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Spider mite management for corn and soybean

Erin W. Hodgson
Iowa State University, ewh@iastate.edu

Mike McCarville
Iowa State University

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Erin W. Hodgson, assistant professor and Extension entomologist, Entomology, Iowa State University; Mike McCarville, graduate student, Entomology, Iowa State University

Twospotted spider mite, *Tetranychus urticae* (Arachnida: Acari: Tetranychidae), is an occasional pest of corn and soybean in Iowa. However, spider mite damage is more pronounced in crops during moisture-stressed growing conditions (Haile and Higley 2003). In 2012, many fields had significant spider mite feeding and subsequent yield loss (Hodgson 2012).

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Description and biology

Adult twospotted spider mites are oval, hairy, and minute (1/50th of an inch long or about half as big as a first instar soybean aphid). Body color can range from tan, brown, yellow, orange or red depending on the species and quality of the host plant. Adults will have eight legs and two dark spots on top of the body.

Spider mites are considered common pests in temperate zones and can be found throughout the United States. Females move out of row crops in the fall and deposit overwintering eggs. In the spring, eggs hatch and nymphs begin feeding on weeds, grasses and other permanent vegetation. As these areas are mowed or decline in quality, mites will move back to crops by ballooning on silken webs. In most years around Iowa, we find twospotted spider mites in corn and soybean in August. But this year, we could find them in field crops in June due to the drought. Having spider mites present during vegetative growth can be very stressful to plants and an early indicator of outbreak conditions during the important grain fill stages. The last time spider mites were a widespread, economic issue was the summer of 1988.

Twospotted spider mites normally produce 10-20 generations every year in Iowa. This pest can have exponential growth when temperatures are consistently above 85 degrees, humidity is less than 90 percent, and plants are lacking sufficient moisture. Under ideal conditions, spider mites can mature from egg to adult in 5 days; cooler temperatures can extend development to 19 days.

Damage and distribution

Spider mites injure plants by crushing cells and removing sap. Heavily infested plants will experience lower chlorophyll content and decreased photosynthesis. Injured plants will have decreased transpiration rates (i.e., cooling potential) compared to healthy plants (Haile and Higley 2003). Yield losses exceeding 40 percent are possible in drought-stressed growing conditions (Bynum et al. 1990). Spider mite damage is not reversible on injured leaves. But rain events and mite suppression can help new growth on plants.

Spider mites prefer to feed on the undersides of leaves, and typically start building colonies in the lower plant canopy and along field edges. Initial feeding injury can be described as white spots, stippling or discoloration of the leaves. As mite populations increase, they will move to the upper canopy to feed. Large infestations are usually accompanied with fine silken webbing. Prolonged spider mite feeding can cause premature leafdrop and death.

How to scout for spider mites

Mites are very small pests and some people have trouble seeing them with the naked eye. A hand lens will help with the first detections on leaves. Consider shaking leaves on a piece of white paper and watching for mites to start moving around (they resemble specks of dust). Scout for spider mites on a regular basis throughout the growing season, especially during drought-stressed growing seasons. To see if a field should be scouted, first look at plants along the field edges. If you find mites, take time to sample the entire field by walking a "W" or "Z" pattern. Stop at 20 locations and check 2-3 plants at each location. Note the presence of mites, location on plants, webbing and any discoloration from feeding.

Treatment thresholds

There are not specific spider mite density thresholds (i.e., # mites/leaf). Instead foliar applications should be based on your estimation of plant quality. For corn, the goal is to prevent spider mites from reaching the ear leaf. Consider treating when most plants are infested in the lower canopy and discoloration is starting. Treatments should be made before R1 – R4 (silking – dough). The most important soybean growth stages to protect are R4 – R5 (full pod – beginning seed set). In soybean, consider using a 0-5 rating scale to make treatment decisions:

0 – no spider mites or feeding damage observed;

1 – spider mites detected on a few plants, minor stippling on lower leaves;

2 – spider mites detected on most plants, stippling common on lower leaves, and small patches of yellowing plants can be found;

3 – spider mites can be found in the middle canopy, yellow plants common and some premature leaf loss (THRESHOLD);

4 – spider mites can be found in the upper canopy, premature leafdrop is common, and stippling can be seen in the upper canopy (ECONOMIC LOSS); and

5 – spider mites are easy to find in the upper canopy, plants are browning, some plants are dead.

Pesticide considerations

Product selection is extremely important for spider mite management (Ostlie and Potter 2012a, 2012b). Some products will not kill eggs, and populations can rebound and continue to injure plants. Most products rely on direct contact to successfully reduce spider mites. Therefore, use sufficient volume to reach mites in the lower canopy and on the undersides of leaves (e.g., 20 gpa by ground or 5 gpa by aerial application). Continue scouting after an application to determine if additional sprays are required. Consider rotating chemistries if additional sprays are needed.

Pyrethroids

In general, pyrethroids are not effective in reducing spider mite populations. Pyrethroids have poor efficacy on spider mites, and some populations have developed resistance to this chemistry. Pyrethroids will kill natural enemies and can allow mites to flare to higher densities than before the spray. In some regions of the United States, pyrethroid applications actually trigger females to increase their reproductive rate. One exception, bifenthrin, is shown to be effective against spider mites in soybean. Also consider pyrethroids typically do not perform as well under high temperatures (i.e., above 90 degrees).

Organophosphates

Several active ingredients are available for spider mites in corn and soybean. Dimethoate should perform well against spider mites, but has a short residual. Others, like propargite, spiromesifen and etoxazole, are efficacious against all mite life stages on corn, but are most effective when used as a preventative because they are slow acting products. For soybean, another effective option is chlorpyrifos.

Fungicides

Naturally-occurring beneficial fungi can reduce spider mite populations, but environmental conditions must be ideal for sporulation. The application of fungicides can eliminate beneficial fungi that kill spider mites and allow for exponential growth of the existing population.

2012 Comparison of spider mite treatments

In 2012, we initiated an efficacy evaluation for soybean pests in soybean at the ISU Northeast Research Farm in Floyd County, Iowa. Plots (six 30-inch rows wide x 50 ft long) were randomized in a complete block design and replicated four times per treatment. Syngenta soybean variety 05RM310021 was used for all the soybean aphid susceptible treatments, and Syngenta soybean variety 07JR801843 was used for the soybean aphid-resistant (i.e., *Rag1*) treatments. Unless specifically noted, seed did not have a pesticidal seed treatment. Twenty nine treatments were evaluated in 2012, including a combination of insecticides and fungicides, seed treatments and foliar applications, and host plant resistance to soybean aphid (Table 1).

Soybean plots were sampled weekly in 2012 from 1 June through 30 August (plant stages V1-R7). Although soybean aphids and other soybean pests were monitored, they had a very low abundance all season. Spider mites were evaluated in two ways. The first way was based on the 0-5 injury rating scale outlined above. The second method was to randomly select 10 leaflets from each plot and note the presence or absence of live spider mites. Yield was determined by weighing grain with a hopper and correcting moisture to 13 percent. An analysis of variance (ANOVA) was used to determine treatment effects within each experiment. Means separation was achieved with a general linear mixed model and least significant difference (LSD) test using SAS software (2011).

Results

Plots were generally not infested with twospotted spider mites until late July, when plants were in R4, or full pod set. Throughout August, visual ratings ranged from 0-2, and plots never exceeded 40 percent infestation of leaves. At this density, we would not expect yield differences between treatments due to spider mite injury.

Our ANOVA ($\alpha = 0.10$) indicated time was significant of spider mite density indicated time was significant ($F = 32.92$, $P < 0.0001$) and the interaction of time*treatment was also significant ($F = 1.44$, $P = 0.0406$). This allowed us to analyze mite densities by the five sampling dates (2, 7, 16, 21, 30 August). Two dates had significant treatment differences, including 16 August ($F = 1.61$, $P = 0.0451$) and 21 August ($F = 1.67$, $P = 0.0338$); these two dates were six and eleven dates after foliar application of most treatments. Soybean yield ranged from 52-60 bushels per acre (Figure 1). A mean separation ($\alpha = 0.05$) test of soybean yield was also significant between treatments ($F = 14.53$, $P < 0.0001$). A discussion of trends between treatments will be provided during the presentation.

Management Summary

- Scout corn and soybean for twospotted spider mites regularly throughout the summer, especially during moisture-stressed growing seasons.
- Monitor for developing and dispersing mite populations and plant injury.
- Treat spider mites before widespread plant discoloration and leafdrop occur; continue to monitor fields for resurgent populations.
- If practical, use sufficient volume and pressure with organophosphates to achieve the greatest efficacy.

Acknowledgments

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Table 1. List of spider mite treatments for the Northeast Farm in 2012

Treatment[a]	Active Ingredient(s)	Rate[b]	Timing[c]
Untreated Control	-----	-----	-----
Rag1	-----	-----	-----
CruiserMaxx Beans	thiamethoxam + mefenoxam + fludioxonil	56g/100kg seed	ST
Rag1 and CruiserMaxx Beans	----- thiamethoxam + mefenoxam + fludioxonil	----- 56g/100kg seed	----- ST
Rag1 and CruiserMaxx Beans and Warrior II CS	----- thiamethoxam + mefenoxam + fludioxonil lambda-cyhalothrin	----- 56g/100kg seed 1.92 fl oz	----- ST 10 Aug
Rag1 and Warrior II CS	----- lambda-cyhalothrin	----- 1.92 fl oz	----- 10 Aug
Warrior II CS	lambda-cyhalothrin	1.92 fl oz	10 Aug
Lorsban Advanced EC	chlorpyrifos	1 pt	10 Aug
Dimethoate 4E	dimethoate	1 pt	10 Aug
Cobalt Advanced EC	lambda-cyhalothrin + chlorpyrifos	13.0 fl oz	10 Aug
Warrior II CS + Lorsban Advanced EC	lambda-cyhalothrin chlorpyrifos	1.6 fl oz + 16.0 fl oz	10 Aug
Brigade 2EC	bifenthrin		10 Aug
Belay SC	clothianidin	3.0 fl oz	10 Aug
Belay SC and Brigade EC	clothianidin bifenthrin	2.0 fl oz + 2.3 fl oz	10 Aug
Belay SC	clothianidin	4.0 oz fl oz	10 Aug
Declare CS	gamma-cyhalothrin	1.02 fl oz	10 Aug
Declare CS	gamma-cyhalothrin	1.28 fl oz	10 Aug
Declare CS and Dimethoate 4E	gamma-cyhalothrin dimethoate	1.02 fl oz + 4.0 fl oz	10 Aug
Leverage 360	imidacloprid + beta-cyfluthrin	2.8 fl oz	10 Aug
Leverage 360	imidacloprid + beta-cyfluthrin	2.8 fl oz	19 July
Leverage 360 and Stratego YLD	imidacloprid + beta-cyfluthrin prothioconazole + trifloxystrobin	2.8 fl oz + 4.0 oz	19 July
Fastac EC	alpha-cypermethrin	4.0 fl oz	10 Aug
Endigo ZC	lambda-cyhalothrin + thiamethoxam	4.5 fl oz	10 Aug
Quilt Xcel SE	azoxystrobin + propiconazole		
Warrior II CS and Quilt Xcel SE	lambda-cyhalothrin azoxystrobin + propiconazole	1.92 fl oz + 13.0 fl oz	10 Aug
Cobalt Advanced EC and Headline EC	lambda-cyhalothrin + chlorpyrifos pyraclostrobin	24.0 fl oz + 12.0 fl oz	10 Aug
Besiege ZC	lambda-cyhalothrin + chlorantraniliprole	9.0 fl oz	10 Aug
Asana XL	esfenvalerate	9.6 fl oz	10 Aug
Asana XL and Lannate LV	esfenvalerate methomyl	8.0 fl oz + 8.0 fl oz	10 Aug

[a] Does not contain a fungicidal/insecticidal seed treatment unless noted
[b] Per acre unless otherwise noted
[c] ST = seed treatment

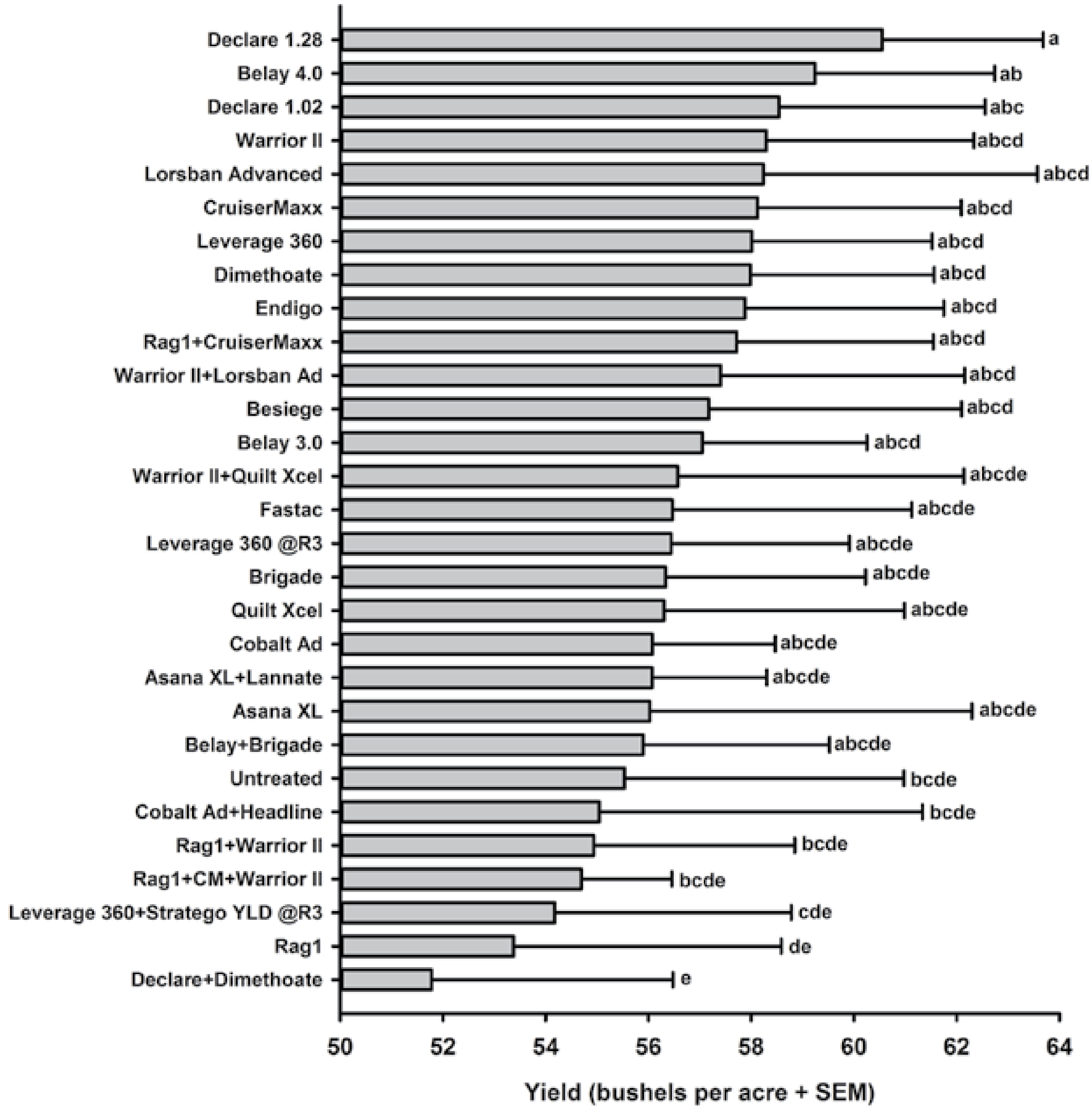

Figure 1. Twospotted spider mite efficacy evaluation at the Northeast Farm for 2012 showing treatment comparisons of soybean yield. Different letters represent a significant difference between treatments.