

Two-spotted spider mite management in soybean and corn

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Common Name—Two-spotted Spider Mite

Scientific Name—*Tetranychus urticae* Koch (Arachnida: Acari: Tetranychidae)

Two-spotted spider mite (*Tetranychus urticae*) is distributed worldwide with an extensive host range. Because it can affect orchard, row, and greenhouse crops, this mite is one of the most important agricultural pests throughout the world. A closer relative of spiders than insects, mites are tiny web-spinning arthropods with eight legs. In Wisconsin and the Upper Midwest, two-spotted spider mite is an occasional pest of soybean and corn. However, this mite only becomes a problem in dry weather conditions. In most years, with adequate rainfall and a fungal pathogen as a primary natural control, outbreaks do not occur. In the absence of these checks, spider mites reproduce quickly with overlapping generations during which eggs, nymphs, and adults can be found together on infested plants.

Appearance

Eggs. Adult females deposit round, translucent eggs singly on the undersides of leaves (figure 1). A hand lens (at least 10x magnification) is needed to see eggs, 0.006 inch (0.14 mm), on crop foliage in the field. Eggs become opaque to pearly white, with the red eyespots of the immature larva visible just before hatch.

Immatures. Development includes one translucent six-legged larval stage followed by two eight-legged nymphal stages. Immatures feed on plant foliage just as adults do.

Adults. Adults are tiny, about 0.016 inch (0.42 mm), with four pairs of legs. They range in color from greenish yellow to dull orange with two irregularly shaped black spots, one on either side of the abdomen (figure 1).

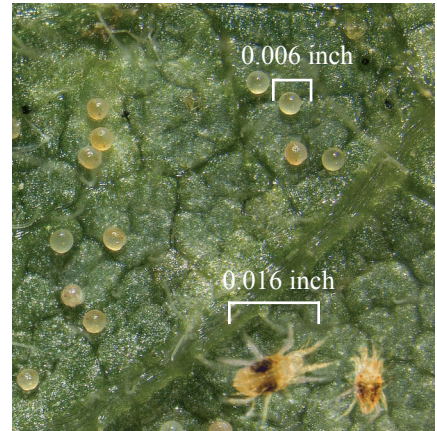


Figure 1. Two-spotted spider mite eggs, adult and nymph

Photo by Peter Sonnentag and Tom Klubertanz

Life cycle

In northern states, two-spotted spider mites overwinter as adult females in field margins and similarly sheltered areas. The time it takes for eggs to develop into reproductive adults depends upon summer temperature, humidity, and host plant.

Generations are typically completed in 4–14 days with faster developmental rates above 91°F. Spider mites have a high reproductive potential, with 7–10 generations or more in one growing season if hot, dry weather conditions persist. Outbreaks are most likely with extended dry weather conditions, even at relatively moderate temperatures. Over a 30-day life span females lay an average of 90–110 eggs, though up to 300 have been reported, resulting in exponential population growth.

Spider mites do not have wings. Mites crawl to locate new leaves within the soybean or corn canopy and move to adjacent plants. To disperse greater distances, mites climb to the top of a plant and spin silken web strands that, when caught on breezes, carry the mites to new host plants and fields.



Figure 2. Two-spotted spider mite damage symptoms at the field level in soybean

Photo by Mike Rankin



Figure 3. Foliar bronzing symptoms in soybean caused by two-spotted spider mites
Photo by Mike Rankin

Damage

Two-spotted spider mites feed by extracting contents of individual leaf cells with needle-like mouthparts. At the plant level, spider mite injury appears as white or yellow specks called stipples. Stippling can occur on both sides of the leaf, and is often noticed first on the underside. This cell-damaging feeding style lowers chlorophyll content, reduces plant photosynthetic capacity, and causes water loss from leaf tissue, resulting in yield loss through reduction in dry matter and grain production.

Soybean. Because outbreaks happen irregularly, and spider mites are so small, this pest can be easy to overlook. On a field scale, spider mite damage appears similar to soybean plant moisture stress (figure 2). Mite infestations usually start in areas prone to drought stress, such as along field edges and on higher ground within fields. As damage increases, leaves become yellow, bronzed, and/or brown, and may prematurely drop off the plant (figure 3). Damage can occur anytime during the growing season when hot and dry weather conditions persist. In outbreak years in Wisconsin, two-spotted spider mite injury and treatment have typically occurred in mid- to late-July through August.

Fields infested with two-spotted



Figure 4. Two-spotted spider mite feeding injury on a corn leaf
Photo by University of Wisconsin-Extension

spider mites during late vegetative and early reproductive growth have recorded yield reductions of 40–60%. Additionally, pods on mite-stressed plants are more likely to shatter, which compounds yield loss. Differences between soybean cultivars in two-spotted spider mite reproductive rates have been noted, but no mechanisms of mite host plant resistance have been identified.

Corn. Two-spotted spider mite colonies are uniformly distributed on the corn plant. Feeding injury appears on corn leaves as chlorotic, pale yellow or yellow-white areas along the leaf (figure 4). Most spider mite feeding and injuries occur between pollen shed and denting.

Effects on corn yield are more severe when mites damage leaves at or above ear level. Infestations have been associated with accelerated plant dry down in the fall. In addition to grain yield reduction, quality and yield of silage corn may decline due to mite feeding.

Scouting and treatment guidelines

Management of two-spotted spider mites in soybean and corn depends upon scouting, action thresholds, and miticides. Although the density of mites per plant is the ideal sampling unit, this is impractical for integrated pest man-

agement decision-making due to the small size of this pest. Scouting and action thresholds rely upon confirmation of spider mite colonies in the field and rating of plant injury symptoms. Crop injury from drought stress or foliar diseases can be confused with spider mite damage. Be sure to base miticide treatment decisions on confirmed presence of mite colonies in the field rather than relying only on apparent plant injury symptoms.

Soybean scouting. Begin at field edges where infestations are likely to start. Green plants within the field may also be affected. The entire field should be inspected.

Examine lower, middle, and upper leaves for stippling. Turn leaves over to confirm presence of spider mite adults, nymphs, and/or eggs with a hand lens (10x magnification). Adults can be detected by tapping soybean plants onto a white sheet of paper. Dislodged spider mites will be noticeable by their dark abdominal spots and can be seen as tiny dark specks moving on the white paper. Look for webbing on the underside of leaves.

No numeric economic thresholds have been developed for two-spotted spider mite in soybean. Begin by estimating the percentage of leaf surface with stippling and chlorotic discoloration. Current action thresholds recommend treatment at 10–15% leaf discoloration from R1 (beginning bloom) through R5 (beginning seed). Spider mites can cause yield reductions as long as green pods are present. Soybean plants recover from mite injury after treatment, although less compensation is possible in later development stages. Check the pesticide label preharvest interval when considering late season treatment. Do not spray after R7; treatment at this point will not impact yield.

The spider mite treatment decision rating scale (table 1) is based on data obtained during previous two-spotted spider mite outbreaks on soybean in the Midwest.

Corn scouting. Two-spotted spider mites do not usually cause economic damage in field corn in Wisconsin. When this pest occurs in dry years, yield losses are more consistent in soybean.

Begin by checking the field for presence or absence of spider mites on individual green leaves on corn plants along field edges. Repeat the procedure on at least 10 plants at several locations within the field. Moderate infestations will result in leaf stippling and chlorotic spotting on the leaf surface. Look for evidence of spider mite adults, nymphs, and/or eggs, as well as webbing on the underside of leaves. Severe infestations can cause entire leaves to turn yellow and brown.

As with soybean, determining the density of tiny spider mite adults and nymphs per plant is not practical. Treatment guidelines are based on indicators such as live mite colonies, leaf damage symptoms, and continued low rainfall conditions in which spider mites thrive. Treatment is justified when corn is in the milk or early dough stages and two-spotted spider mite colonies

cover extensive leaf area, discoloring leaves near the ear and spreading to other leaves over a significant area of the field. Control is suggested if you find active mite colonies on one-third of the leaves of 50% of the plants, or if 15–20% of the leaf area is covered with mites and their damage.

Further yield loss and economic benefit to chemical control are unlikely once corn reaches dent stage.

Control

Biological and natural controls

The most effective natural control of two-spotted spider mite in soybean and corn is the fungal pathogen, *Neozygites floridana*. It attacks all mite stages, and is host-specific to spider mites. Infected mites have a waxy or cloudy appearance. This mite-killing fungus depends on environmental conditions cooler than 85°F, coupled with 90% relative humidity, to produce infective spores. Periods of at least 12–24 hours of relatively cool, moist, and humid conditions are necessary for the

fungal pathogen to disperse throughout the two-spotted spider mite population in a field. Mites die within 1–3 days of infection, and populations can decline quickly once the pathogen has spread.

Several species of insects, mites, and spiders prey on spider mites in corn and soybean. Predatory mites in the family Phytoseiidae are the primary arthropod natural enemy of two-spotted spider mites. Predaceous mites have been utilized through conservation and mass release for spider mite management in orchard, garden, and greenhouse crops. Although predaceous mites occur in corn and soybean, augmentative releases of commercially reared predaceous mites are currently cost prohibitive in field crop systems.

Spider mite infestations and weather

Miticide treatment may be delayed if rain with cooler temperatures and high humidity are expected. However, continue to monitor fields to make sure mite populations decline. Although rainfall reduces the risk of damaging spider mite populations, thunderstorms

Table 1. Treatment guidelines for two-spotted spider mite in soybean. Ohio State University, 2005.

Presence of mites and plant damage	Rating
Mites barely detected on undersides of leaves in dry locations or on edges of fields. Plant damage barely detected.	1 Non-economic
Mites easily detected on undersides of leaves in dry locations or on field edges, but difficult to find on leaves within the field. Plant foliage green, but stippling injury detected on undersides of leaves, although not on every plant.	2 Non-economic, keep monitoring
Most plants are infested with mites when examined closely. Most plants in field show stippling, even on healthy green leaves. Speckling and discoloration of lower leaves. Field edges and dry areas exhibit damage.	3 Treatment is warranted, especially if eggs and nymphs are found with adults
All plants heavily infested with mites when examined closely. Discolored and wilted leaves easily found throughout the field. Severe damage evident.	4 Treatment may be warranted; rescue treatment may recover yield
Extremely high mite infestation. Field discolored, leaves bronzing and leaf drop.	5 Treatment may not recover yield

alone will not eliminate infestations, particularly when rains arrive after large mite populations are established and when rains are followed by dry, warm conditions.

Chemical control

If dry weather conditions result in two-spotted spider mite outbreaks, chemical control options are available. Some corn and soybean insecticides are also labeled as miticides for two-spotted spider mite. Select a product labeled for spider mite control in the appropriate crop, corn or soybean. A product labeled for spider mites on one crop, may not be labeled for spider mites on the other. Follow label directions and spray guidelines.

The organophosphate insecticide active ingredients chlorpyrifos and dimethoate are labeled for spider mite control. Chlorpyrifos is not labeled for spider mites on corn, but corn has additional labeled options including the organosulphate active ingredient propargite, and the keto-enol active ingredient spiromesifen. Although the pyrethroid active ingredient bifenthrin is labeled for spider mites in soybean and corn, other pyrethroid active ingredients are not labeled for spider mites, or are labeled for suppression only, and are not expected to adequately control

two-spotted spider mites.

Please consult UW-Extension publication *Pest Management in Wisconsin Field Crops* (A3646) for product suggestions and label information for two-spotted spider mite on soybean and corn.

It is important to be aware of the effect that insecticides applied for other pests, such as corn rootworm beetles in corn or soybean aphid in soybean, may have on two-spotted spider mite populations. Studies conducted in corn indicated that the pyrethroid active ingredient permethrin was associated with a significant increase in two-spotted spider mite populations. When miticide application is justified or if mites are present when treating other pests at economic threshold, select a product labeled for spider mite control to avoid mite flare-ups.

Additionally, fungicide use in corn and soybean may further aggravate existing spider mite infestations by eliminating mite-killing fungal pathogens.

Miticide applications are not effective on eggs. When large numbers of two-spotted spider mite eggs are present, scout the treated area within 3–5 days. If newly hatched nymphs are present, make a follow-up application. Two-spotted spider mites have the ca-

capacity to develop insecticide resistance. If more than one treatment is required within a season, switch to a different active ingredient labeled for spider mite control, rather than applying the same active ingredient twice to one field.

Because spider mites are found primarily on the undersides of leaves, it is important to use high spray volume and pressure to achieve adequate leaf coverage. For ground applications, use 20 or more gallons per acre. For aerial application, 3–5 gallons per acre are recommended.

Late season treatments can be difficult because most chemicals labeled for spider mite control have a preharvest interval of 21–28 days. It may also be necessary to adjust yield expectations in mite-treated fields since drought conditions associated with two-spotted spider mite outbreaks will further limit yield potential.

Treatment of isolated “hot spots” or field edges may prevent infestation of the entire field. However, spot treatment is not effective once mites have spread throughout the field. Typically, by the time live spider mite colonies and visual symptoms are noted along field edges and dry areas within the field, colonies have spread throughout the field.



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