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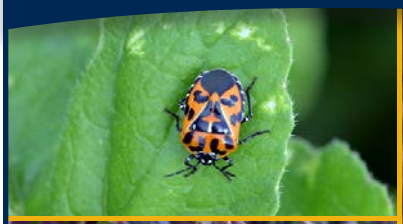

In This Issue:

The ever-evolving story of food production

While significant scientific advances have occurred over the past few decades in food production, consumers still remain somewhat skeptical about certain types of foods in the market. An average consumer is bombarded with varied messages from information sources about what they eat. Sensational, often unreliable information, tends to spread quickly among social media outlets, so it is increasingly important to seek information from credible sources.

Because foods derived through fundamentally different breeding techniques have dominated markets in quick succession over the past few decades, current populations have consumed different extents of each type. For example, older generations consumed crops or foods that were generated through classical breeding techniques that produced new varieties of hybrids by cross-breeding plants belonging to the same species. In the 2000s, genetically modified crops entered the market; hence, middle-aged individuals are likely to have consumed food derived from both classical breeding techniques and from genetically engineered crops. Younger generations, on the other hand, may have mostly grown up on genetically modified foods as opposed to its predecessors.

Figure 1. The evolving nature of food production practices. (Photo credit: R. Chandran)

There are important questions about which type of food is better for our health and environment. Answers are emerging as a result of scientific studies that have analyzed large quantities of data, while answers to others remain elusive due to the sheer complexity of the situation.

From the integrated pest management perspective, this topic is highly relevant because methods to manage pests in crop production use traits derived from genetic modification. In 2000, a series of articles was published by WVU Extension Service *(http://anr.ext.wvu.edu/pests/weeds/genetic_engineering principles; http://anr.ext.wvu.edu/pests/weeds/genetic_engineering/pros_and_cons; http://anr.ext.wvu.edu/pests/weeds/genetic_engineering/current_and_future)* that critically examined genetically modified crops, based on information available at that time. Since then, much more information became available – particularly information related to the health aspects of genetically modified crops and novel crop breeding techniques.

We will delve into the subject more in depth this year in the *IPM Chronicle*. Please stay tuned for future issues as we explore the debate from a scientific approach based on the latest research.

Potato blackleg caused by an aggressive bacterial strain of *Dickeya dianthicola*

Potato blackleg and tuber soft rot disease caused by different bacteria (*Pectobacterium atrosepticum, P. carotovorum* subsp. *carotovorum* and *Dickeya* spp.) have long been associated with potato production. However, over the past two years, *Dickeya dianthicola*, a more aggressive form of the pathogen, has emerged to threaten potatoes in the Northeast and Mid-Atlantic.

Although disease symptoms from the usual black leg-causing organisms and the new one are often indistinguishable, *Dickeya dianthicola* can occur from lower inoculum level, spread through the plant's vascular tissue quicker, is considerably more aggressive and needs higher optimal temperatures (75 to 77 degrees Fahrenheit) for disease development. Infected tubers may look healthy at planting, but the disease develops when soil temperature increases.

Figure 2. Dark lesions on the plant's stems are symptoms of blackleg. (Photo credit: MM Rahman)

Symptoms

Above-ground symptoms include fields that have uneven plant emergence and irregular stands with 10 to 40 percent of plant death. Wilting and blackleg symptoms, including dark lesions on the plant's stems (Figure 2), begin to appear in plants that may have emerged from infected tubers. They'll eventually die, but not before spreading the disease to neighboring plants.

Generally, disease caused by *D. dianthicola* under warm, wet conditions leads to stem rotting with symptoms similar to less destructive blackleg caused by *P. atrosepticum*. Under less humid conditions, less rotting is observed with *D. dianthicola*, but symptoms such as wilting, increased leaf desiccation, stem browning and a hollow stem can be present (Figure 3).

Tubers may develop symptoms later on, including a light-colored rot with no odor, which differs from blackleg that produces a much more distinct smell. Although symptom expression in the Northeast is slow, it can be very quick and devastating in the warmer Mid-Atlantic and the Southeast. The pathogen was detected during the summer of 2016 on seed from Maine and New Brunswick, Canada.

Potato growers, crop consultants and extension personnel in states that grow Maine potatoes should remain vigilant and scout fields for *Dickeya* symptoms on a regular basis and submit suspect samples for diagnostic testing.

How Does *Dickeya* Spread?

The most significant means of spread is the movement of latently infected seed tubers. The pathogens can not only be carried on the tuber surface and in lenticels, but also in the tuber vascular system, where they enter the stolon from the infected mother plant or from a root infection.

Figure 3. A hollow stem is evidence of D. dianthicola. (Photo credit: Steven Johnson, UMaine)

Prevention and Management

- *D. dianthicola* is a seedborne pathogen and infected seed pieces often exhibit no symptoms. Growers should take precautions when acquiring seed potatoes in order to prevent the introduction and spread of *Dickeya* to their farms. Request a laboratory testing confirmation from the seller that shows that the seed was tested in a certified testing facility and found to be free from *Dickeya*.
- Cutting seed will spread *Dickeya*. Growers should consider planting uncut seed when possible. If cutting seed, ensure that the cut surfaces are

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Japanese stiltgrass – an encroaching invasive

Japanese stiltgrass (*Microstegium vimineum* (Trin.) A. Camus) is a shallow-rooted, non-native annual grass that typically invades moist and shaded environments. It is capable of establishing dense canopies that can displace native species by excluding light. This fast-growing weed encroaches on the outer edges of pastures and other managed landscapes, such as home lawns and gardens.

While stiltgrass typically grows about knee height, it can grow up to 2 feet under ideal conditions. The leaves are lance-shaped, asymmetrical and pale green in color with a shiny midrib (Figure 4).

Being an annual, stiltgrass propagates through seeds every year but is capable of spreading by rooting at nodes giving rise to new plants within each growing season. The seeds can remain dormant in the soil for up to three years and are disturbed by animals or surface water.

Seeds start to germinate in early spring and produce flower spikes by late summer. This is an ideal time to implement control measures.

Figure 4. The leaves of Japanese stiltgrass are lance-shaped and asymmetrical with a shiny midrib. (Photo credit: R. Chandran)

Mechanical control

Mechanical control methods, such as mowing, should be carried out before plants come to bloom in late summer. In lawns or landscapes that are constantly mowed, the plants may adapt by blooming at low heights.

Figure 5. The shallow root system of Japanese stiltgrass makes hand removal an effective control method for small areas. (Photo credit: R. Chandran)

The shallow root system makes hand removal an effective control method for managing small populations (Figure 5); however, it is important to remember that early removal may cause germination of seed remaining in the soil, which could allow for another life-cycle during the growing season. Mulching gardens or flowerbeds with 4 to 6 inches of wood chips can also be effective for controlling small populations.

Chemical control

Herbicides are more effective in controlling larger populations of stiltgrass. Herbicides containing active ingredients pendimethalin (Pendulum, Prowl) are used to control stiltgrass prior to germination.

Actively growing plants may be selectively controlled from broadleaf plants by herbicides containing fenoxaprop (Acclaim), sethoxydim (Poast, Vantage), clethodim (Select Max), quizalofop (Assure II) or fluazifop (Fusilade).

Non-selective herbicides, such as glyphosate (Roundup, Accord), paraquat (Gramoxone) or glufosinate (Liberty), may be used to control stiltgrass along with other undesirable plants. Post-emergent herbicides should be applied prior to the bloom stage.

It may be necessary to monitor a managed site for three to five years after treatment to ensure the seedbank is completely depleted.

This can be accomplished by reseeding and stabilizing the area with desirable native plants along with repetitive removal of stiltgrass before it comes to bloom.

Consider your mulch options

Mulching is covering bare soil and is a common practice that is appropriate for vegetable gardens, raised beds, flower beds, around landscape trees and commercially grown vegetables and fruits. Mulch controls weeds, preserves moisture, heats or cools the soil and beautifies the landscape.

Types

There are two different kinds of mulch: inorganic and organic. They have different uses, functions and effects on the soil. Both types will improve weed suppression and moisture retention and will impact the temperature of the underlying soil.

When mulch is not properly used, it can hurt more than help, causing issues with root and collar rots, vole damage, termites and even plant death. Remember the surface must be weed-free before application, and a layer of 3 to 5 inches will discourage most weeds.

Organic Mulch Options

- Grass clippings break down quickly and provide nitrogen. Clippings from chemically treated lawns should not be used for mulching vegetable gardens and flowers, because residues may have negative effects on those plants.
- Compost is another good choice with some limitations. It is nutrient-rich and biologically active, which will enrich the soil; however, weed seed may be introduced and compost tends to dry out. As long as those issues are addressed, compost is a good choice for vegetable gardens, flower beds and small fruits.
- Pine needles provide a good source of nitrogen and phosphorus with the added bonus of lowering the soil pH. However, they have a strong allelopathic effect when fresh plant material is used meaning that it will have negative effects on the surrounding plants through plant growth inhibition on germination and plant development.
- Wood chips and shredded bark look good and appear to last longer; however, there are some inherent problems. Wood uses available nitrogen to break down and become new soil, so it is necessary to apply nitrogen fertilizer prior to mulching. Wood chips and shredded bark can induce the development of slime mold (Figure 6B) and shotgun or artillery fungus (Figure 6A) that will discharge spores in a 30-foot radius. Once dried, these spores become dark-colored and are particularly unsightly and they are very difficult to remove. This type of mulch also has an allelopathic effect.
- Shredded leaves provide a lot of nutrient-rich mulch material. Avoid using fresh leaves, rather chop up fall leaves with the lawn mower before using as mulch.
- Straw is often used, though weed seeds are brought in with straw mulch. The other significant limitation is that straw provides living quarters for voles. Rodents eating bark will often girdletree trunks and shrub shoots, resulting in plant death.

Figure 6A. Spores of a shooting/ artillery fungus on blueberry leaves. (Photo credit: Bill Shockey)

Figure 6B. Slime mold found growing on wood chips. (Photo credit: M. Danilovich)

Inorganic Mulch Options

- Black plastic mulch will rapidly transmit heat to the soil. It is suitable for flower beds, vegetable gardens, raised beds and tunnels. An added bonus is that it prevents fruits from directly contacting the soil. On the negative side, plastic is not breathable and doesn't allow free air and water exchange. This can result in increased incidences of root rot.
- Landscape fabric is usually used as an underlining for other types of mulch. It cuts down on light, preventing weed seed germination, while water and air pass through it.
- Pebble, rock and crushed stone in combination with landscape fabric are attractive options. The material warms up fast during the day and releases absorbed heat over a prolonged time, creating a microclimate for the surrounding plants.

What to do before you buy your seeds

I am as guilty as everyone else who is giddy over the new seed catalogs (Figure 7). All of the new varieties and old favorites get my hands itching to start planting. However, before orders are placed, there are some things to do to prepare for the next growing season.

Figure 7. Getting ready for the next growing season by going through the glut of seed catalogs and packages. (Photo credit: B.E. Liedl)

Factors to consider

If you took notes during last year, start to look at those notes to see where and if you had problems. Recording what is happening to your crop(s), both good and bad, is critical to making future decisions on your farm.

If it is a previously grown crop that you have had trouble with, what were those problems? Was it an insect or disease problem or was none of the produce marketable?

Gather resources so you can treat the problem. Consider contacting local agriculture service providers or a local, experienced farmer. Then you can start gathering a library of resources to help you. Anticipating possible problems can help you determine if a crop is for you or not.

Problem Solving

Perhaps the problem can be solved by using a resistant variety. For example, if you routinely get late blight on your tomatoes, you might try using one of the new, late blight resistant varieties. If resistant varieties are not available, then consider another crop or being extra vigilant on scouting for this pest problem early on.

If you are having a problem in the same place every year with a crop, consider rotating this crop to another location or not growing the crop for at least a year. If that isn't possible, are there management practices that you can do to reduce the pest problem? Did you use disease-free seed? Can you break the pest life cycle? Other alternatives include planting the crop earlier, using mulch or trying to rotate crops with different growth habits to help control weeds.

Did you follow recommendations for fertilizer and irrigation to maximize plant vigor? For instance, the blotchy ripening in a tomato can be due to inadequate potassium.

Similarly, if your cucumbers are cracking, it could be that they were exposed to cold temperatures during fruit development, which reduces the elasticity of the skin. Thus, it is important to optimize the environment of your greenhouse or high tunnel for the crop(s) you are growing.

Introducing New Crops

When considering growing a new crop you may ask what you already know about growing it. Do you know the common pests and control measures? Or the nutritional needs of the crops and common nutrient deficiency signs?

Consider these things before you add new crops to your farm operation.

Potato blackleg – *continued from page 2* –

seed when possible. If cutting seed, ensure that the cut surfaces are suberized prior to planting to avoid new infections. Clean and disinfect tools and equipment used for cutting and planting seed as well.

- This organism lives three months in the soil but can easily survive on plant debris for more than a year. As such, rotate crops yearly with a non-host crop to reduce the risk of disease.
- Delay harvest until skin set is complete, up to 21 days after top-kill. Avoid wet conditions during harvest to prevent soil from sticking to tuber skins.

Feral swine becoming a challenge in West Virginia

Commonly known as feral hogs or feral pigs, feral swine *(Sus scrofa)* are not native to West Virginia. Feral swine are an exotic, invasive species that are the wild descendants of domestic swine introduced by European explorers in the 16th century. Feral swine are found in small populations scattered around West Virginia.

Feral swine make up one of the two populations of "wild pigs" that exist within the state; the other population is wild boar. Wild boar occur in the four-county area of Boone, Raleigh, Logan and Wyoming counties. This population was introduced in 1971 when 30 pen-reared European wild boars were released in southwestern West Virginia. These wild boars were introduced to supplement big-game hunting opportunities for sportsmen and women in West Virginia. This population still exists in those counties and is regulated as a game species.

The feral swine in West Virginia occur in several localized populations, because domestic swine have escaped or feral swine have been intentionally released (Figure 8). With each generation of offspring, the domestic characteristics diminish, and the pigs develop traits for survival. These traits include longer hair, tusks and a darker coloration that resembles the wild boar.

Figure 8. Feral swine in West Virginia exist in several localized populations. (Photo credit: https://www.flickr.com/photos/sloalan/569986774/Alan Schmierer)

Damage

It is estimated that wild pigs in the U.S. cause more than $1 billion in damages each year. Damage to agriculture and natural resources is caused through wallowing and aggressive rooting behavior. Apart from man, wild pigs are considered the greatest vertebrate modifier of natural communities. Rooting damage can increase soil erosion, damage native plant communities, increase spread of invasive exotic plants species and reduce plant or forest regeneration. Even shallow rooting may cause significant soil erosion, slope destabilization and impede nutrient cycling.

Wild pigs are closely associated with moist areas and their wallowing may reduce water quality, and destroy sensitive riparian or wetland systems. They may also impact aquatic ecosystems via soil erosion and bacterial contamination.

Wild pigs compete with other wildlife species for food resources, especially hard-mast items such as acorns and beech nuts. Wild pigs can be significant predators of ground-nesting birds, frogs, salamanders, snakes, turtles, small mammals and even white-tailed deer fawns.

In addition to damage to our natural ecosystems, wild pigs can also damage pastures and agricultural crops. Wild pigs not only feed directly on and trample planted crops, but they can damage fields by rooting, digging and creating wallows.

Wild pigs are highly mobile and are able to carry many diseases and parasites that can infect other wildlife, livestock and humans.

Reporting

They have become a challenge to landowners, land managers and wildlife managers nationwide. Fortunately, the wild pig population in West Virginia has not exploded like it has in other states and appears to be at a controlled level. Therefore, we should continue to discourage the movement and release of wild pigs in our state. Take action and report wild pig activity to USDA Wildlife Services (1-866-4USDAWS) or to your West Virginia Division of Natural Resources District Office.

The winter months can make this good insect go bad

The multicolored Asian lady beetle *(Harmonia axyridis)* is common throughout much of the U.S. yet is native to Asia. During the growing season, these beetles are quite beneficial as predators of aphids and other soft-bodied insects that are associated with trees, shrubs, ornamental plants and some agricultural crops. However, the multicolored Asian lady beetle is considered a household pest during the fall and winter months as it seeks protected overwintering sites.

Figure 9. Multicolored Asian lady beetle adult. Arrow points to the pronotum.

In nature, common overwintering sites for this beetle include rock outcroppings and other natural crevices that offer a cool, dry location sheltered from inclement weather. Unfortunately, homes can be just as inviting for this pest. Although they do not reproduce indoors, the mere presence of such large numbers inside homes can be a nuisance. Furthermore, the multicolored Asian lady beetle can emit an unpleasant odor if agitated, or may stain walls and fabrics if crushed.

Identification

As the name implies, this beetle can occur in many different color combinations. Populations can range in color from pale yellow-orange to bright red-orange and with or without black spots on the wing covers. A useful characteristic to help identify this insect is the unique pronotum (top covering of the middle body part). The coloring of the pronotum is white to straw-yellow with four black spots joined to form a W-shaped mark or a solid trapezoid (Figure 9).

Control

The multicolored Asian lady beetle enters homes through small openings around doors, windows and utility access points. In addition, they can enter through siding gaps, cracks and attic vents. Sealing these entry points is the best method of keeping Asian lady beetles and other pests from entering the home.

Exterior applications of a synthetic pyrethroid (e.g., cypermethrin, cyfluthrin, lambda-cyhalothrin and deltamethrin) can also prevent some infestations where exclusion is difficult or impossible. For best results, spray treatments must be initiated in mid-September before the beetles enter homes. After the beetles have gained entry, the use of insecticides is not recommended.

To remove beetles already in the home, use either a broom and dust pan or a vacuum cleaner. When using a vacuum either discard the beetles immediately or bag them for release outdoors during the spring. To bag beetles, insert a knee-high stocking into the extension wand of a vacuum cleaner and fasten the open end of the stocking on the mouth of the wand with a rubber band. Transfer the beetles from the stocking into a cardboard box or other breathable container. Place a piece of damp cloth in the container to prevent the beetles from drying out. The container can be stored in an unheated area over the winter and the beetles can be released in your garden or landscape during the spring.

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