EXTENSION
UtahStateUniversity

Vegetable IPM Advisory

UTAH PESTS

Pest and Production Update, Utah State University Extension, **August 11, 2014**

Why Leaves Curl

We have seen tomato plants in many Utah counties that have curled leaves. Curling or rolling of tomato leaves can be caused by various factors including environmental stresses, herbicide damage, viruses, and insects. To determine the cause of the problem take a close look at the plant(s); look at which leaves are rolling (old, new, or all the leaves), what direction the leaves roll (up or down) and check to see if any other parts of the plant, including fruit, are exhibiting symptoms.

ENVIRONMENTAL CAUSES

Leaves roll upward starting with older leaves, no other symptoms.

Physiological Leaf Roll:

Leaf roll is a physiological disorder of tomatoes that is most commonly associated with hot dry weather, but can occur in response to other stresses like excessive moisture and nitrogen, fast growth, high production, root damage and pruning. This disorder is believed to be a strategy to conserve moisture. Leaf margins roll upward until they touch or overlap in an almost tube like fashion. Affected leaves are firm and leathery to the touch. Lower leaves are affected first, and can recover if environmental conditions and cultural factors are adjusted to reduce stress. If the conditions favoring leaf roll are prolonged, affected leaves may not recover. In severe cases, whole plants can be affected. If environmental conditions and cultural factors are adjusted after prolonged leaf rolling, new growth that develops subsequently may not exhibit leaf roll symptoms. There is no discoloration of leaf veins associated with this condition.

Don Ferrin, Louisiana State University Agricultural Center, Bugwood.org

The severity of leaf roll may also be cultivar dependent. Cultivars selected for high yield tend to be most susceptible. Indeterminate cultivars of tomato are more sensitive to this disorder than determinate cultivars. Determinate varieties of tomatoes, also called "bush" tomatoes, stop growing when their first fruit sets, whereas indeterminate varieties, also called "vining" tomatoes, grow and flower until killed by frost or other harsh environmental conditions.

Plant growth, fruit yield, and fruit quality are not usually affected by physiological leaf roll.

Management:

Use preventive practices to manage leaf curl such as planting determinate cultivars in well-drained soils and with adequate, uniform, and consistent soil moisture. Use caution when fertilizing, especially with nitrogen fertilizers, so that you don't apply too much. At the same time, make sure to provide adequate phosphorus (utilize soil test results if you have them). Avoid heavy pruning and use shading or evaporative cooling to maintain temperatures below 95°F.

VIRUSES

Leaves roll upward, other symptoms.

Several viruses can cause leaf curling and stunting in tomatoes. Initial virus symptoms can be confused with herbicide damage, but as the disease progresses you will often see yellow-green mosaic patterns on the leaves. In addition to curly top (see July 28 2014 advisory) there are at least two other viruses that cause leaves to curl on tomato plants.

Tomato plants infected with curly top have upwards curled, yellow leaves, and the veins on the underside of the leaves are purple.

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Tomato Yellow Curl Virus:

When tomato plants are infected with tomato yellow leaf curl virus (transmitted by whiteflies), new leaves become cupped and pale green in color. In addition, the entire plant may exhibit stunted growth, yellowing leaf edges, purplish veins on the undersides of leaves, and decline of fruit production.

David B. Langston, University of Georgia

Central Science Laboratory, Harpenden Archive, British Crown, Bugwood.org

Whitefly populations can be treated with insecticidal oils and soaps.

Tomato Mosaic Virus:

Tomato mosaic virus also causes rolling of leaves, as well as other symptoms, including mottled-coloring of leaves, small leaflets, and internal browning of infected fruit, distinguishing it from physiological or herbicide-induced leaf roll.

Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

Management:

There is no treatment for virus-infected plants. Removal and destruction of plants is recommended. Since weeds often act as hosts to the viruses, controlling weeds around the garden can reduce virus transmission by insects. As some viruses are transmitted mechanically on garden tools, it also helps to disinfect tools that have come into contact with diseased plants. Management of virus-transmitting insects should be focused on methods that prevent the insects from spreading the virus.

HERBICIDE INJURY

Leaves roll downward starting with older leaves, other symptoms.

Tomatoes are very sensitive to injury from broadleaf herbicide chemicals. Damage from phenoxy herbicides such as 2,4-D and dicamba is usually the most common injury seen. These herbicides are used for controlling weeds like dandelions, plantain, and clover in home lawns. Tomato plants can come in contact with the chemical through volatile fumes on a hot day, spray drift, or the use of a sprayer that was previously used to apply the herbicide. Tomato plants may also be exposed to these broadleaf herbicides by using grass clippings from treated lawns as mulch in the vegetable garden. Be sure to follow any and all herbicide label directions regarding the use of treated grass clippings for mulches in vegetable gardens.

Damage from herbicides may have different symptoms depending on the degree of exposure and age of plant at exposure. Older leaves are excessively pointed, down-curved, or rolled with prominent light-colored veins; young leaves do not fully expand and are narrow and elongated with parallel veins; stems are split, distorted, or brittle; and fruits are catfaced or irregularly shaped.

Plants exposed to small amounts of phenoxy herbicides will outgrow the symptoms without seriously reducing yield or fruit quality; harvest, however, might be delayed. Plants may not recover from severe damage by herbicides.

Management:

There is no remedy for leaves that are already injured by herbicides. If new growth continues to show injury symptoms, harvest any salvageable fruits and pull up the plants.

If new shoot growth is normal, and there is still at least 4 to 6 weeks left in the growing season, the plants may be able to outgrow the injury. New buds and leaves should begin growing within about a week. If not, pull the affected plants and replant.

Minimizing Herbicide Drift

- Always read and follow the herbicide label instructions.
- Avoid spraying when wind speed is more than 5 mph.
- Avoid spraying when wind is blowing toward sensitive crops.
- Use a hooded sprayer when applying post-emergence herbicides near growing plants.

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- Reduce spray pressure so droplet size is larger and less likely to move with the winds.
- Reduce the speed of the spray application to avoid movement in the circulating air.
- Ensure that the dosage applied is correct.
- Use the correct spray nozzles/tips for the chemical to be applied.
- Use drift reducing spray additives if available.
- Wash out all previous herbicide from inside the spray tank.

Herbicide damage can result in curled, twisted leaves and stunted plants.

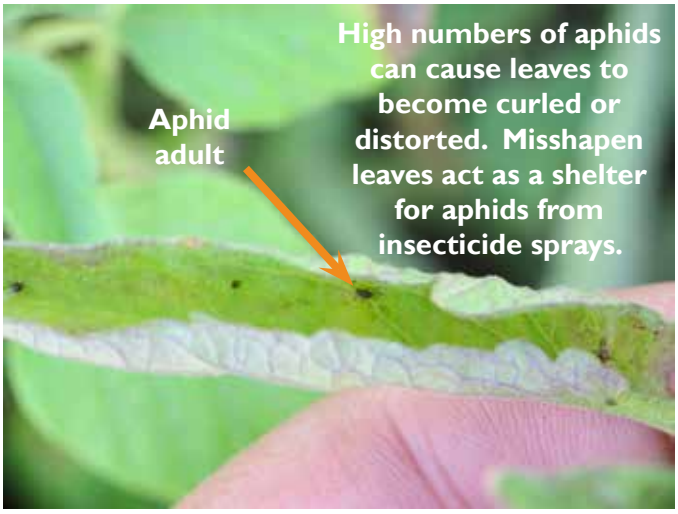
INSECTS

Leaves roll upward, look for evidence of insects.

Aphids:

Aphids are small, soft-bodied insects with long slender mouthparts that they use to pierce stems, leaves, and other tender plant parts, and suck out fluids. Aphids have a pair of tubelike structures called cornicles projecting backward out of the hind end of their body. The presence of cornicles distinguishes aphids from all other insects.

Almost every plant has one or more aphid species that occasionally feed on it. Although aphids may be found singly, they often feed in dense groups on leaves or stems. Most aphids don't move rapidly when disturbed. Aphids have many generations a year.



Management:

Many aphid species prefer the underside of leaves, so turn leaves over when checking for aphids. Check your plants regularly for aphids in order to catch infestations early. Many species of aphids cause the greatest damage in late spring when temperatures are warm but not hot (65°-80°F). Once aphid numbers are high and they have begun to distort leaves, it's often difficult to control these pests, because the curled leaves shelter aphids from insecticides and natural enemies.

If aphid populations are small, you can prune them out, making the habitat less desirable for the aphids. A strong spray of water (or a water solution with soap) can dislodge the aphids and wash off the honey dew they have produced. Spray water early in the day to allow plants to dry off rapidly in the sun so they will be less susceptible to fungal diseases.

High levels of nitrogen fertilizer can cause aphid populations to increase so apply nitrogen fertilizers in small amounts throughout the season rather than a large amount at one time. Time-release fertilizers that are urea-based or organic formulations that release nitrogen at a slow rate are ideal.

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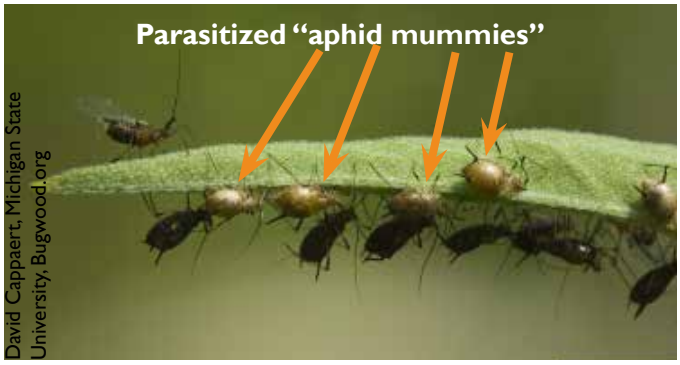
Many plants are most susceptible to aphid damage when they are young, so use protective covers and manage weeds early so aphid populations can't build on the weeds.

Natural enemies can be very important for controlling aphids. Predators such as lady beetle adults and larvae, lacewing larvae, soldier beetles, and syrphid fly larvae feed on aphids. Among the most important natural enemies are the various species of parasitic wasps that lay their eggs inside aphids. The skin of the parasitized aphid turns crusty and golden brown, a form called a mummy. The generation time of most parasites is quite short when the weather is warm, so once you begin to see mummies on your plants, the aphid population is likely to be reduced substantially within a week or two.



Chemical Treatment Options:

When considering whether to apply insecticides for aphid control, remember that larger plants usually can tolerate light to moderate levels of aphids with little damage. Larger aphid populations often rapidly decline due to biological control or when hot temperatures arrive.

Insecticidal soaps and oils are the best choices for most situations. Target the underside of leaves as well as the top and make sure the foliage is thoroughly covered. Applications may need to be repeated. Use caution when applying soaps or oils on water-stressed plants or when the temperature exceeds 90°F because the soaps and oils can be harmful to some plants in these conditions.

Psyllids

The adult psyllid is about the size of a typical aphid and is striped with alternating dark and light bands. Psyllid adults are less commonly seen in gardens than aphids, but can be collected with a sweep net or knocked onto a cloth placed around the base of the plants. Psyllids pass through three life stages: egg, nymph (immature stage) and adult. Eggs are small, 1/32 inch long. They are orange-yellow and are commonly deposited along leaf margins but may occur on either leaf surface. Eggs are supported by small stalks which are smaller than the stalked, white egg produced by lacewings, which also are common in gardens. Eggs hatch in six to 10 days.

Newly hatched nymphs are yellowish but become progressively greener as they develop. When almost mature, nymphs are nearly the same color as leaves and are flat, elliptical and scale-like. Nymphs are most numerous on the undersides of leaves but can occur on shaded upper leaf surfaces.

Damage from psyllids occurs when adults and nymphs feed on tomato or potato plant sap, injecting toxic saliva. Usually the first abnormal condition is a slight discoloration (yellowing or purpling) along the midribs and the edges of the top leaves and the basal portion of these leaves also tend to curl upward. These symptoms collectively are known as "psyllid yellows".

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As the condition progresses, the entire plant top changes to yellowish-green or purple-red, and foliar growth is stunted. The leaves remain small and narrow and tend to stand upright, giving the top of the plant a feathery appearance.

When the attack comes early in the development of the tomato plant, severe psyllid feeding may cause the plant to not set fruit. Late attack on tomato plants can cause production of an abnormal number of fruits that never attain a desirable size or quality.

Problems with psyllids do not occur every season, but originate from winged, migrating forms of the insect. Outbreaks tend to be irregular, depending on weather conditions. Psyllids also occur on other plants such as potato, eggplant and pepper and can cause significant damage.

Psyllid nymphs secrete small, white, waxy beads that look like sugar granules.

Management

Some tomato varieties appear to be partially resistant to psyllids. Increased hairiness of the leaves tend to make plants less favorable to psyllids. Monitor plants often to ensure psyllid populations don't get out of control. As few as 15 nymphs per plant, feeding for 5 days can cause psyllid yellows (or 5 nymphs feeding for 15 days). If you see adults, you may need to apply a chemical treatment.

Chemical Treatment Options:

Insecticides should be applied in the late evening just before earwigs come out to feed. Target sites where earwigs congregate (sites where females brood their young), and on plants when injury appears.

Commercial growers: Abamectin (Agri-Mek), Spinosad (Entrust, Success).

Residential growers: sulfur dust, permethrin, lambda-cyhalothrin.

Insect Information

Corn Earworm

Monitoring traps have been put out to check population levels. Since this pest lays eggs on corn that is silking, it's important to know what the population level is before deciding whether to treat.

The corn earworm adult is tannish brown moth. The front wings are marked with a distinct dark spot in the center and darker bands near the outer margins. The hind wings are lighter tan, with a dark band along the outer margins. Male moths have green eyes. Caterpillars range from about 0.1 to 1.5 inches in length and are brown-headed with green, brown, or black bodies. Alternating dark and light stripes run lengthwise on the body.

Corn earworm adult.

Corn earworms (CEW) overwinter in the soil as pupae in warmer locations of the state and further south. Moths emerge in the spring and migrate or are blown into northern Utah. There are usually three flights, or generations, per year in northern Utah; four or more in southern Utah. The first is typically small. The second and third flights are much larger and occur during August and September, so now is the time to watch for them. Moths are active on warm, overcast evenings.

Corn earworm larva feeding on corn kernels.

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CEW moths typically lay eggs on fresh, green corn silks, but will lay eggs on weeds and selected vegetables when corn silk is unavailable. When larvae hatch, they crawl down the corn silk and into the ear tip where they chew into developing kernels. Larvae will also chew on silks and leaves. After feeding 10 to 14 days, they will exit, drop to the ground, and burrow into the soil to pupate. After about 10 to 25 days, the CEW will emerge as an adult moth for a subsequent generation.

Feeding/Damage

CEW causes direct damage by chewing into kernels near the ear tip and/or chewing on silks, decreasing pollination, and leading to poor ear-fill. Frass within the ear produced by feeding can reduce quality, storage life, and increase mold growth. Additionally, injury at the ear tip provides openings in the husk that can attract sap beetles and earwigs.

Management

Place a clothes pin at the point where silk enters the ear. This helps keep worms out of ears, and should be done soon after the first silk emerges. Leave pins in place until the ear has filled and is ready for harvest.

Use traps and lures when possible to monitor CEW populations. The net style Heliothis trap and a pheromone lure (used for baiting CEW traps) are useful tools for monitoring CEW.

In places where pupae overwinter, till corn fields in the fall to decrease CEW survival in the soil.

Chemical Treatment Options:

Good control is dependent on applying insecticides before larvae enter the ears. Start spraying within two days of the beginning of silking, or as indicated by trap counts. About half of the eggs are laid within two days of silk emergence. Reapply insecticides to keep an active residue on new silk. Once silks turn brown, they are no longer attractive as egg laying sites.

See the new Utah Vegetable Production and Pest Management Guide for more information on CEW (pages 97-99) and insecticides registered for CEW in Utah for commercial and home use (pages 108-110).

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Natural Enemies Spotlight: Lacewings

Lacewings are often found in crops highly infested with aphids, such as sweet corn, potatoes, cole crops, tomatoes, peppers, eggplants, asparagus, leafy greens, apples, strawberries, and alfalfa. Adults are also highly attracted to lights at night.

What They Feed On:

Lacewings are generalist predators and are commonly found in agricultural, landscape, and garden habitats. Most species of lacewing adults are predaceous, while others feed strictly on honeydew, nectar, and pollen. Larvae prey upon a wide variety of small insects including mealybugs, psyllids, thrips, mites, whiteflies, aphids, small caterpillars, leafhoppers, and insect eggs.

Appearance and Life Cycle:

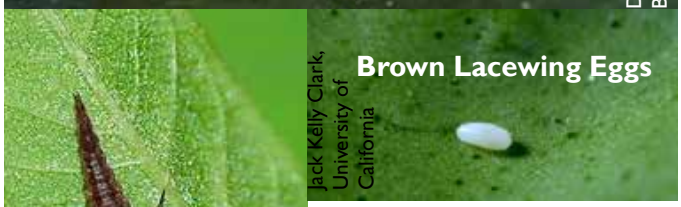
There are two common lacewings in Utah; the green lacewing and the brown lacewing. The Green lacewing (family Chrysopidae) is the most common type of lacewing found in Utah. Brown lacewings (family Hemerobiidae) are not as commonly seen as green lacewings because they prefer wooded areas.

Green lacewing adults have delicate, pale green bodies, golden eyes, and are named for their green, lacy, wing veins. Adults are 0.50 to 0.80 inch long, have long antennae, and are active flyers during the evening. Adults often fly at night and are seen when drawn to lights.

Female green lacewings lay distinct eggs on the undersides of leaves, and are individually attached to a ½ inch hair-like filament or stalk which helps protect the eggs from predation.

Larvae, which are pale with dark markings, look like tiny alligators. They are flattened, tapered at the tail, measure 1/8 to 4/5 of an inch long, have distinct legs, and possess prominent mandibles with which they attack their prey. Average development time from egg to adult is about one month.

Brown lacewings are typically smaller, about half the size (3/8 inch) of green lacewings, and have light brown bodies and transparent wings. Adults fly predominately at night and are often seen when drawn to lights. They are predatory both as larvae and adults and help contribute to early-season pest control.



Female brown lacewings lay their tiny, oblong eggs singly on their side onto plant tissues. Brown lacewing eggs look similar to syrphid fly eggs but are smoother and have a small protrusion on one end. The larvae are creamy-brown with dark reddish-brown stripes and spots and move their heads from side to side when walking.

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How To Attract Them:

There are a few guidelines for making your garden look especially attractive to lacewings, and other beneficial insects. In general, adults seek out pollen and nectar to fuel migration and reproduction.

- Start with using as many different native plants as you can. Try to incorporate native flowering plants in addition to the fancy varieties.
- Plan for nectar and pollen availability all summer long. Seek out plants that have long-lived blooms so that adult natural enemies always have access to food. Consider using flowers that bloom at different times of the year for continuous pollen production.
- Natural enemies might initially be attracted to an area because of the available pollen and nectar, but will not necessarily stay. In general, predatory insects like to reproduce and generate offspring near a generous food supply of other insects. For example, lacewings like to lay their eggs on plants that are infested with aphids because it ensures the offspring will have food to eat when they hatch into larvae.
- Avoid using broad spectrum insecticides whenever possible, because they can kill beneficial insects too.

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