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UTAH PESTS QUARTERLY

NEWSLETTER

Utah Plant Pest
Diagnostic Laboratory

USU Extension

IN THIS ISSUE

NEW FACT SHEETS

Ticks and Tickborne Diseases of Utah

Verrucosis del Duraznero (peach leaf curl)

National Pest Alert: European Cherry Fruit Fly

EXTENSION
UtahStateUniversity

New Utah Forest Pest: Balsam Woolly Adelgid

Dieback and decline of subalpine fir due to attack by balsam woolly adelgid.

The USDA Forest Service's Forest Health Protection group in Ogden, Utah detected and confirmed the presence of a new invasive forest pest in Utah called the balsam woolly adelgid (BWA). First noticed in the mountains above Farmington Canyon and near Powder Mountain Resort, this aphid-like insect has now been detected in seven northern Utah counties (Box Elder, Cache, Davis, Morgan, Salt Lake, Summit, and Weber). So far, the damage is mostly north of Salt Lake City.

In 2015, Utah's forest health specialists first noted an increase in fir death of an unknown cause. Just two years later, aerial insect and disease surveys outbreaks showed an increase in dead and dying subalpine fir trees. In June 2017, forest health professionals visited Farmington Canyon and found evidence of attacks by balsam woolly adelgid; including branch node swelling and old deposits of woolly material on tree bark.

Suspected to have originated in the Caucus Mountains along the boundary between Europe and Asia, BWA was first detected in North America in Maine in 1908 and in California about 20 years later. It was first found in Idaho near Coeur d'Alene in 1983 and has since spread across northern Idaho. It is believed that separate invasions of subspecies or races of BWA may differentially impact tree host species. Idaho foresters have noted that the scale of the dieback in some locations is alarming. In the western Payette National Forest, north of Boise, an estimated 70% of subalpine fir trees are dead and falling down.

In Utah, BWA primarily attacks subalpine fir (often called "balsam trees" in Utah), typically killing the tree within a few years. Subalpine fir (*Abies lasiocarpa*) are most easily identified by their conical crowns, usually growing at elevations above 7,500 ft. This insect has also been found attacking white fir (*Abies concolor*) in Utah, but this tree species is more resistant. BWA is of particular concern because until now, subalpine fir has been one of the few forest tree species that has resisted insect infestations such as bark beetles, which have killed millions of acres of pine and spruce across the West. Now it appears that Utah's subalpine fir may be facing a significant decline.

continued on next page

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Identification and Symptoms

BWA feeds only on bark, not on needles, by sucking out plant sap. They don't move from their feeding site (except the first nymph stage, called a crawler). The tiny insect itself is difficult to see, but is covered in a white, woolly material that builds up to large patches on the bark of infested trees.

Crawlers are present from late spring through fall. They can be blown by wind or spread on the feet of birds, but the primary movement is by walking. In North America, BWA is exclusively parthenogenic (asexual reproduction); therefore, only females are present and they lay female eggs without the mixing of gametes. Asexual reproduction can increase the likelihood of the insect developing resistance to insecticides, as parents pass on the resistance genes to offspring.

Injury from BWA is most visible in the fall. Needles turn brown, mimicking drought stress, with a key difference being that the crown starts thinning and browning from the inside out. It may take a well-tuned eye to notice that affected needles don't turn red like they do with bark beetle attacks, but instead turn brown. Branches swell and twist in a deformity known as gouting. Although BWA prefers vigorously growing and mature trees, it will attack trees of all sizes and ages, as opposed to native forest pests that tend to favor larger, older trees. Smaller trees under attack by BWA take on a bonsai appearance. In Utah, we have observed gouting in seedling-sized fir trees. Once a tree of any age starts to fade, it can take up to 10 years to die, in some cases dying within two years of infestation.

Wool-covered adelgid bodies are visible on the collar of a subalpine fir tree.

'Gouting' of branches, the swelling and deformity caused by balsam woolly adelgid feeding.

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Treatment

One challenge of managing this insect on wild lands is the lack of market value for subalpine fir. Recovering treatment costs through the sale of saw logs is not an option. Moving subalpine fir firewood from the mountains down to towns will likely result in introduction to urban fir trees. Therefore, limiting the movement of infested firewood is key to preventing spread.

Managed lands with high-value trees such as near cabins, campgrounds, and ski areas, can be treated with insecticides to suppress BWA. If the infestation is not widespread when first detected, affected trees should be harvested, and removed or burned that season. These trees are unlikely to recover even with an insecticide treatment.

There are many insecticides labeled for BWA control. Products such as Asana, Astro, Safari, Sniper and Talstar can be applied at any time of the year. Lorsban and insecticidal soap should only be used from late fall to early spring, a time of year when no eggs are present. Horticultural oil should only be used during winter because it may burn foliage if trees are not dormant. Thorough coverage of the trunk and limbs is critical to penetrate the adelgid's waxy covering. Good coverage is more important than the choice of insecticide. A high pressure sprayer that delivers several hundred gallons of spray per acre is essential.

Utah's Response

Widespread mortality has been observed in Utah high elevation firs, and in many locations, there are few other tree species to occupy the growing site, increasing the potential for this insect to inflict serious ecological damage such as erosion, decline in watershed health, and loss of wildlife. A Utah partnership has been formed to survey, research, and implement education and management efforts for BWA. Led by the Utah Department of Agriculture and Food, members represent a wide variety of concerned organizations including USDA Forest Service, USU Extension, the Utah Division of Natural Resources, USDA Animal Plant and Inspection Service, and ski resort representatives. This group is coordinating efforts to secure grant funding to study BWA's spread and impact in Utah, and to develop public educational products.

— Darren McAvoy, Extension Assistant Professor, Forestry
— Diane Alston, Extension Entomologist

Meeting of the Utah Balsam Woolly Adelgid partnership members in Farmington Canyon, September 2017.

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Guardian Plants Can Prevent Pests in the Greenhouse

In greenhouse operations, excellent pest control is a top priority. For example, a shipment of poinsettias can be rejected by a retailer for the mere presence of a single whitefly. Thankfully, there are cheap, non-chemical tools to improve the odds of control. In a Canada research trial, 75% of greenhouse poinsettia producers that included eggplants in their houses did not need to chemically treat the poinsettias all season long. The job of the eggplants was to lure whiteflies away from the poinsettias. A protective plant like this is considered a guardian plant because it helps guard the crop against pest damage. There are various roles that guardian plants can serve in any size greenhouse, whether for commercial or hobby production, and are often used in conjunction with biocontrol agents.

Trap Plants

In the example above, the eggplant would be considered a trap plant. Trap plants draw pests away from crop plants. Using this system requires that spot controls, whether biological or chemical, be targeted toward the trap plants to prevent further pest reproduction. This eliminates the need to treat the entire crop. Alternatively, if the trap plant becomes heavily infested, it should be bagged and removed from the greenhouse to eliminate the pest.

Marigold trap plants lure thrips away from the crop

Banker Plants

A banker plant is always used in combination with a biocontrol agent. The plant harbors a pest that the biocontrol can consume, and this pest does not harm the primary greenhouse crop. The ready source of prey on the banker plants allow the biocontrol agent to reproduce and build its population in the greenhouse, and thus disperse into the crop to target the primary pest. The banker plant system is essentially a mini-rearing lab for the biocontrol. One popular example of this system is barley. Commercial insectaries sell barley banker plants that are infested with a grass-specific aphid called bird cherry-oat aphid. This aphid does not attack greenhouse crop plants (so long as they are non-grass plants), but provides food for aphid parasitoids such as *Aphidius colemani*. A small amount of *Aphidius* is purchased along with the barley banker plants, and thanks to the bird cherry-oat aphids, *Aphidius* populations increase in the greenhouse. By the time green peach and melon aphids appear on the crops, the parasitoids are poised and ready to attack in high numbers.

Barley banker plant with the beneficial parasitic wasp *Aphidius colemani*

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Indicator Plants

Rather than searching for a needle in a haystack, indicator plants make pest scouting much easier. They are plants that pests prefer to attack before the crop plants, and are spaced evenly throughout the greenhouse. Growers can save time by carefully examining the indicator plants rather than the entire crop. Indicator plants can be more accurate than sticky cards because they detect the first arrival of the pest, and also give evidence of non-flying as well as flying stages of pests. In addition, they can indicate the status of beneficial populations. Biocontrol agents will be drawn to the more infested indicator plants, providing a picture of the natural enemy/pest dynamic that is occurring in the greenhouse. Care must be taken when using indicator plants to ensure they don't become a source for a pest outbreak.

Bean indicator plant for spider mites in tomato

Habitat Plants

Habitat plants support natural enemies by supplying pollen, nectar, shelter, and a place for them to lay eggs. They can be in-ground perennial or annual plantings, or potted plants. Certain commercial biocontrols such as adult lacewings or parasitoids need a boost of sustenance after shipment, and can be released at the flowering habitat plants. These plants also attract and sustain naturally-occurring beneficials.

Combining a variety of guardian plants helps to fulfill multiple roles. A project in the northeast U.S. studied the use of mixed planters for the control of aphids and thrips. The pots contained season-long flowers to attract

Habitat planting of alyssum with pepper.

and support reproduction of both wild and commercially introduced natural enemies. The mix included marigolds, alyssum, lantana, and fennel, and the banker plant, barley (for aphid parasitoids). This mix resulted in reproducing populations of three released biocontrol agents and a 75-fold increase in the wild species of beneficials. This natural enemy complex reduced pest populations by 50% alone.

Using guardian plants makes sense in today's retail climate, where consumers are demanding less application of pesticides and more sustainable pest management. Start-up costs are minimal, ongoing investment is low, the risk from failure is low because pesticides can be used when necessary, and they require minimal time.

Eggplant used as a trap plant for whiteflies

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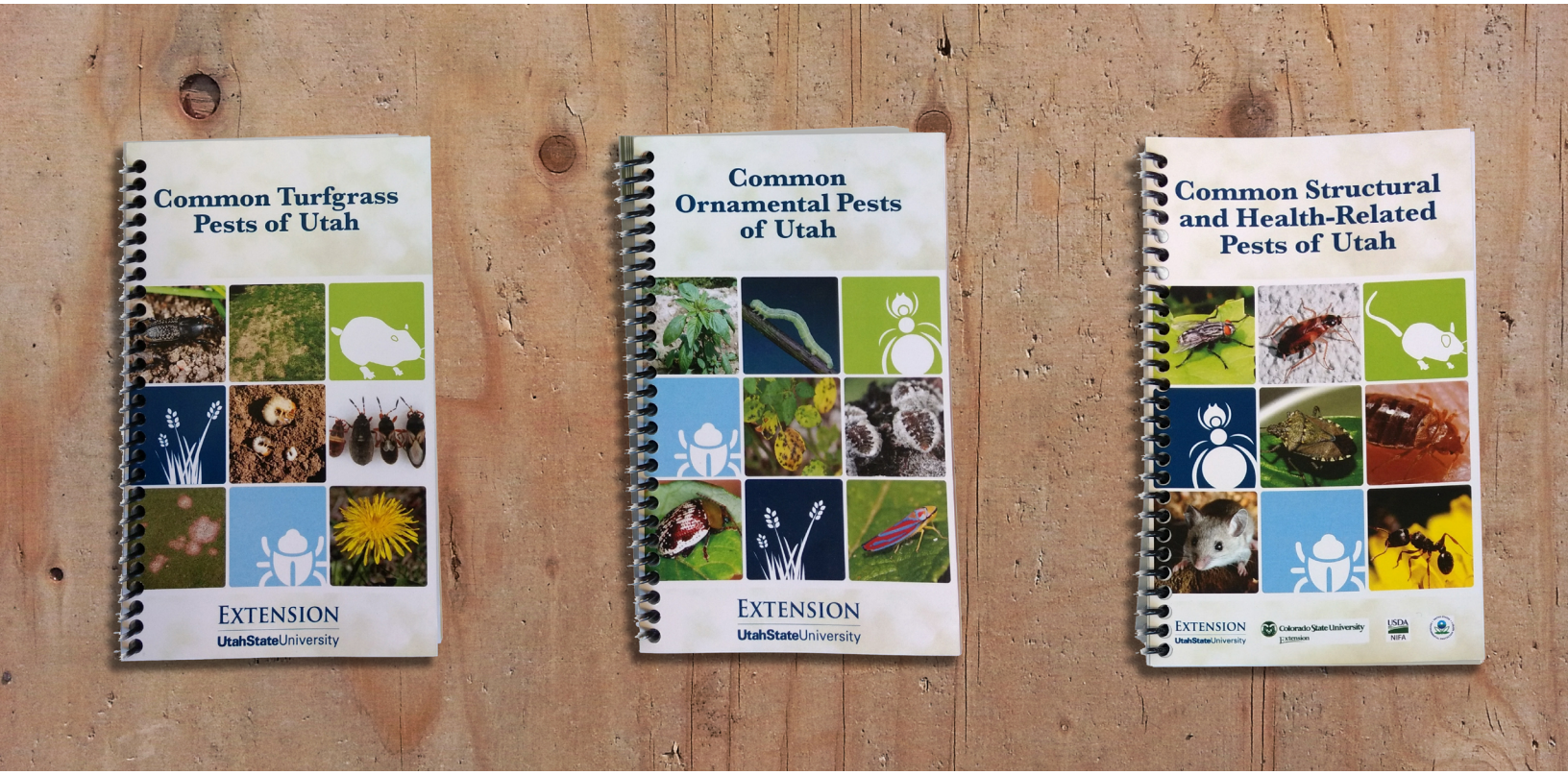
Examples of Guardian Plant Roles

Guardian Plants	Target Pest	Notes
ROLE: Trap Plant		
yellow marigold, mum, petunia, gerbera	thrips	Position plants around edges of crop plants.
cuban oregano (*Plectranthus amboinicus*)	thrips	Thrips are highly attracted to the plant, but don't feed on it. Add a yellow sticky card in each pot to mass trap thrips.
tomato, eggplant	whitefly	Offers excellent protection to fuchsia and poinsettia crops.
bush bean	spider mites	
ROLE: Banker Plant		
papaya	greenhouse whitefly	Papaya harbors papaya whitefly, which sustains whitefly parasitoids.
barley	green peach, melon, and other aphids	Barley harbors bird cherry-oat aphid, which sustains aphid parasitoids.
flowering ornamental peppers	thrips	Peppers provide pollen and prey (thrips) to sustain minute pirate bug.
ROLE: Indicator Plant		
eggplant	whitefly	
bush bean	spider mites	
marigold, impatiens, dill, castor bean	thrips	Position plants evenly throughout the greenhouse.
Calypso, Super Blue Magic, or Summer Madness petunia cultivars	thrips and *Impatiens necrotic spot virus* and *Tomato spotted wilt virus*	Virus symptoms appear within 2 days of thrips feeding. Because the virus does not cause systemic infections, these plants do not serve as a source for spread.
fava beans	thrips and *Impatiens necrotic spot virus*	Once the virus is detected, remove the plant to prevent spread.
ROLE: Habitat Plant		
castor bean	thrips	Castor bean pollen supports the beneficial mite, *Amblyseius degenerans*.
sunflower, lobularia, alyssum, ornamental pepper	thrips	Provides pollen for minute pirate bug, an important predator of thrips.
fennel, dill, alyssum, marigold	aphids, thrips, spider mite eggs	Syrphid flies are attracted to pollen and nectar.
eggplant	thrips	Pollen sustains many predators when prey is absent.

——— Marion Murray, IPM Project Leader

New Pest Identification Guides



The Utah Plant Pest Diagnostic lab, in cooperation with other USU Extension cooperators, has created three new booklets to help with pest identification and management in Utah. With a USU Extension grant in 2017, a team of subject experts including Ryan Davis (Entomologist), Britney Hunter (former County Agent), Kelsie Johnson (Writing Assistant), Claudia Nischwitz (Plant Pathologist), Ricardo Ramirez (Entomologist), and Katie Wagner (County Agent) developed photographic guides to identification and management of over 300 pests common to Utah, including abiotic disorders, arthropods, plant diseases, mollusks, vertebrates and weeds.

Each guide contains multiple color images of each pest and basic biology, life history and management information. The guides are intended to be used by pest management professionals to quickly identify common pests and to formulate basic pest management strategies. The new *Common Turfgrass Pests of Utah* covers 58 pests and is 115 pages. The *Common Ornamental Pests of Utah* guide covers 157 pests and is 307 pages and the revised *Common Structural and Health-Related Pests of Utah* guide covers 95 pests in 193 pages. While seemingly large, the guides are compact at 4.5 x 7 inches and are intended for easy transport and use in the field.

The guides will be available starting in February through USU Extension. Instructions on ordering the guides will be posted on the UPPDL website when they become available. While the guides will initially be free (act fast), there will be a shipping fee. Currently, the guides are available online for free in both html and pdf formats. The guides can be located by visiting utahpests.usu.edu and clicking on the blue "Pest Identification Guides" icon on the main page. We will also be distributing the guides for free at the 2018 Utah Green Conference in Sandy, UT, so stop by the UPPDL booth (#612) to get your free copies.

— Ryan Davis, Arthropod Diagnostician

Disturbing the Peace of Beneficials

Human-caused changes to the environment is a major factor leading to declines in arthropod species diversity and abundance. This result has been attributed to several changes including pesticide use, landscape use, and climate change. A recent article published in the journal Plos One in 2017, showed a 75% drop in total flying insect biomass in protected natural sites in Germany in just nearly three decades. The data for this study was gathered from citizen scientists and is being portrayed as a warning of an 'ecological Armageddon' and 'apocalypse', although the causes are not completely clear. What is clear is that several of these insects provide an array of important ecosystem services with perhaps pollination and natural pest control being the most recognized.

One mechanism described for resulting pest outbreaks includes a low level or reduction of predatory insects in the environment that would otherwise keep pests in check. In this case, a pest population can flourish by escaping predation. In agricultural systems, the classic cases that have shown this to occur following a broad-spectrum insecticide application that kills both pest and predators and that subsequently leads to an outbreak of another once innocuous pest. With the lack of predators, the 'pesticide treadmill' ensues, that is a constant need to bring down the pest population with pesticides because the natural balance of predators can no longer catch up and provide natural pest control.

While insecticide use can severely decrease the diversity and abundance of predators, in research conducted in northern Utah alfalfa, it was shown that not all predators are harmed in the same way. In part, this was a result of the phenology and life history traits of these predators. For instance, damsel bug populations were negatively affected by insecticide sprays targeting alfalfa weevils, but the later occurring big-eyed bug was not affected by these early season sprays. However, taking the community of predators into account, this altered the timing of life stages that were present throughout the season. Instead of having a diverse community of predator species represented by adult and immature life stages, communities were skewed to favor single life stages and appeared to diminish the effectiveness of predators as a whole. Even though a diverse community can be resilient when exposed to a disturbance such as a pesticide, it can still impact the functioning of the ecosystem.

Predators forage for prey in different ways, from the way they seek out their prey to the preference in prey size and type. Research has suggested that species in a diverse predator community can complement one another with these foraging differences to more efficiently suppress pests compared to a single predator species alone. Damsel bug nymph on left; lady beetle larva on right.

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Habitat loss from changes in land use across a gradient from natural to agricultural or urban land has had implications for pollinators, among other insects. Human population growth, as seen along the I-15 corridor in Utah, for example, has led to sprawling urban sites with anthropogenic modification to the habitat, with the installment of new landscape characteristics, and fragmentation and major disturbance to the surrounding original habitat. These types of changes have surely impacted the interaction of pollinators with the plants in the environment, available nesting sites, and the distribution of nectar, pollen, and nesting resources in the landscape. All of this contributes to changes in pollinator diversity and abundance in these new habitats.

In some of these simplified environments, pollinator behavior can change for certain species, where pollinators spend more time foraging in landscapes with few flower resources, and alters the quality of the food gathered. The agroecosystem has also shown this too, particularly in large monocultures where crop type and flower timing is uniform, leading to a spurt of a single type of nectar and pollen with major differences in quality compared to diverse cropping systems with flowering that occurs throughout a growing season across the landscape. As you may imagine, these changes can have major impacts on the communities of beneficial insects in the environment.

Climate change has had overarching impacts for pest and beneficial populations. An overwhelming amount of data have shown that anthropogenic actions are a culprit in the changes. Warming temperatures and drought have favored pests that thrive in these conditions including spider mites, bark beetles, wood borers, and sap feeders. In addition, these changes in climate have shifted the range expansion of certain pests to exist and persist in areas where they might not have otherwise occurred. For beneficials, there have been very subtle changes, but these can still have major implications. Temperature changes have resulted in various timing mismatches for beneficials. Shifts in bloom time and pollinator emergence and activity have been documented and can harm the success of both plants and pollinators. Similarly, there are cases where these shifts have provided an escape for pests from their predator that are not aligned as well as with their host.

A diverse array of plant and flower types can encourage a diverse community of beneficials to be maintained in the environment. Even predators need alternative food sources that include nectar and pollen when prey are lacking.

Despite these unintended consequences, there are strategies to conserve beneficial species with only a few themes being highlighted here. First is recognition that humans have a role in the health of the ecosystem. Pollinators and predators can be conserved by focusing on integrated pest management practices and reducing pesticide use whenever possible. It is evident that providing refuge areas, maintaining diverse cropping systems, and expanding community gardens in urban environments can improve diversity of beneficials and their ecosystem services. Finally, efforts to address climate change will be necessary to maintain a healthy balance for the success of beneficials, the suppression of pests, and the health of plants.

— Ricardo Ramirez, Entomologist

Genetic Mutations Cause Disease-Like Symptoms

Plants undergo occasional genetic mutations. Most of the time they go unnoticed, but sometimes disease-like symptoms develop under some environmental conditions. In Utah, the most common genetic mutation is in onion, resulting in yellow or white streaks on foliage that could be mistaken for a viral infection such as Iris yellow spot virus.

This type of mutation is called leaf variegation or chimera, and occurs randomly in plants. The white or yellow areas of the leaf lack chlorophyll, which can result in stunted plants. In contrast to genetic mutations in other vegetables, the occurrence of symptoms in onion is not associated with environmental conditions.

Genetic mutations are common in onions and may be confused with diseases such as Iris yellow spot virus.

This summer, we saw symptoms of genetic mutations in both sweet corn and tomato caused by extended hot temperatures. The symptoms in mutated corn are exacerbated by drought stress, and are called disease lesion mimic. They resemble foliar infections caused by bacteria or fungi. The mutation is common and usually does not cause any symptoms. The foliar symptoms reduced photosynthesis, resulting in unmarketable corn ears. Unfortunately, there is no corn variety that is immune to the mutation and there is no test to determine if a seedlot has the mutation. The disorder is less common in sweet corn, and more frequently seen in the Midwest on field corn.

Disease lesion mimic in sweet corn (top) and fruit pox on tomato (middle & bottom) caused by extended hot temperatures.

Symptoms on mutated tomato plants also require extended hot temperatures to appear. In addition, they show up during rapid growth and on fruits that do not have good foliar coverage. The symptoms primarily occur as lesions on fruit. The lesions are called fruit pox, and consist of small white areas on immature fruit that become necrotic and rupture on mature tomatoes. They resemble bacterial infections or feeding by insects. Usually the symptoms are on the shoulder of the fruit.

— Claudia Nischwitz, Plant Pathologist

Vegetable Varieties and Seed Companies

Now is a great time to research the diseases and insect pests that are giving you the most trouble, and to identify techniques to plug in to an IPM plan for the coming season. Some techniques that can be applied now include selecting vegetable varieties that are well-suited to your soil and climate, as well as choosing varieties with disease and insect pest resistance or tolerance (when available).

Varietal Selection

New vegetable varieties are constantly being developed with hundreds of options for each vegetable crop. Because of this, it is important to learn about new varieties. Suggestions given in this article are based on limited testing and are included to provide reference. Most varieties listed are suitable for the primary production areas in the Intermountain West region. Some varieties may perform better than others depending on local conditions. Note that varietal resistance to disease may break down over time due to different pathogen strains, environmental conditions that favor the organism, or when there is reduced natural plant resistance.

Keep the following points in mind when considering a new variety:

1. Use seed catalogs or other sources to identify a variety that has the characteristics (maturity times, growth habits, fruit size, cold/heat tolerance, pest resistance) you are looking for.
2. Grow the new variety on a small scale for 1-2 years and compare its performance to your standard variety to see if the new variety performs the same or better under your conditions and management practices.
3. For commercial growers, evaluate the new variety's performance in the marketplace, noting customer preferences.

Open-Pollinated vs Hybrid

Open-pollinated varieties (uncontrolled cross pollination) have good disease resistance, produce acceptable yields, and have historically been more common in vegetables grown from seeds. **Hybrid** seeds (controlled pollination – specific male and female parents) are generally more vigorous and uniform in growth, possess better disease resistance, and have greater productivity than open-pollinated varieties. Hybrids are usually more expensive than open-pollinated. Performance differences between the two varies with growing conditions.

Heirloom, Genetically Modified, and Organic

Heirlooms are "old" varieties that have been selected and preserved from historic seed lines over many generations. They are generally open-pollinated, but not all open-pollinated varieties are heirlooms. **Genetically modified (GM)** varieties are developed when genetic material from different plants, animals, or organisms is inserted into the desired crop in order to include desirable traits such as improved disease or insect tolerance, resistance to specific chemicals like herbicides, or tolerance to adverse environments. **Organic** varieties can be heirlooms, open-pollinated, or hybrids, but they cannot be GM because to be organic, seeds must be harvested from plants that were grown following organic production practices.

Disease Resistance

Most hybrids and some open-pollinated varieties have resistance to some of the major vegetable diseases and plant parasitic nematodes. Using disease-resistant varieties can reduce crop loss and minimize pesticide use. When possible, select varieties with resistance to multiple diseases and nematodes, especially if persistent problems have occurred in the past. Look in seed catalogs and on seed packets for a list of diseases to which a variety is resistant. See Cornell's Tables of Disease Resistant Varieties for a list of resistant vegetable varieties.

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Other Characteristics

Number of days to maturity is a variety characteristic that varies greatly with all vegetable species and varieties. Early-maturing varieties should develop in most growing areas of Utah, but many do not have the quality of late-maturing varieties. Long maturity vegetables and those that require warm temperatures may not mature in some areas where early fall frosts occur.

Several other factors need to be considered when selecting a variety, including plant size, eating quality, color, flavor, adaptability, tolerance to variations in climate, and processing characteristics.

Ordering Seeds

Some companies send out their catalogs upon request (see company list below). It is best to order seed catalogs during the late fall or early winter for next year's growing season. Order seeds by January to February to be sure they arrive in time for spring planting.

Garden centers, discount stores, super markets, or nurseries may have limited supplies and selections of varieties. Consult your nursery or garden center specialist for specific information on the varieties they carry. Transplants of specific varieties are often in short supply. Check with your local nursery or garden center to see if they have specific varieties you are looking for. If not, they may be able to special order or produce these varieties for you in the future. Most nurseries and garden centers generally grow and sell varieties requested by customers.

Use the following lists of vegetable varieties suggested for Utah and seed companies to help you plan your upcoming season. Seed catalogs and seed packets will include a list of disease(s) to which a variety is resistant.

Variety Suggestions for Utah (limited list)

Vegetable	Suggested Varieties or Types for Utah
Asparagus	Jersey Giant, Jersey Knight, UC 157 F1, Purple Passion
Broccoli	Emerald Crown, Gypsy, Hallmark, Marathon, Packman, Premium Crop
Brussels Sprouts	Diablo, Dominator, Hestia, Revenge, Royal Marvel
Cabbage	Artost, Caraflex, Bronco, Cairo (red), Quisto, Rendero (red), Surprise
Cauliflower	Amazing, Denali, Freedom, Hermon, Minuteman, Synergy, Whistler
Kale	Red Russian, Redbor, Rogue, Starbor, Winterbor
Kohlrabi	Kolibri (red), Konan, Kongo, Early Purple Vienna
Summer Squash - Types	crookneck, patty pan, round, straight neck, yellow, green, striped zucchini
Winter Squash - Types	acorn, banana, buttercup, butternut, delicate, hubbard, kabocha, spaghetti, turban
Pumpkin	New England Pie, Munchkin, Small Sugar, Spookie, Autumn Gold, Spirit, Connecticut Field, Howden, Big Max, Atlantic Giant, Polar Bear, Moonshine
Cucumber - Pickling	Atlantic, Calypso, Cross Country, Jackson, Multipik, Napoleon, Pikmaster, Quest, Shenandoah, Vlasset
Cucumber - Slicing	Centurion, Dasher II, Meteor, General Lee, Marketmore 76, Rider, Slice Nice, Striker, Turbo
Cucumber - Tunnel	Unistar, Katrina, Socrates, Iznik, Diva
Cantaloupe	Trinity, Edisto Star, Yuma Grande, Top Net, Anita, Sweet East, Western Charm, Olympic Express, Olympic Gold, Western Express, El Camino, Primo, Torreon, Coronado, USAM90000
Honeydew Melons	Precious Dew, Dewlightful, #252 HQ, Moon Dew, Honeybrew, Snow Mass, USAMX 23000, USAMX 63001, Dulce Nectar
Casaba-Crenshaw-Specialty Melons	Juan Coronel, Ananas Hyb EM815, EM850 Falia F1, Casaba Golden Beauty, Tamara, Visa, Lilly

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Variety Suggestions for Utah (limited list) (cont.)

Vegetable	Suggested Varieties or Types for Utah
Seeded (Diploid) - Open Pollinated	Crimson Sweet, Jubilee, Sugar Baby, All Sweet, Cal Sweet, Charleston Grey
Seeded (Diploid) - Hybrid	Sentinel, Sangria, Mara, Sweet Star, Fantasy, Sweet Fashion, EM Scarlet, Carmen, Starbrite
Seeded (Diploid) - Hybrid, Yellow Flesh	Yellow Baby
Seedless (Triploid) - Red Flesh	Coopertown, Majestic, Fascination, Distinction, Marita, Affirmed, Citation, Millionaire, Ruby, Tiger Eye, Liberty, Freedom
Seedless (Triploid) - Yellow Flesh	Yellow Buttercup
Pollinators	Gladiator, Polimax, Ace, Wild Card, Sidekick, Accomplice
Onion	Calibra, Candy, Charismatic, Crockett, Delgado, Desperado, Fiesta, Granero, Joaquin, Legen, maverick, Mesquite, Ranchero, Redwing, Sedona, Swale, Sweet Sandwich, Tequila, Utah Sweet Spanish, Vaquero, Walla Walla
Green Onion	Evergreen White Bunching
Potato - Early	**CalWhite** (white skin; white flesh), **Irish Cobbler** (buff skin; white flesh), **Russett Norkotah** (russet skin; white flesh), **Dark Red Norland** (dark red skin; white flesh), **Norland** (red skin; white flesh)
Potato - Mid-Season	**French Fingerling** (pink skin; yellow flesh), **Gold Rush** (russet skin; white flesh), **NorValley** (white skin; white flesh), **Chieftan** (red skin; white flesh), **Red La Soda** (deep red skin; white flesh), **Red Pontiac** (red skin; white flesh)
Potato - Late-Season	**Bannock Russet** (russet skin; white flesh), **Katahdin** (whitish skin & flesh), **Russet Burbank** (russet skin; white flesh), **Yukon Gold** (yellow/buff skin; yellow flesh), **Ida Rose** (red skin; white flesh), **Russian Banana** (yellow skin; yellow flesh), **Western Russet** (russet skin; white flesh)
Eggplant	Cappi, Epic, Megal, Millionaire, Nadia, White Star
Eggplant - Heirloom	Black Beauty, Long Purple, Rosa Bianca
Pepper - Bell Peppers	Ace, Aristotle, Bell Boy, California Wonder, King Arthur, Revolution, Socrates
Pepper - Banana Types	Ethem, Key West, Sweet Savannah
Pepper - Sweet (non-bells)	Aruba, Cubanelle, Giant Marconi, Pimento, Sweet Cherry, Sweet Hungarian
Pepper - Hot Peppers	Cayenne, Chili, Habanero, Hungarian, Jalapeno, Serrano
Pepper - Heirloom	Chocolate Beauty, Emerald Giant, Golden Calwonder, Orange King Bell, Yolo Wonder
Tomato - Large Fruited	Mountain Glory, Mountain Fresh, Mountain Majesty, Celebrity, Sunbrite, Sunshine, Jet Star, Empire, Heatmaster
Tomato - Cherry (Saladette Types)	Sweet Million, Sweet Gold, Sweet Hearts, Juliet, Verona
Tomato - Heirloom	Branscomb, Golden Swedish, Black Prince, Black Zebra, Chocolate Stripes, Beafsteak, Brandywine, Cherokee Purple, Coldset, San Marzano, Red Heart
Corn - Standard Sugary	Earlivee, Honey & Cream, Jubilee, Silver Queen
Corn - Sugar Enhanced	Sugar Buns, Bodacious, Fantasia, Luscious, Miracle, Temptation
Corn - Shrunken-2/ Super Sweet	Devotion, How Sweet It Is, Obsession, Vision, Xtra-Tender
Corn - Synergistic and Others	Cameo, Gourmet Sweet, Vitality

continued on next page

For more variety suggestions see the USU Extension Yard and Garden Fruits, Vegetables, and Herbs Webpage.

For more information on variety selection see Variety Selection in the Utah Vegetable Production and Pest Management Guide and Dan Drost's Home Vegetable Garden: Variety Recommendations for Utah.

Seed Companies

W. Atlee Burpee Co.
Warminster, PA
1-800-888-1447
burpee.com

Gurney's Seed Co.
Greendale, IN
513-354-1492
gurneys.com

Rupp Seeds
Wauseon, OH
1-800-700-1199
ruppseeds.com

Nichols Garden Nursery
Albany, OR
1-800-422-3985
nicholsgardennursery.com

Park Seed Co.
Greenwood, SC
1-800-845-3369
parkseed.com

Twilley Seed Co.
Hodges, SC
1-800-622-7333
twilleyseed.com

Stokes Seeds
Buffalo, NY
1-800-396-9238
stokeseeds.com

Johnny's Selected Seeds
Albion, ME
1-877-564-6697
johnnyseeds.com

***Mtn. Valley Seed Co.**
Salt Lake City, UT
1-866-948-4727
trueleafmarket.com

*Specializes in varieties adapted to Utah growing conditions

Find other seed suppliers at seedquest.com.

— Cami Cannon, Vegetable IPM Associate

NEWS, PUBLICATIONS, AND MORE

IPM In The News

Native Biocontrol Helps Cranberries

Sixty percent of the nation's cranberries are produced in Wisconsin, creating a $1 billion industry. But insect pests can threaten harvests each year, and pesticides used in fields can leak into groundwater. Entomologists at the USDA Vegetable Crops Research Unit in Madison looked to reduce pesticide use with biological control. They collected native beneficial nematodes from wild cranberry marshes to determine their effects on two pests—flea beetles and fruitworms—that spend a portion of their life cycle underground. Two of the six nematode species collected were as effective as pesticide sprays, in some cases wiping out up to 90% of the insect pest populations. The next step for the researchers is to develop a strategy for producing a sprayable nematode product that cranberry growers can use.

Fungicides Tied to Declining Bumblebee Populations in the United States

A Cornell-led team of scientists conducted a landscape-analysis of two dozen environmental factors to understand predictors of decline in four bumblebee species, as published in the journal, *Proceedings of the Royal Society B.* Across the 284 sampling locations and 24 variables, they found that greater usage of chlorothalonil was a major factor in predicting bumblebee decline. Prior lab studies have already implicated chlorothalonil in increasing both bumble bee and honey bee vulnerability to *Nosema*, a fatal gut infection. But this recent analysis shows the first landscape-scale connections between chlorothalonil usage, *Nosema* prevalence, and decline of certain bumble bee species.

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Insecticides Affecting Songbird Migration

The influence of insecticides on bird migration is not completely known. University of Saskatchewan researchers exposed seed-eating white-crowned sparrows to two widely used agricultural insecticides, imidacloprid and chlorpyrifos, and compared effects on body mass, migratory activity, and orientation. In *Scientific Reports*, they document that imidacloprid-dosed birds exhibited significant declines in fat stores and body mass and that chlorpyrifos impaired birds' orientation. These results suggest that wild songbirds eating the equivalent of four imidacloprid-treated canola seeds or eight chlorpyrifos granules per day over 3 days can suffer impairment, migration delays, and improper migratory direction, which could lead to increased risk of mortality or loss of breeding opportunity.

The Myth of Ancient Cockroaches

In a paper published in *Palaeontologica Electronica*, a review of the oldest cockroach fossils known to science debunked the theory that cockroaches have been around for 200-300 million years. Instead, they report that the oldest known cockroach fossils, *Valditermes brennae* and *Cretaholocompsa montsecana*, are from somewhere around the end of the Jurassic and beginning of the Cretaceous periods (about 120-130 million years ago). Their study assessed all existing fossils and found that only 25 percent of them are actually cockroaches. The dates of these fossils indicate that most of the 7,000 species of cockroaches alive today probably originated *after* the extinction of the dinosaurs. Cockroaches almost certainly existed in the Cretaceous and Jurassic periods, too, but most of those lineages appear to have gone extinct.

Fallen Fruit Promotes an Invasive Pest

Spotted wing drosophila (SWD; *Drosophila suzukii*) now occurs in nearly every U.S. state and Canadian province, and in some areas, is responsible for yield losses in berries and other fruits of up to 80 percent. In a recent study reported in *Journal of Economic Entomology*, researchers from Michigan State University investigated non-chemical alternatives to reduce reproductive ability of the flies. They examined a wide variety of ground-collected fruit types and found that 100% of apples, pears, grapes, and raspberries were infested with SWD, with grape and cider apple waste being highly popular egg-laying sites. Peaches, plums, pumpkins, and cherries were not heavily infested with the fly, if at all. Although grapes and apples are not considered threatened by SWD, susceptible crops grown nearby may become more susceptible. The authors' findings represent a warning that fallen grapes and apples are fertile ground for reproduction and any fruit waste at those sites needs to be disposed of as quickly as possible. Incineration is one current and effective method, as is burial at least four inches deep.

'Probiotic' May Rescue Endangered Plant

The mint plant, *Phyllostegia kaalaensis*, once only grew in the Waianae mountain range in West Oahu and now only exists in state and federal greenhouse facilities. This critically-endangered plant is threatened by habitat loss, invasive animals, and the plant disease, powdery mildew. Powdery mildew does so much damage to these fragile plants that, even in a greenhouse, they require regular fungicide treatments. Researchers from the University of Hawaii tested the use of a sprayable mix of beneficial microorganisms called endophytes (in essence "probiotics") as a treatment for powdery mildew. They took leaves from a closely related, healthy wild plant, blended them together, and sprayed the resulting mix of endophytes onto the leaves of *P. kaalaensis*. The treated plants did so well that they were replanted on Oahu island and now represent the only wild population on the planet.

Potential New Tool to Reduce Antibiotics for Bees

Honey bee larvae should be plump and pearly-white. Those that are killed by American foulbrood disease (AFB) become brown and slimy. AFB, caused by the *Paenibacillus larvae* bacterium, is highly contagious and destructive. It is also difficult to control because the bacteria are able to form survival structures called spores that can withstand extreme environmental conditions and live up to 70 years. Currently, antibiotics or hive-burning are the only management options. Researchers at the University of Nevada, Las Vegas have explored mechanisms to block the spores' ability to germinate. They are using an "antagonist," which is a molecule that binds to the receptor on the spore and prevents germination from happening, akin to getting the wrong key stuck in a lock. In a study published in the *Journal of Insect Science*, the researchers reported that bee larvae that were fed a diet containing the antagonist, 5-chloroindole, were better able to survive exposure to *P. larvae* spores. The next step is to develop a practical method for treatment of bee larvae with 5-choroindole.

Update on the Global Status of Resistance to Bt Crops

Since 1996, farmers worldwide have planted more than 2 billion acres of genetically modified corn, cotton, and soybean that produce insect-killing proteins from *Bacillus thuringiensis* (Bt). Some scientists fear that the widespread use of Bt proteins in genetically engineered crops would spur rapid evolution of resistance in pests. Researchers at the University of Arizona have been testing this prediction. They analyzed data for 36 resistance cases representing 15 pest species in 10 countries, and published their results in the journal, *Nature Biotechnology*. They discovered 16 cases of resistance as of 2016, compared with only three cases by 2005. In those 16 cases, pests evolved resistance in an average time of just over five years. On the flip side, in 17 other cases, pests have not evolved resistance to Bt crops, particularly due to plantings of non-Bt crops nearby as alternative food, called refuges. This paper represents only the beginning of using systematic data analyses to enhance understanding and management of resistance.

Can Poison Ivy Save the Forests?

Japanese knotweed is an invasive species that has been taking over many North American rivers and floodplains, in particular, forests classified as Silver Maple Floodplain. Scientists report that the silver maple forests in particular, have not been able to regenerate with new seedlings for the last 50 years. Ecologists at Bucknell University, Pennsylvania, report in *Biodiversity Data Journal* that they have discovered a few areas where new silver maple seedlings have successfully established. Their extensive field surveys revealed poison ivy as the unlikely hero. Where this despised plant grows in combination with knotweed, it out-competes it, and creates microhabitats for new tree seedlings to take hold. The authors caution, however, against relying on poison ivy to save the day. Eradication of knotweed is still essential to avoid ecological dangers such as erosion and loss of habitat.

New Publications, Videos, Books, and Apps

- If your farm or property has been affected by pesticide drift, be prepared with the publication, In Case of Drift: Toolkit for Responding to Pesticide Drift. It includes details on how to protect your health, how and where to report drift incidents, and how to seek compensation for crop loss.

- Cornell University recently published a video on "Managing Cucurbit Downy Mildew on Organic Farms", which includes strategies such as selecting resistant cultivars, using OMRI-listed pesticides, choosing specific high tunnel designs (such as movable tunnels), and rotating crops.

- The Current State of Integrated Tick Management includes a summary of the latest progress in IPM practices for ticks.

- Food and Agriculture Organization of the United Nations revised their Climate-Smart Sourcebook, which contains a wide range of information and expertise to help guide policymakers, program managers, academics, extension, and other practitioners in creating more productive and sustainable agricultural sectors, while improving food security and reducing carbon intensity.

- The Land Stewardship Project offers a new publication, Soil Health, Water, and Climate Change (fill out a form to receive it here). This resource is an introduction to the latest innovations in science and farming related to building soil health.

- USDA Natural Resources Conservation Service (NRCS) has introduced a series of Growing Organic videos that highlight different types of assistance provided by the NRCS for organic farmers, including irrigation, habitat, weed management, and soil health.

- NRCS has introduced a new soil health-themed campaign featuring "Mighty Mini Microbe," a tiny, 3D-animated superhero character to encourage the next generation of farmers, conservationists, and scientists. The campaign includes a science-based coloring book and a promotional video.

Featured Picture of the Quarter

These two photos show *Watermelon mosaic virus* (WMV) symptoms on squash fruit and leaves found in summer 2017. Dense populations of aphids were also found on the leaves, flowers, and stems of this plant. WMV infected plants were found at multiple locations this summer.

WMV is a potyvirus that affects several vegetables such as summer and winter squash, zucchini, gourds, and pumpkins. The virus is spread by aphids which acquire the virus from infected weeds or alfalfa. WMV overwinters in infected perennial weeds or alfalfa.

Symptoms such as mosaic patterns on leaves, distorted leaves, color-breaking on fruit, and warts on fruit usually begin to show in June. First symptoms are often seen on field edges and aphids continue to move the virus across the cucurbit field. Aphids and aphid skins may also be seen on infected plants. Symptoms can be confused with herbicide injury or other abiotic disorders.

— Photos by Cami Cannon, Vegetable IPM Associate

UTAH PESTS people and programs are supported by:

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WPDN Western Plant Diagnostic Network
NPDN National Plant Diagnostic Network

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