NebGuide

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Spider Mite Management in Corn and Soybeans

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This NebGuide describes the two common spider mites found in Nebraska corn and soybeans, their natural enemies and management.

Two species of spider mites, the Banks grass mite and twospotted spider mite, commonly feed on Nebraska corn. Banks grass mites (BGM) feed almost exclusively on grasses, including corn and sorghum. Twospotted spider mites (TSM) not only feed on many species of grasses, but also on soybeans, fruit trees and a variety of vegetables and ornamental plants. Although these two species are somewhat similar in appearance, they differ in several biological characteristics and in their susceptibility to pesticides.

Banks grass mites usually appear earlier in the season, feed mostly on the lower leaves of the corn plant, and in Nebraska are moderately susceptible to many of the commonly used miticides. On the other hand, TSM tend to appear in mid to late season, increase rapidly, feed over the entire plant, and often are not consistently controlled by available pesticides.

Biology

Although mites may occasionally overwinter in crop residues, BGM primarily overwinter in the crowns of winter wheat and native grasses, and TSM primarily overwinter in alfalfa and other broadleaf plants bordering the fields. In the spring or summer, mites crawl or are carried by wind to corn or soybean fields where they deposit small, round, pearly-white eggs on the underside of the leaves. Early mite reproduction and damage often appear first on the south and west edges of fields due to the prevailing wind direction, but infestations also may arise in "hot" spots scattered throughout the field.

Mite eggs usually hatch in about three or four days. Young mites resemble the adults, and increase in size by periodically shedding their skins. It takes about five to 10 days after hatching (depending on the temperature) before mites are mature and begin to produce eggs. All stages of mites may be present at the same time, and there may be seven to 10 generations during the growing season.

Damage

Mites damage crops by piercing plant cells with their mouthparts and sucking the plant juices. The first evidence of mite feeding, which can usually be seen on the top of the leaf, is a *yellow or whitish spotting* of the leaf tissues in areas where the mites are feeding on the lower leaf surface. Because many other things can cause similar discoloration, it is important to check leaves closely to make sure mites are actually causing the damage. Leaf discoloration caused by mite feeding can be easily identified by checking the undersurface of leaves for the presence of mites, eggs and webbing. Both BGM and TSM produce webbing, and a fine network of silken webs likely will be associated with mite colonies. A magnifying glass or 10X hand lens is helpful in examining plants for the presence of mites.

As mite infestations develop, leaves may be severely damaged and the food manufacturing ability of the plants progressively reduced. If an infestation is severe, leaves may be killed. In corn, effects on yield are most severe when mites start damaging leaves at or above the ear level. Infestations may reduce corn grain yields due to poor seed fill and have been associated with accelerated plant dry down in the fall. The quality and yield of silage corn also may decline due to mite feeding.

Damage is similar on soybeans, and includes leaf spotting, leaf droppage, accelerated senescence and pod shattering, as well as yield loss. Early and severe mite injury left untreated can completely eliminate yields. More commonly, mite injury occurring during the late vegetative and early reproductive growth stages will reduce soybean yields between 40 percent and 60 percent. Spider mites can cause yield reductions as long as green pods are present.

Factors Contributing to Mite Infestations

Mites do not cause major economic damage every year in Nebraska. Several factors, which fluctuate from year to year, strongly influence spider mite numbers. Probably the most important of these factors are weather, natural enemies and pesticide use. Overwintering sites that are close to corn and soybean fields, especially grasses, wheat and perhaps alfalfa, also may increase the possibility of mite invasion.

Figure 1. Predatory mite, *Neoseiulus fallacis*.

Figure 2. Mite destroyer beetle (adult), *Stethorus* sp.

Figure 3. Six-spotted thrips, *Scolothrips sexmaculatus*.

Dry, hot weather favors mite reproduction and survival, especially if accompanied by drought stress in the crop. When the weather in June, July and August is especially hot and dry, mites can reach damaging numbers in most corn and soybean growing areas of Nebraska. Major mite infestations are more likely to occur in central and western counties that normally experience less rainfall. Sandy soil types also may contribute to spider mite problems in these areas because crops grown on these soils are more likely to experience drought stress even when irrigated.

Several species of insects and mites prey on spider mites. These predatory insects and mites play a major role in suppressing spider mites in most years. Many spider mite problems in corn and soybeans may be traced back to an earlier application of a broad spectrum insecticide that reduced populations of these natural controls. The most important of these include a predatory spider mite, the mite destroyer beetle, the six-spotted thrips and the minute pirate bug. In addition to these predators, a fungal disease also may be important in reducing spider mite populations.

The predatory mite, *Neoseiulus fallacis*, is the most important spider mite predator found in Nebraska. These mites are slightly larger than the pest mites, pear-shaped and uniformly pale brown or straw-colored *(Figure 1)*. In addition, they do not have the dark pigmentation characteristic of the pest mite species. These predatory mites will eat an average of about 15 mites per day. When present, the predatory mite can quickly increase its numbers and significantly reduce pest mite numbers.

The mite destroyer beetle *Stethorus (Figure 2)* is a small black ladybird beetle which can eat up to eight mites per hour. The adult beetle is about 1/16 of an inch in length and lays eggs in active mite colonies. The larvae, which feed on mite eggs, are gray and cylindrical, growing to about 1/16 inch in length before they complete their development.

The six-spotted thrips *(Figure 3)* is a small (1/16 inch long), tan, cigar-shaped insect. Both adults and the immature stages feed within mite colonies. This predatory thrips has been observed to eat about 60 mite eggs each day of their 30-day life span.

Minute pirate bugs (*Orius* spp.) *(Figure 4)* are small insects (1/16 inch long), and can be important predators of insect eggs and spider mites in both their immature and adult stages. The immature bugs are orange and wingless. The adults are black with white triangles at the tips of the wings.

Figure 4. Minute pirate bug, *Orius* sp., adult (left) and nymph (right).

In addition to predatory arthropods, a naturally occurring fungus can, under the proper conditions, control spider mite infestations. *Neozygites floridana (Figure 5)* is a common pathogen of spider mites. Weather conditions that favor fungal growth are an average daily temperature below 85ºF and relative humidities above 90 percent. If several cool, damp days occur together, the pathogen has an excellent opportunity to infect and kill spider mites. Infected mites have a shriveled, brown appearance and die quickly. If weather conditions favoring fungal infection occur, a re-evaluation of the mite population should be made before making a treatment decision.

Figure 5. Spider mite infected (left) and uninfected (right) with *Neozygites floridana* fungus.

These natural enemies may be important in keeping spider mite populations below damaging levels during many years. They are particularly effective during cool, moist periods in early and mid-summer when mite reproduction is slowed. For this reason, their presence and abundance should be noted and considered when evaluating spider mite populations.

Nearly all synthetic insecticides used in corn and soybeans have severe, detrimental effects on spider mite predators. Additionally, pesticides differ a great deal in their effects on BGM and TSM. Some cause little mortality of either species, while others are somewhat toxic to BGM. Fewer are toxic to TSM. Thus, great care should be taken to evaluate the benefits of an insecticide application before any material is applied for insect control in a field that also has spider mites. Even small numbers of mites can rapidly increase to damaging levels when conditions are favorable. In many cases, it is an earlier treatment for European corn borers, western bean cutworms or corn rootworm beetles that leads to a later spider mite problem in corn.

If a decision is made to treat an insect pest in a field that also has spider mites, the choice of products becomes very important. Use of products containing *Bacillus thuringiensis* (Dipel, Biobit, Thuricide, etc.) for control of European corn borer is suggested, particularly in fields with a history of mite problems, since these products are harmless to spider mite natural enemies. Because TSM and BGM differ in their susceptibility to various pesticides, it is important to determine which species is present. Products that have been associated in the past with both BGM and TSM buildup following their use include *permethrin* (Ambush, Pounce), *fenvalerate* (Pydrin), and to a lesser extent, *carbaryl* (Sevin). Other products, such as *parathion*, are most likely to be associated with problems only when TSM is present. Still other insecticides have only a slight tendency to increase spider mite numbers or may suppress them to some extent. These include *chlorpyrifos* (Lorsban) and *terbufos* (Counter). *Carbofuran* (Furadan) and *parathion* seem to suppress BGM, but not TSM.

Spider mites (particularly TSM) are noted for their ability to develop resistance to chemicals that were once toxic to them. For this reason, it is very likely that some products now toxic to spider mites will become less toxic in the future. Obtain the most current information before choosing an insecticide.

Field Identification of Spider Mites

Proper identification of the mite species present in a field is essential for making control recommendations and selecting an appropriate pesticide. This is because colonies of TSM generally are more difficult to control than BGM, and some insecticides used to control other pests are more likely to increase TSM numbers than others.

Accurate identification of spider mites is difficult and requires specialized microscopes and specimen handling procedures. Since BGM and TSM now are the only species known to damage corn in Nebraska, a simplified method has been developed to help differentiate between these two species in the field. Using this method and a 10X hand lens, it should be possible to determine the species composition of most mite infestations.

The characteristics used to identify the two species will apply to most specimens; however, there is considerable variation among individuals. Examine at least 20 adult female mites. In an established colony, adult female mites will be the largest individuals. The rear of their body is rounded whereas that of the much smaller male mite is more tapered.

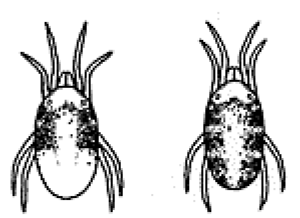

Figure 6. Line drawing contrasting twospotted spidermites (left) and Banks grass mites (right).

The most useful characteristics for identification are the overall shape of the body and the pattern of pigmentation spots on the back *(Figure 6)*. The dark green spots on both species are caused by food particles that accumulate in their gut. Because of differences in gut structure, these pigment spots accumulate in slightly different patterns. In BGM, the pigments accumulate along both edges of the body near the rear and along the sides of the body *(Figure 7)*. In TSM, the pigments accumulate along the sides of the body in two distinct spots and do not extend back more than halfway on the body *(Figure 8)*. The BGM is also slightly less robust than the TSM, and is slightly flatter from top to bottom.

Figure 7. Banks grass mites, *Oligonychus pratensis*.

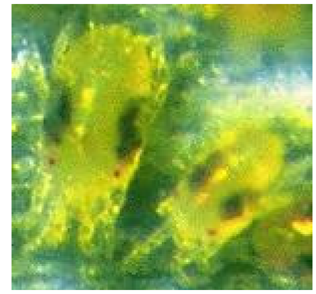

Figure 8. Twospotted spider mites, *Tetranychus urticae*.

In addition to the differences between individuals of the two species, there are some differences associated with colonies. There are exceptions, but TSM colonies tend to produce more webbing than BGM. BGM colonies often begin earlier in the season and remain longer on the lower leaves before moving up the plant. TSM usually appear later in the season and colonies can be found anywhere on the plant.

Treatment Thresholds

Researchers in Texas have developed economic injury levels for spider mites in field corn. Although these were originally developed based on data from TSM, additional research has shown that the BGM has the same damage potential as the TSM, so this information can be used for either species in corn. To use this procedure, the per acre control costs (miticide + application costs) and the expected value of the crop (yield [bu/acre] x corn grain value [$/bu]) must be estimated. A two-step sampling procedure is used.

First check the field for the presence or absence of spider mites on individual green leaves on a corn plant. Record the number of infested green leaves (containing one or more live spider mites) and the total number of green leaves on each plant. Repeat this procedure on at least 10 plants from different portions of the field. Compare the percentage of infested green leaves to the first value in *Table I* associated with the appropriate control costs and crop value. If your sample equals or exceeds the value in the table, then estimate the percentage of leaf area on the corn plants that is damaged by spider mites, and compare that value with the second value in the table. Spider mite damage can be described as chlorotic spotting of the leaf surface caused by mites sucking out plant juices at a feeding site. At either step, if the sample value is less than the value in the table, control of spider mites is unlikely to be profitable.

For example, if your estimated control costs are $15 per acre and the crop value is $300/acre (150 bu/acre x $2.00/bu), if 29 percent or more of the green leaves are infested, then you need to estimate the percentage of leaf area on the corn plant that is damaged by mites. If 16 percent or more of the total leaf area is damaged by mite feeding, it will likely pay to control spider mites in this example.

Research also has shown that corn is unlikely to benefit from treatment for either BGM or TSM after the **dent** stage.

No research has been conducted that would allow calculation of an economic injury level for twospotted spider mites on soybeans. Iowa State University Extension specialists have suggested that control may be warranted when infested plants have substantial spotting or leaf yellowing and live

Table I. Economic injury level for the Banks grass mite or twospotted spider mite on corn, based on the percentage of infested leaves per plant and percentage of total leaf area damaged.

Control cost per acre	*Market value per acre ($)*										
	200	*250*	*300*	*350*	*400*	*450*	*500*	*550*	*600*	*650*	*700*
% Infested leaves per plant / % of total leaf area damaged											
$5	15/8	12/6	10/5	8/5	7/4	7/3	6/3	5/6	5/3	5/2	4/2
10	29/16	24/13	20/10	17/9	15/8	13/7	12/6	11/6	10/5	9/5	8/4
15	44/23	35/19	29/16	25/13	22/12	20/10	18/9	16/9	15/8	14/7	13/7
20	59/31	47/25	39/21	34/18	29/16	26/14	24/13	21/11	20/10	18/10	17/9
25	74/39	59/31	49/26	42/22	37/20	33/17	29/16	27/14	25/13	23/12	21/11

mites, but before mites cause browning and leaf drop. Damage from mites may be confused with that caused by drought and several foliar diseases, so be sure to base treatment decisions on the presence of mites, rather than just apparent injury symptoms. Fields may be spot treated if the infestation is localized, but check other areas for mites (especially downwind of infestation) and extend treatments into these areas if large numbers of mites are found. Although late-season infestations may accelerate soybean senescence and increase pod shattering, caution should be used in deciding to treat with pesticides because many of the pesticides used for mite control have 21-28 day preharvest intervals.

Control

Mite infestations occurring early in the season should be carefully scouted during the rest of the season. These populations may not need to be controlled because they frequently do not develop to damaging levels on pretassel stages of corn. Low numbers of spider mites may allow predators to build up and prevent the spider mites from reaching damaging levels.

For effective control, spider mites must come into contact with the miticide. Since mites are found primarily on the underside of the leaves, they are difficult to reach with low volume applications. Using three or more gallons of water per acre to carry miticides may increase effectiveness. Aerial applications are generally more effective if applied very early in the morning or in the late evening. Applications made at these times avoid the upward movement of sprays, away from the plants, on hot rising air.

Eggs are difficult to kill with miticides, so reinfestation is likely to occur seven to 10 days after treatment as a result of egg hatching. The reinfestation is frequently heavy because natural enemies have been reduced or eliminated. A second application may be necessary to kill newly hatched mites before they mature and deposit more eggs.

In many cases, especially with TSM, slowing the rate of population increase is all that can be accomplished with a miticide application.

Failure to obtain adequate spider mite control may be attributed to:

1. Inappropriate choice of miticide.
2. Incorrect formulation.
3. Failure to obtain adequate plant coverage.
4. Application made during adverse climatic conditions.
5. Failure to repeat applications when infestations are heavy.
6. Mite resistance to the product.

To evaluate the effectiveness of a pesticide for control of spider mites, a field survey should be conducted before the pesticide is applied. Using a 10X hand lens or magnifying glass, closely examine 25 infested leaves and mark them so that the same leaves can be reexamined after treatment. Five to seven days after treatment, reexamine the same 25 leaves to determine if live mites are present. (NOTE: always observe the field reentry interval listed on the pesticide label.) If the treatment was effective, there should be no adult mites present. However, eggs present during treatment may not have been killed (most miticides do not kill the eggs) and may have begun to hatch, resulting in the presence of young mites. In some cases, retreatment may be necessary before immature mites can become adults and begin producing eggs.

Currently Available Treatments

Available miticides are listed at *http://entomology.unl.edu*.

UNL Extension publications are available online at *http://extension.unl.edu/publications.*

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