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University of Minnesota Extension Service

Spider Mites, Aphids and Rain Complicating Spray Decisions in Soybean

August 3, 2006

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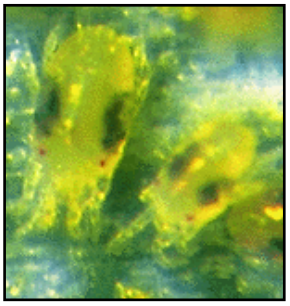

Prolonged drought always raises the specter of **two-spotted spider mite *(Tetranychus urticae)*** infestations in soybean. While minor, local outbreaks have occurred in recent years, the last statewide spider mite outbreak occurred in 1988. The scope of the 2006 problem has not yet reached 1988 levels (thanks to a wetter spring and milder temps than 1988!), but spider mite infestations have reached treatable levels in soybeans in scattered droughty areas throughout Minnesota. One factor complicating spider mite management decisions is soybean aphid, and vice versa.

Even though we've had significant rain in southern Minnesota the last few days, don't assume rain has eliminated aphid or mite problems. Heavy rains in the 2-6" rain certainly remove a lot of stress on the plant, but you need to make sure that ongoing aphid or spider mite problems don't continue to rob yield. Scout now for spider mites, their signs, and damage, especially if you're contemplating a spray for soybean aphids. Spraying for soybean aphid with pyrethroid sprays (Asana, Baythroid, Decis, Delta Gold, Mustang Max, Proaxis, or Warrior) could aggravate the situation. Pyrethroid insecticides perform poorly against spider mites and could even aggravate the situation by "flaring", or increasing spider mite populations. The only products that are recommended for spider mites include chlorpyrifos and dimethoate. With dimethoate performance quite variable against soybean aphid, only chlorpyrifos will work well against dual infestations. If you previously sprayed for aphids in the last two weeks, check the fields for spider mites and rebounding aphid infestations.

Since many of you may feel rusty regarding two-spotted spider mites, let's quickly overview two-spotted spider mites, scouting and decision-making.

What are two-spotted spider mites? Two-spotted spider mites are minute (<0.002 inch), green to yellowish to orange arachnids (See close-up photos). Note the 8 legs, not 6 like insects, and the two spots on the abdomen. To put their size in perspective, spider mite adults are ca. half the size or less of the smallest soybean aphid nymph you've been looking at this week. These mites attack a wide variety of plants, including crops (soybeans, dry beans, alfalfa, and corn, vegetables, ornamentals, and trees. Mites overwinter as eggs in permanent vegetation. Hatching mites establish colonies on the undersides of leaves that produce the webbing over the leave surface (see photo on right). This webbing earns them the name "spider" mites.

Spidermites have a straightforward life cycle, progressing through three stages between egg and adult (see Fig. 1). Their development is completed in 5 to 19 days, depending on temperature. Development is accelerated by the 90 – 100 ^{o}F temperatures that we recently experienced. Reproduction slows down at cooler temperatures. With females producing up 100 eggs each, it's easy to understand how populations can explode. Populations have been known to increase 70X in as little as 6-10 days.

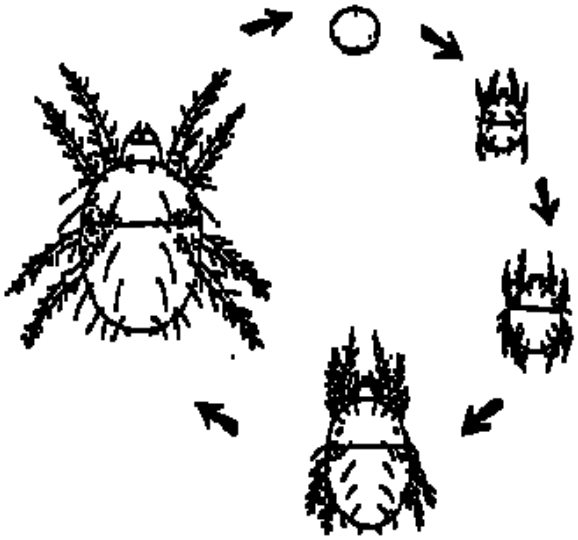

Figure 1. Life cycle of the twospotted spider mite Egg, larva, protonymph, deutonymph, and adult.

Why are spider mite problems worse during drought?

Spidermites populations are held in balance by natural enemies, weather and host quality. Drought triggers spider mite outbreaks in soybean and corn by upsetting this balance in four ways.

1. Drought stress accelerates spider mite movement to soybean and corn from surrounding permanent vegetation and alfalfa as it dries down or is cut for hay. Cutting initiates mass movement into adjacent soybean under drought conditions.
2. Drought stress improves the food quality of soybean for spidermites.
3. Drought diminishes or stops the activity of naturally occurring fungal diseases that attack mites, such as *Neozygites*. Disease outbreaks are fostered by cool, highly humid conditions that favor spore formation and mite infection. Hot dry weather stops these diseases in their tracks.
4. Hot temperatures also speed spidermite reproduction so that predatory insects and mites can't keep up.

How do spider mites injure plants? Spider mites injure leaves by piercing cells and sucking our cell contents. This injury produces a white or yellow spots or "stipling" that is heaviest on the underside of the leaves (see photos of minor and extensive stipling). The leaves lose photosynthetic surface as feeding continues. Water loss from damaged leaf surface is uncontrolled. Research verifies that both photosynthetic rate and leaf water status decline with increasing levels of spider mite injury. As colonies grow and feeding intensifies, entire leaves progress from grayish green to yellow, brown or coppery, and eventually drop off. Damage begins in the lower canopy and progresses upwards. Heavily stippled upper leaves may exhibit deformations reminiscent of herbicide injury. If the infestations is unchecked by disease, predators or miticides, spider mites may kill the entire plant. For farmers and crop advisors not familiar with spider mites, the progression of symptoms from silvering, yellowing, browning, lower leaf loss and death, may be mistaken for drought symptoms.

How do you scout for mites?

Infestations typically are first noted near field edges or where soybeans are stressed. If lower leaf loss, yellowed or browning spots are noted at the field edge or in patches within the fields, its time for some detective work. Examine plants at the field edge first, especially adjacent to roadside ditches or alfalfa fields. Pull plants and examine the leaves from the bottom upwards. Look at the underside of leaves. Note stipling, webbing, and examine for mites with a hand lens or magnifying lens. Examine how far up the plant mites and symptoms have progressed. Tap selected soybean leaves with symptoms over a white sheet of paper or cardboard and examine for mites. Note the abundance of moving dark spots (mites) highlighted against the white paper. If mite presence is verified, it's time to progress into the field. Move at least 100 feet into the field before making your first stop. Walk a "U" pattern checking at least 2 plants at each 20 locations. Assess mite damage using the following scale:

0 – No spider mites or injury observed.

1 – Minor stipling on lower leaves, no premature yellowing observed

2 – Stipling common on lower leaves, small areas or scattered plants with yellowing

3 – Heavy stipling on lower leaves with some stipling progressing into middle canopy. Mites present in middle canopy with scattered colonies in upper canopy. Lower leaf yellowing common. Small areas with lower leaf loss. (Spray Threshold)

4 – Lower leaf yellowing readily apparent. Leaf drop common. Stipling, webbing and mites common in middle canopy. Mites and minor stipling present in upper canopy. (Economic Loss)

5 – Lower leaf loss common, yellowing or browning moving up plant into middle canopy, stipling and distortion of upper leaves common. Mites present in high levels in middle and lower canopy.

When should spider mites be sprayed? Full Pod (R4) and Beginning Seed (R5) stages are critical in determining soybean yield. Spider mite feeding reduces photosynthetic area and accentuates drought

stress. The result is reduced pod set, seed number, and seed size. If plants are killed, pod fill is stopped in its tracks. Pods on mite-stressed plants are more likely to shatter, which compounds yield loss. Only a 10-15% reduction in effective leaf area, yield losses will justify an insecticide / miticide application. Unfortunately it's not easy to estimate a 15% reduction in effective leaf area.

Edge treatments are not effective since mites are usually spreading throughout the field before any visual symptoms are noted. In 1988 fields progressed in only 2 or 3 days from symptoms visible at the field edge to sever leaf loss throughout the field. Treatment is recommended only if damage and mites are detected throughout the field. Use the previous scale following guide, treat when injury progresses to a rating of 3. Fields with ratings of 5 or worse may not be salvageable. Check fields every 4-5 days if drought persists since damaging infestations can develop quickly.

Will rainfall stop spider mite infestations?

Single rainfall events during a drought, unless drought-breaking, are usually not sufficient to derail a rapidly growing spider mite infestation. Rainfall exerts its biggest impacts not by washing mites off leaves, but by slowing down infestations in several ways. First, it may alleviate drought stress on the soybean or corn. Alleviating moisture stress lowers its quality for spidermites and indirectly reduces reproductive rate. Significant rainfall also enhances soybeans' or corns' ability to tolerate spider mite feeding. Second, cooler temperatures behind a cool front will slow spider mite activity and reproduction, allowing predators begin catching up . Third, prolonged rainfall or elevated humidity that leads to heavy persistent dews may create the highly favorable environment for a fungal disease outbreak. Unfortunately, after a prolonged drought period there's little disease inoculum so disease outbreaks may not occur immediately.

If you've made a decision an infestation warrants spraying, don't hold up a spray waiting for rain. Instead, if rain is unlikely to occur before the spray dries, go ahead with the spray. Reducing spider mite pressure will allow the crop to take full advantage of the moisture.

What miticides control two-spotted spider mites?

While there are numerous insecticides labeled on soybean, only two have adequate mite activity, chlorpyrifos and dimethoate are currently recommended for two-spotted spidermites (see table below). Do not count on these products for high levels of control; I found only about 80% control in 1988 Minnesota trials. Both chlorpyrifos and dimethoate will not kill eggs and have a short residual, so hatching spidermites began rebuilding the population in a few days along with re-colonization from adjacent fields and non-cropland areas.

Insecticides Recommended for Two-Spotted Spidermites in Soybean

Chemical Name	Trade Name(s)	Rate (lb AI/acre)	Re-entry Period	Pre-Harvest Interval	Use Notes
chlorpyrifos	Lorsban Chlorpyrifos Nufos Yuma	0.5	4 days	28 days	In severe situations, a second spray (8 oz) after 5-7 days later may be needed. Do not feed or graze treated soybean plants.
Dimethoate	Dimethoate Dimate Cygon	0.5	1 day	21 days	Recheck after 2 weeks. Do not feed or graze within 5 days.

These miticides primarily rely on direct contact to kill mites. With mites primarily occurring under leaves, thorough coverage is critical. Do not skimp on water. For ground applications, use 20 or more gallons

per acre. For aerial application, 3 to 5 gallons pre acre are recommended. Sloppy application will be revealed since mites readily reproduce.

How could spraying for soybean aphid aggravate the spidermite situation?

Many of the insecticides labeled against soybean aphid are either ineffectual against spidermites, or may even aggravate the situation. Newer pyrethroid insecticides labeled for soybean (Asana XL, Warrior T, Proaxis, Delta Gold, Mustang Max, Baythroid), older pyrethoids (Ambush, Pounce, Pydrin), or their generic counterparts are weakly effective, neutral or even "flare" spidermites. These insecticides can cause populations to rise above untreated levels by removing predatory spidermites and insects, and by triggering more rapid reproduction.

Research during the last major spider mite outbreak in 1988 provides an excellent example of flaring by Ambush and the poor performance of other labeled insecticides, such as Furadan or Penncap-M (see table below). The change between spidermite densities at 5DAT and 10 DAT reveal the poor control and the rapid rebuilding of the mite pop: Penncap-M declined from 44.1% control to 29.6%, Furadan from 27.1% to 11.9%. The flaring was evident with Ambush, whose control declined from 45.4% to 3% greater than the untreated population.

Insecticide Performance against Two-Spotted Spidermites in Minnesota, 1988.

Insecticide	Rate (AI/acre)	Mites per Leaflet (10 DAT)	% Control	% Leaf Injury	Yield (bu/acre)
Cygon 400	0.50	71 c	84.5	14.8b	24.7ab
Lorsban 4E	0.50	150 c	68.1	15.5b	26.0 a
Penncap-M 2 FM	0.50	403 b	29.6	22.6a	21.5bc
Furadan 4F	1.00	541ab	11.9	23.3a	21.8bc
Ambush 2E	0.15	675 a	- 3.0	23.3a	18.8 d
Untreated		552ab		25.1a	19.6cd

Insecticides applied on 8/13/1988 to soybeans (Weber) at R5.5 (beginning seed) with stipling evident up to the 2-3 upper leaves. Mite counts taken from 4th and 8th leaves from the top.

Warning: If a pyrethroid was applied for soybean aphids, check for mites within 10-14 days of application to make sure that mite populations are not flaring in the field.

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