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CROP WATCH

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Scout for western corn rootworm beetles

Western corn rootworm beetles began emerging at Clay Center last week, a signal to begin a regular scouting routine.

Beetles emerging before silk emergence may feed on corn leaves. They feed by scraping the surface tissue, leaving a white parchment-like appearance.

When silks emerge, they become the favored food. There are no thresholds for silk-clipping damage based on beetle numbers because damage levels are not correlated well with beetle densities. Usually an average of at least 10 beetles per silk are required to seriously affect pollination. Severe silk feeding at 25-50% pollen shed may indicate the need for an insecticide.

During August these beetles will be laying eggs in corn fields. These eggs overwinter in the soil, hatch into rootworms in the spring, and feed on corn roots if continuous corn is grown. However, not all continuous corn fields\ have economic infestations of corn rootworms. Weekly scouting of adult rootworm beetles in July and August will provide the information needed to decide whether a rootworm insecticide is needed next year. People using adult beetle control programs should base the decision to treat and spray timing on information from field scouting.

Begin scouting for corn rootworm beetles soon after beetle emergence begins and continue scouting weekly until threshold levels are exceeded or beetle activity stops. Examine 50 plants per field, taking samples from each quarter of the field. Sampled plants should be several paces apart, so that examining one plant doesn't drive beetles off of the next plant to be sampled. The most reliable method is to examine the whole plant for beetles. Beetles may hide behind leaf sheaths or in the silks, so take care to observe all beetles present. An alternative method is to check for beetles only in the ear zone (the area including the upper surface of the leaf below the primary ear and the under surface of the leaf above the primary ear).

In continuous corn if beetle counts exceed 0.75 beetle per plant, damaging populations of corn rootworms are possible in that field next year. In first year corn, there is a higher proportion of female beetles, so the threshold is lowered to 0.45 beetle per plant. These thresholds are based on a 24,000 plant population per acre. The number of beetles per plant to equal a threshold level should be adjusted for

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Mites infestations severe in some western Nebraska fields

Spider mite infestations have been severe in several areas of western Nebraska with numerous fields needing treatment in the Panhandle and southwestern counties. Most all corn fields have mites on the lower leaves, and some fields already have mite colonies on the leaves up to the ear leaf. Nearly all of the mites have been Bank's grass mites. These early infestations have resulted from mite populations which moved from the maturing wheat to establish early colonies in the corn.

Factors affecting infestation

The development of severe mite problems depends on the current infestation level and also on the weather over the next several weeks. Hot and dry conditions will increase the potential for these mites to increase in numbers and in their damage potential. Growers must be checking their fields to follow the development of infestations.

The problem with this situation developing this early in the year is that multiple treatments may be necessary to keep the mites in check until corn matures. Adequate control will rely heavily on not letting the mite infestation get too far beyond the economic

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Western corn rootworms (Continued from page 115)

different plant populations (See NebGuide G86-774, *Western Corn Rootworm Soil Insecticide Treatment Decisions Based on Beetle Numbers*). People scouting using the ear zone method should divide the above thresholds in half, since on average only 50% of the beetles on a plant are counted using this method.

In addition to visual scouting methods, yellow sticky traps may be used. Research conducted in Iowa identified an unbaited Phercon AM trap as the best trap among several tested. Attach traps to the corn plant at ear height and leave in the field for a week. Use 12 traps per field, spread out over the whole field. If counts exceed an average of six beetles per trap per day, this is equal to the treatment threshold. If beetle counts are below this level, continue sampling until the threshold is exceeded or beetle activity stops. Some advantages of using traps over visual examination include 1) traps catch beetles over an extended time and are not influenced by time of day or weather; and 2) counts are not influenced by the experience or skill of the sampler. Traps are available from the manufacturer, Trece (408-758-0204), or from Great Lakes IPM (517-268-5693) or Pest Management Supply, Inc., (800-272-7672). Cost is about $1 per trap.

Rotating the field out of corn or using an insecticide at planting or cultivation would help prevent economic damage. Fields remaining below the threshold level do not need to be treated with a rootworm insecticide next year. Individuals using adult beetle control programs should begin treatments when the beetle threshold is exceeded and 10% of the female beetles are gravid (abdomen visibly distended with eggs). This is an important point since the first beetles to emerge are mostly male, and females require at least 10-14 days of feeding before they are able to lay eggs. Treatments applied too early may be ineffective if large numbers of females emerge after the residual effectiveness of the treatment has dissipated. Continue to monitor fields weekly after treatment for rootworm beetles. If beetle numbers exceed 0.5 beetles per plant, retreatment is warranted. Late maturing fields are particularly susceptible to corn rootworms moving into them from nearby earlier maturing fields.

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For more information

If you've recently suffered hail damage, your local Extension Office has several publications to help you determine degree of damage. They include:

Sorghum Yield Loss Due to Hail Damage (G86-812);

Assessing Hail Damage to Corn (G86-803); and

Soybean Yield Loss Due to Hail Damage (G85-762);

Cereal Aphids, G96-1284, a new Extension publication released this week provides drawings and color photos to help you identify and differentiate among six major aphid groups: Western wheat aphid, Russian wheat aphid, Bird cherry-oat aphid, greenbug, corn leaf aphid, and English grain aphid.

For these and other helpful publications, contact your nearest Cooperative Extension Office.

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Rootworms show insecticide resistance

Field reports of poor control of adult corn rootworm beetles with foliar insecticides at some Nebraska sites led us to conduct a study of western corn rootworm beetle susceptibility to insecticides in 1995. Beetles were collected from 16 locations across Nebraska from July 26 to Aug. 24. In every case beetles were collected before fields had been treated for beetle control, but after a significant amount of adult emergence had occurred to ensure that we obtained a representative sample of the population containing both males and females.

Three insecticides were tested:

1) carbaryl (active ingredient in Sevin products and SLAM),

2) methyl parathion (active ingredient of Penncap-M, widely used for rootworm beetle control), and

3) bifenthrin (active ingredient of Capture).

These insecticides represent the three major classes of insecticides registered for use on corn: carbamate, organophosphate and synthetic pyrethroid, respectively. Beetles were brought back to the laboratory and tested within 2-6 days after collection. Different concentrations of each insecticide were tested by applying a known amount of technical grade insecticide dissolved in acetone to individual insects. Control insects received acetone alone. Each dosage was tested against 10 insects per replication, with four replications. Each test was replicated on different days. Mortality was recorded after 24 hours.

Results indicate that susceptibility levels of western corn rootworm beetles to each insecticide were variable across Nebraska. The largest relative differences in susceptibility among collection sites occurred with methyl parathion. Up to 17 times more insecticide was required to kill 50% of a population from Phelps County compared to the most susceptible collection. Overall the greatest differences in susceptibility occurred with beetles from collection sites in Phelps and York counties. Similar trends were seen with beetle susceptibility to carbaryl except that the least susceptible beetles required eight to nine times more insecticide to kill 50% of the population. Beetles were relatively susceptible to bifenthrin across the state; however beetles from Phelps and York counties were again the least susceptible (2.5-3.5 times more insecticide was needed to kill 50% of beetles).

Bioassay data from this study, historical insecticide use patterns, and field reports of poor control with products containing methyl parathion or carbaryl suggest that western corn rootworm beetles have developed resistance to these insecticides in certain parts of Nebraska. This problem appears to be somewhat limited in its distribution; beetles collected from sites surrounding the Phelps County sites, such as Buffalo and Gosper counties, were as susceptible as the most susceptible collection sites.

These bioassay results cannot be directly related to percent control of rootworm beetles in the field. There are numerous factors in addition to insect susceptibility that determine efficacy of control efforts, including application timing, spray volume, and weather. The bioassays do provide a measurement of beetle susceptibility to insecticides under standard conditions that allow comparison among different populations.

Since last summer additional research has begun in the following areas: development of a diagnostic testing procedure for field use, determining susceptibility to insecticides of larval rootworms reared from resistant and susceptible beetles, and determining the biochemical and physiological basis of resistance in western corn rootworms.

Management implications

The most important way to manage for insecticide resistance is to reduce the selection pressure on populations. Scout fields for adults, and take management actions only if numbers exceed the threshold (See NebGuide G774, *Western Corn Rootworm Soil Insecticide Treatment Decisions*). Crop rotation is an effective nonchemical control option for western corn rootworms and does not contribute to the development of insecticide resistance. Injury to first year corn due to beetles laying eggs in the previous year's soybeans has been reported in Illinois and Indiana but has not been observed in Nebraska.

If you plan to use foliar insecticides to control rootworm adults, the following suggestions may provide increased control:

1) Increase gallonage of spray applications to provide better coverage of insecticide within the canopy. Labels for Penncap-M and Warrior recommend a minimum of 1 or 2 gallons spray volume per acre, respectively.

2) Avoid spraying too early, before significant numbers of females are ready to lay eggs. Males begin to emerge before females and females require about two weeks after emergence before they are ready to lay eggs.

3) Avoid repeated use of the same insecticide product on a field; if possible rotate between insecticides of different chemical classes. Unfortunately, there is not a great diversity of insecticides available for control of adult corn rootworm. Penncap-M, Lorsban 4E, malathion, and Cygon (dimethoate) are organophosphates, Capture, Pounce, Ambush, Asana, Warrior are synthetic pyrethroids, and Sevin is a carbamate.

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Evapotranspiration data helps you estimate irrigation needs

Nebraska's corn crop is entering the critical pollination stage. To aid with irrigation management, *CropWatch* will provide water use information for the rest of the growing season. Instead of providing crop specific water use based on one emergence date at each location, a weekly summary of the potential evapotranspiration (ET) will be given.

Table 1 gives the potential evapotranspiration for the prior week, normal evapotranspiration, and precipitation received at each location. To ensure that the information in *Table 1* is as current as possible, it will be updated the morning *CropWatch* goes to press.

The accumulated weekly potential evapotranspiration in *Table 1* is calculated using the Penman-Monteith equation, with alfalfa as the reference crop. Readers should notice that accumulated evapotranspiration values in *Table 1* don't vary significantly among locations. Therefore, a fairly accurate measure of your crop water needs can be calculated if your location is between two of the sites listed in *Table 1*. Use the potential evapotranspiration from the station closest to your area or take an average of the two locations on either side.

Depending on the development stage of your corn crop, multiply the accumulated potential evapotranspiration from *Table 2* by the appropriate crop coefficient provided in *Table 1*. This will give you a rough estimate of what your corn crop will have used under a well watered situation.

You can keep track of the water balance in your field by monitoring the precipitation that has fallen at your location. Subtract any precipitation that has fallen from what the crop used during the period. If precipitation is greater than what the crop requires during the period, you have a net gain in your soil water profile. Conversely if crop evapotranspiration is greater than precipitation, you will have a net decline in your soil water profile.

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For more information on using this evapotranspiration data with the checkbook method of irrigation scheduling, please see page 102 of the june 21 issue of *CropWatch*, No. 96-13.

Table 1. Coefficients based on corn development to be used when calculating evapotranspiration.

Crop Stage	*Coefficient*	*Crop Stage*	*Coefficient*
Emergence	0.00	16 leaves	1.06
2 leaves	0.18	Silking	1.06
4 leaves	0.35	Blister	1.12
6 leaves	0.51	Dough	1.20
8 leaves	0.69	Begin dent	0.98
10 leaves	0.88	Full dent	0.98
12 leaves	1.01	Mature	0.00

Table 2. Actual and average evapotranspiration and actual and average precipitation for the period from July 9-16.

	Accum. ET 7/9-7/16	Avg ET 7/9-7/16	Diff	Precip 7/9-7/16	Avg 7/9-7/16	Diff
Alliance	1.77	2.45	-0.68	0.85	0.51	0.34
Holdrege	1.62	2.44	-0.83	1.11	0.77	0.34
McCook	1.82	2.39	0.58	1.11	0.75	0.36
Mead	1.36	2.53	-1.17	0.04	0.75	-0.71
North Platte	1.49	2.23	-0.74	1.06	0.64	0.42
O'Neill	1.58	2.63	-1.05	0.04	0.76	-0.72
Ord	1.35	2.57	-1.22	0.08	0.70	-0.62
Red Cloud	1.55	2.16	-0.61	1.12	0.73	0.39
Sidney	1.62	2.54	-0.92	0.83	0.57	0.26

Western bean cutworm moths emerge

Western bean cutworm (WBC) moths are beginning to emerge. These large (3/4" long) moths are dark brown and have a white stripe on the leading edge of the upper wing.

Moths lay eggs on corn or dry edible field bean leaves. Corn fields in the late whorl stage are most attractive to the females for egg laying. Eggs are laid in masses of 5 to 200, usually on the upper surface of the top leaves. The eggs are about the size of a pinhead. When first laid, the eggs are white. As the eggs develop they turn tan, then purple just before hatching.

Newly hatched larvae are about 1/4 inch long and are dark brown with a faint diamond shaped pattern on their backs. As the larvae grow they become tan to pinkish brown and when mature are about 1 1/2 inches long. When the eggs hatch, the larvae first feed on pollen and then move to the corn ears or bean pods. The larvae will feed there for several weeks before they drop to the soil to form an overwintering chamber. By the end of the five larval instars, considerable feeding damage can occur. In corn, one larvae per plant usually will not cause severe damage but the ears may contain up to 10 larvae which can significantly reduce yield.

Start scouting for the western bean cutworm with the beginning of moth flight in mid July. In corn check 20 consecutive plants at five locations. If eight percent of the plants have an egg mass or young larvae are found in the tassel, consider applying an insecticide.

Timing of the application is critical. If the tassel has not emerged when the larvae hatch they will move into the whorl and feed on the developing pollen granules in the tassel. As the tassel emerges, the larvae will migrate down the plant to the green silks. The larvae will move down the silk channel and feed on the developing ear. Once the larvae reach the ear tip, control is difficult. If an insecticide is needed, time the application so that 90-95% tassel emergence has occurred. If the tassels have already emerged, the application should be timed for when 70-90% of the eggs have hatched.

If an insecticide application is needed, corn fields should be checked for the presence of spider mite colonies. If mites are found, select a product that will not stimulate mite reproduction. Products that contain permethrin (Pounce, Ambush) or esfenvalerate (Asana) have been associated with increased mite reproduction. Other products labelled for western bean cutworm control on corn include Sevin 80S and XLR Plus, Lorsban 4E, Penncap-M, Capture 2EC and Warrior 1EC.

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Mites *(Continued from page 115)*

thresholds. Tables describing mite treatment thresholds can be found in the NebGuide "Spider Mite Management in Corn and Soybeans"(G93-1167) and in the "Insect Management Guide for Corn and Sorghum" (EC-1509).

It is important to watch corn fields to determine the status of the mites and to watch the weather since it will be a big factor in treatment need and timing. It is best to delay treatments as long as possible to allow for better weather conditions and a chance for natural enemies to have an impact on the mites. **However, do not delay treatments after the thresholds have been reached unless the weather or natural enemies are in your favor.**

Treatment

Three chemicals are available for mite control in corn. These are dimethoate, Comite II, and Capture. Dimethoate is the cheapest product and should control Bank's grass mites in all of Nebraska. Dimethoate does not provide long residual activity and early treatments may need to rely on two applications -- the first to control the adult mites and a second about a week later to control those mites not controlled as eggs by the previous treatment. These two dimethoate treatments should reduce the mite populations and may provide control for the season without further treatment, but they also will increase the cost to be comparable to a Comite II treatment. Another advantage of dimethoate is it will provide good grasshopper control at field edges. The best timing for Comite II is just prior to tassel emergence. Comite II will control both Bank's and two-spotted spider mites, provide longer residual activity and be easier on natural enemies. The disadvantages of Comite II are its higher cost and its slower action in controlling mites (difficult to control established colonies). If mite colonies are present beyond the lower few leaves, adding dimethoate to Comite II will help to control these established colonies while Comite II will provide the residual control. Capture is the most expensive mite product, but it will control both mite species and several other corn insect pests. Capture will provide good residual activity and should be applied when the threshold is reached. Control with any of these products will be less than adequate if infestations are allowed to become extreme before treatment.

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Figure nutrient availability of manure & crop needs when planning application

Manure and compost can be good sources of nitrogen (N), phosphorus (P), and potassium (K) as well as micronutrients (zinc, iron, sulfur etc.). They also can be excellent sources of organic matter which has been shown to improve soil water holding capacity, infiltration and soil structure. The amount of manure or compost to be applied to a particular soil depends on the composition of manure, crop grown, and environmental conditions. Manure and compost should be applied to provide adequate nutrients for the growing crop while having no adverse effects on the environment.

To apply the correct amount of manure and compost, the amounts of nitrogen, phosphorus and potassium in the manure or compost that is available to plants needs to be determined. Release of nitrogen, phosphorus and potassium and micronutrients from manure or compost is a complicated biological and chemical activity and depends on soil moisture, temperature, pH, and soil type as well as manure or compost chemical composition, i.e. nutrient content, carbon/nitrogen ratio, etc. Nitrogen release from manure of various livestock species are different since manure from each has different chemical and physical compositions.

Chemical fertilizers contain plant available nutrients that are predictable based on the fertilizer grade. Unfortunately, nutrients in manure and compost are not available based on some grade level. How much nutrient becomes available in the year of application can be estimated based on some average soil moisture and temperature and chemical composition of manure or compost. For example, first year nitrogen availability would include the amounts of nitrate and ammonium contained in the manure or compost plus some proportion of the organic nitrogen that would mineralize into plant available forms.

Nitrogen availability from compost is usually less than fresh manure since most of the easily convertible nitrogen compounds are converted to ammonium and eventually lost as ammonia during composting and the remaining nitrogen compounds are more resistant to mineralization.

First year nitrogen availability from various manures and compost are given in *Table 1*. Nitrogen availability shows the greatest variability since nitrogen compounds undergo the greatest chemical and biological reactions during storage, handling, and spreading. Phosphorus availability to crops from all sources is very high (> 60%) in the first year after application since phosphorus in manure or compost is in easily degradable forms. The remaining phosphorus is expected to become available in the next year. Potassium availability from manure is almost 100% in the first year and therefore manure can be used the same way as potassium fertilizer. Availability of micronutrients from manure is estimated to be about 50% in the first year after application.

Table 1. Approximate amount of nitrogen available to crops from applied manure and compost in the first four years after application.

Manure source	*N (dry wt basis)*	*Nitrogen availability 1st yr*	*2nd yr*	*3rd yr*	*4th yr*
	%				
Cattle feedlot	1.5-2.0	40	20	10	5
	1.0-1.5	35	15	7	3
Swine	2.5-3.5	80	10	5	3
Dairy	2.5-3.5	60	15	5	3
Poultry	3.0-3.8	75	10	5	3
Compost	1.5-2.0	30	15	10	5
	1.0-1.5	20	20	10	5

These values may change with environmental conditions and variations in manure composition.

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