicotinoid pesticides on bees](#) has been published by a University of Guelph professor.
- A [new website](#) addresses the need for partnerships between organic and IPM agencies and groups.
- The USDA has added several new fact sheets to their list of [National Organic Program publications](#).

UTAH PESTS people and programs are supported by:



Utah State University is committed to providing an environment free from harassment and other forms of illegal discrimination based on race, color, religion, sex, national origin, age (40 and older), disability, and veteran's status. USU's policy also prohibits discrimination on the basis of sexual orientation in employment and academic related practices and decisions. USU employees and students cannot, because of race, color, religion, sex, national origin, age, disability, or veteran's status, refuse to hire; discharge; promote; demote; terminate; discriminate in compensation; or discriminate regarding terms, privileges, or conditions of employment, against any person otherwise qualified. Employees and students also cannot discriminate in the classroom, residence halls, or in on/off campus, USU-sponsored events and activities. This publication is issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Kenneth L. White, Vice President for Extension and Agriculture, USU.