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In This Issue

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Executive editor: Kevin Steffey, Extension Entomologist

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FOR SUBSCRIPTION INFORMATION, PHONE 217.244.5166, OR E-MAIL acesnews@uiuc.edu

Correlation Guidance

Incorporation of insecticides for corn rootworm larval control requires a little effort. The following questions and answers are designed to provide some additional input on this topic.

 Aren’t corn rootworm larvae almost impossible to find?

Locating corn rootworm grubs in mid-June requires some effort. First instars are quite small, and they tend to burrow into root tissue and feed internally. As rootworms reach the third and last larval instar, they become easier to find; however, a full-grown grub will not grow much beyond 1/2 inch in length. Figure 1 provides some information that can be used to determine larval instars for corn rootworms.

If I find corn rootworm larvae, how concerned should I be?

Don’t be alarmed. Soil insecticides will not kill 100% of corn rootworm larvae within a field. Remember that soil insecticides are placed in-furrow or in a narrow band during planting. Untreated areas between rows effectively serve as a rootworm refuge. Because the entire rootworm larval population within a treated field is not exposed to a soil insecticide application,
resistance to commonly used products has not occurred for decades. Corn rootworm resistance to methyl parathion (Penncap-M) has been confirmed in Nebraska. However, this resistance developed because of the widespread and long-term use of broadcast applications of Penncap-M for egg-laying suppression programs.

When should I be concerned if I find corn rootworm larvae?

If you find three or more larvae per plant (7-inch cube of soil and roots from base of plant) and root injury is evident, a rescue cultivation treatment may be warranted. An insecticide applied during cultivation does not generally perform as well compared with a planting-time treatment. This is especially true under very dry soil conditions. Because of the earlier and earlier planting we’ve witnessed in recent years, the application of rescue treatments at cultivation is increasingly no longer an option for many producers because plants are too tall.

How do I grade the performance of my soil insecticide?

To get an accurate picture of how well your soil insecticide worked, you should dig several (5 to 10) plants from about 10 different areas (treated and untreated strips) of your field. Following the digging, wash off the soil from the roots, and look for any general feeding (brown scars) or, more importantly, examine the plants for pruned roots. Most entomologists throughout the Corn Belt suggest that a soil insecticide has done its job if it keeps root injury below a rating of 3.0 (several roots pruned to within 1.5 inches of the plant; never an entire node pruned) on the Iowa State root-rating scale. The economic root-injury index is static and varies according to the hybrid selected and the amount of precipitation that occurs throughout the growing season. Rainfall after the larval-feeding period is very important. The level of root regeneration from mid-July through mid-August may significantly affect yield.

Let’s assume that I follow your suggestions and find very little root injury. Can I now assume that I got my money’s worth for using a soil insecticide?

Perhaps, but only if roots also were removed from a check strip(s) and you found they were injured. Unfortunately, many producers are unwilling to leave some rows untreated at planting. If you don’t leave some untreated areas in your cornfield, you’ll never be able to estimate the real value of your soil-insecticide purchase. The use of four widely separated check strips (two to four rows per strip) works well for this purpose. Comparing root injury in treated and untreated strips throughout a field is the only way to adequately determine the value of your soil insecticide investment for rootworm control.

If I find very few rootworm adults in my cornfield in July, doesn’t this suggest that my soil insecticide worked pretty well?

Not necessarily. Soil insecticides were designed to provide only one important function: root protection. Research in Illinois and other states clearly indicates that in certain years more corn rootworm adults may emerge from treated than untreated areas of cornfields. If you don’t find many corn rootworm adults in your cornfield, it may simply mean that you didn’t have much of an infestation to begin with. Also, corn rootworm adults are very mobile (particularly the females) and may have left your field and flown to a nearby later-planted and more generously pollinating field.

If I don’t have any severe lodging in my field, is it safe to assume that my soil insecticide performed adequately?

No. Corn plants lodge for a variety of reasons that may have nothing to do with corn rootworm larval injury. Plants that are top heavy (tall with large ears) may topple over in severe thunderstorms. Saturated soils may predispose plants, even those with no root injury, to lodging because of the weakened soil structure around the root system. Conversely, if soils are extremely dry and hardened, plants with severe root pruning may not lodge because they are held in rigid “concrete-like” growing conditions.—Mike Gray

First Flight of European Corn Borer Persists at Low Levels

Reports of the first flight of European corn borer moths continued across central and northern Illinois counties. By now, this flight is mostly a memory for folks in southern Illinois. In issue no. 10 of the Bulletin, we presented a table that highlighted the occurrence of different corn borer events or life stages according to the number of accumulated degree days from the initial spring capture of moths. Based on the first reported captures of moths in southern Illinois (May 9), we project that for the southern one-third of the state, many corn borer larvae are already fourth-larval instars. Consequently, these borers are tunneling within stalks and no longer susceptible to rescue treatments. From May 9 through June 12, Bob Scott, Illinois State Water Survey, reports that 635 heat units (base 50°F) have accumulated (average across seven southern reporting stations). As Table 2 in issue no. 10 of the Bulletin indicates, when 567 heat units have accumulated beyond an initial capture of moths, stalk boring has begun. In central Illinois, an average (nine reporting stations) of 476 heat units had accumulated from May 15 through June 12. The first general observance of moths across central Illinois counties occurred on May 15. For central Illinois, mid-rib tunneling and stalk boring should be under way by third-instar larvae. We estimate the first flight of moths began across northern Illinois on May 22. As of June 12, an average of 352 heat units had accumulated (average of three stations) in northern Illinois counties since May 22. This suggests that most second instars will very soon be completing
their development, and decisions regarding a rescue treatment should not be delayed.

As we’ve indicated several times this spring, the first flight has been very weak. However, don’t neglect to monitor fields for whorl-feeding injury. Also, we welcome reports of your scouting efforts.—Mike Gray

**Effect of Bt Corn on Nontarget Insects: The News Isn’t All Bad**

*Bt* corn and other transgenic crops have received so much negative press within the past year that one begins to wonder if anything positive will ever see the light of day. The potential adverse effects of *Bt*-corn pollen on monarch butterfly caterpillars, based initially on one preliminary laboratory study, received an inordinate amount of press coverage, and most of it was negative. We wonder if a more recently conducted study in Illinois will receive a similar amount of press coverage.

The study to which we are referring was conducted by C. L. Wraight, A. R. Zangerl, M. J. Carroll, and M. R. Berenbaum in the Department of Entomology at the University of Illinois. The objective of the research was to determine whether mortality of early-instar eastern black swallowtails, *Papilio polyxenes*, was associated either with proximity to a field of *Bt* corn or by levels of *Bt*-corn pollen deposition on host plants. The results of the research were published recently in the *Proceedings of the National Academy of Sciences USA* and were published online before print June 6, 2000. The article is entitled “Absence of toxicity of *Bacillus thuringiensis* pollen to black swallowtails under field conditions” and can be viewed at http://www.pnas.org/cgi/content/full/130202097v1.

Black swallowtail caterpillars occur throughout North America east of the Rocky Mountains. They feed almost entirely on plants in the celery or parsnip family, several of which are found in pastures and along roadsides and edges of cultivated fields. Consequently, these caterpillars may be found feeding on their host plants near *Bt* cornfields. Wraight et al. used arrays of potted wild parsnip plants (five rows of five potted plants per row) as hosts for the caterpillars (10 first instars per plant). The potted plants and caterpillars were placed next to a *Bt* cornfield (Pioneer 34R07; event MON810, Cry1Ab gene) 24 hours after the initiation of pollen shed. The amount of pollen falling on each plant was estimated with microscope slides covered with a thin coat of Vaseline. The number of live larvae on each plant were recorded daily for 7 days; the condition of surviving larvae was determined by weighing each larva at the end of 7 days. In addition, Wraight et al. conducted bioassays in the laboratory to determine the range of toxicity of pollen from *Bt* corn (both Pioneer 34R07 and Novartis Max 454 [event 176, Cry1Ab gene]) and non-*Bt* corn (Pioneer 3489).

We won’t bore you with detailed results from the study; you can peruse the results yourself at the aforementioned website. However, the authors of the paper summarized their results as follows: “... there was no relationship between mortality and proximity to the field or pollen deposition on host plants. Moreover, pollen from these same plants failed to cause mortality in the laboratory at the highest pollen dose tested (10,000 grains/cm²), a level that far exceeded the highest pollen density observed in the field (200 grains/cm²). We conclude that *Bt* pollen of the variety tested is unlikely to affect wild populations of black swallowtails. Thus, our results suggest that at least some potential nontarget effects of the use of transgenic plants may be manageable.”

Wraight et al. also stated: “Larvae of the black swallowtail, by virtue of their multivoltine life history and broader host range in the Midwest, are as, if not more, likely to encounter corn pollen between late June and mid-August during its 8- to 10-day period of anthesis than are larvae of the monarch butterfly, yet under actual field conditions no mortality directly or indirectly attributable to ingestion of endotoxin-containing corn pollen could be detected in our study. This is not to say that monarch butterflies are unaffected by *Bt* corn pollen; however, field studies as well as appropriately controlled laboratory studies are necessary before such a conclusion can be drawn.”

Potential effects of *Bt*-corn pollen on nontarget insects continue to generate a great deal of interest. In fact, considerable field research regarding the effects of *Bt*-corn pollen on monarch butterfly caterpillars was initiated in 1999, and even more will be conducted in 2000. Results from a lot of these studies will help us determine whether *Bt*-corn pollen will affect *populations* of nontarget insects such as monarch butterflies in the field. These “real-world” studies should help us address the most important questions. The findings from the Wraight et al. study suggest that *Bt* corn is not the ecological disruptor it is claimed to be by many anti-biotechnology groups. We challenge the media to provide an amount of coverage regarding these findings similar to the coverage they gave the monarch butterfly story.—Kevin Steffey and Mike Gray

**PLANT DISEASES**

**Corn Viruses and Thrips**

Concerns over the potential for corn-virus transmission from the southwestern part of the state have been sprinkling in over the last 2 weeks. It is not surprising virus infection is on the minds of people in the southern part of the state given the devastating effect viruses such as wheat streak mosaic (WSMV) had on the wheat crop this year. What does that have to do with the corn? Well, several reports have come in concerning thrips infestations in seedling corn. This is a bit of an unusual situation, with one consultant
reporting 36 thrips per plant. The corn in these fields were of course showing the rasping from the thrips feeding but also appeared to be somewhat stunted. Stunting is a very common symptom of virus infection. So the question was this: Can thrips transmit viruses to field corn? Well, as it turns out, two viruses are reported to be transmitted to corn by thrips: maize chlorotic mottle and tobacco streak virus. The good news is that neither of these viruses has to date been reported in Illinois. The cautionary news is that virus diseases and their vectors don’t have a map showing the state border so they know that they aren’t supposed to show up there. We have seen time and time again that it isn’t wise to ignore pest situations in nearby states. That’s a bit more information about one of these diseases that bears keeping in mind over the next few years. — Suzanne Bissonnette

Maize Chlorotic Mottle

Maize chlorotic mottle virus (MCMV) is not widespread in the United States; it has been reported in Nebraska, Kansas, and Hawaii. Symptoms are fine chlorotic yellow streaks developing in the youngest leaves about 10 days after inoculation. The streaks then coalesce to form chlorotic mottling, which is then followed by leaf necrosis, epinasty, stunting, and plant death. The natural vectors of this virus are *Diabrotica* spp. adults and larvae and thrips. Experimental vectors include a few other Chrysomelid beetles as well. Hosts of the disease include corn, wheat, barley, rye, sorghum, and many grass species. This virus is very often found in mixed infections with maize dwarf mosaic virus or wheat streak mosaic virus. In combination, the viruses cause corn lethal necrosis, a disease name that is self-explanatory.

It is probably fairly obvious where I am headed now. We commonly do have maize dwarf mosaic virus (MDMV) transmitted by aphids in the state. As discussed earlier in this year in the *Bulletin*, corn is a host to wheat streak mosaic virus (WSMV), although not affected by it. Wheat curl mites from infested wheat fields move into the corn, and the virus is maintained there. So, we have several but not all pieces of the puzzle present for corn lethal necrosis. Definitely something to keep in mind.

Hopefully no new virus diseases will make their way into the state. The right questions were asked, though, when a high population of a suspected virus vector was found infesting several fields of seedling corn. That was good scouting and troubleshooting.— Suzanne Bissonnette

Update on Stewart’s Bacterial Wilt

Stewart’s wilt is starting to make itself known in the northwestern part of the state now. Dave Feltes, IPM educator in the Quad Cities, reports a heavy Stewart’s infection on seedling corn V-5 to V-6 growth stage in Joy, Illinois. The plants had characteristic leaf striping and brown rotted growing points. See issue nos. 3, 7, and 8 of this year’s *Bulletin* for more information on Stewart’s wilt and lookalikes. There are a number of other factors that can cause these types of symptoms. A definitive diagnosis of Stewart’s wilt is made in the lab, where we look for microscopic “bacterial streaming” from the infected tissue.— Suzanne Bissonnette

CROP DEVELOPMENT

Corn Charges Ahead

A number of folks have been wondering lately, “How much rain does it take to end a drought?” Most areas of Illinois have received some respectable rainfall in the past 2 weeks, and some, mostly in the northern part of the state, are truly hoping that the rains slack off soon, before crop damage from too much water increases further. Even in areas that have received rainfall, the “drought mentality” has set in to the point that many are still worried about the prospects for the corn crop, even if soils have a good supply of stored water at this point.

The recent weather pattern has not cooperated with earlier predictions of a drought setup, which was supposed to include high pressure dominating over the southeastern states, stopping the flow of moist air into the Corn Belt. Rainfall in May was variable, ranging from several inches below normal in parts of west-central Illinois to several inches above normal in other places. Overall, though, rainfall in May was adequate to restore soil water to some extent, and the crop at the end of the month was not suffering seriously from lack of water anywhere in the state.

How much is the crop at risk from lack of water as we move toward pollination? Probably no more than average for this time of year. The fact that the crop was planted early and got off to a fast start is a real benefit, in that it will likely pollinate a week or so earlier than normal except where planting was delayed. In most fields in Illinois, there is adequate stored soil water to take the crop at least to tasseling, if not well into pollination. As the crop nears full canopy development in the next weeks, the rate of water loss will increase, approaching 1.5 inches per week if the temperatures are average, and even more if it’s hotter than usual. Well-supplied soils can store as much as 8 to 10 inches of water in the rooting zone, and so can carry the crop for several weeks even without rainfall.

There is little evidence that the crop has been held back by lack of water to this point; even in the area east of Quincy where rainfall has been considerably below normal, the crop was 3 to 4 feet tall at the end of last week. It also has excellent color, and even though rainfall has been low and soils appeared to be dry, it was clear that the crop had not suffered greatly. That area has received some rain since then.
It is useful to “let the crop tell us” how it has fared through dry periods. The main response we would see from very dry soils up to now would be shorter-than-normal plants; plant cells do not compete well for water with the air, and if soil water is inadequate, cells don’t elongate as much, and so the stem does not grow as much. In this way, plant height (and, to a lesser extent, leaf size) represents an accumulation of effects of dry soils on growth. On a daily basis, the earlier in the day the plant leaves start to roll, the more deficient in water the soil is. If leaves curl only in late afternoon and then relax in the evening, they are being affected by dryness, but not very severely. If they curl before noon and don’t relax until well after sundown, then moisture deficits are having more effect. This year, despite reports of dry soils, few fields showed much leaf curling at all. That means that they had roots tapping into soil moisture adequately to meet the water needs of the plant.

While the crop looks very good at this point in most areas, it is certainly too early to conclude that water supply is assured for this crop. As recently as 1997, the crop ran out of water abruptly in July in some areas, with large yield losses in many cases. A clear advantage this year is that the roots have been able to grow well in soil that was less compacted than normal this spring, and the dry surface soils in some areas have encouraged root development at greater depths. But we still need rainfall in July for this crop to reach what looks to be outstanding potential at this point. And with drier soils now than last year at this stage of development in some areas, the need for August rainfall might be greater than it was last year.

Back to the present: corn planted in late April here at Urbana is now about 36 inches tall, in stage V9, while corn planted in late March is about 10 inches taller and at stage V10 to V11. All of the crop has very good color, and there are few obvious problems at this point. Corn that is V10 now should show tassels by the end of June if temperatures remain normal or above.—Emerson Nafziger

**REGIONAL REPORTS**

Extension center educators, unit educators, and unit assistants in northern, west-central, east-central, and southern Illinois prepare regional reports to provide more localized insight into pest situations and crop conditions in Illinois. The reports will keep you up to date on situations in field and forage crops as they develop throughout the season. The regions have been defined broadly to include the agricultural statistics districts as designated by the Illinois Agricultural Statistics Service, with slight modifications:

- North (Northwest and Northeast districts, plus Stark and Marshall counties)
- West central (West and West Southwest districts, and Peoria, Woodford, Tazewell, Mason, Menard, and Logan counties from the Central district)
- East central (East and East Southeast districts; except Marion, Clay, Richland, and Lawrence counties, McLean, DeWitt, and Macon counties from the Central district)
- South (Southwest and Southeast districts, and Marion, Clay, Richland, and Lawrence counties from the East Southeast district)

We hope these reports will provide additional benefits for staying current as the season progresses.

**Northern Illinois**

Last week we talked about the storms and moisture. This week it is essentially the same, other than the areas affected by large rainfall totals the past few days have increased.

Considerable flooding along all area rivers and streams with more heavy rain predicted at the end of the week. Pythium and phytophthora are two water-mold diseases taking a toll on the soybean population.

Crazy top is a distinct possibility in cornfields where the entire plant was submersed and survived.

Some reports of Stewart’s wilt trickling in.

Saturated soils and nitrogen in the nitrate form in the soil could lead to denitrification and leaching of nitrates, which could lead to some shortages of nitrogen available to the plant in the future.

Post-herbicide applications to soybeans and corn are falling behind schedule, and weeds are growing with the ample moisture.

Leafhopper numbers are holding steady in fields swept late last week in Stephenson County, with treatment thresholds not yet reached.

Fireflies are supposed to be the indicator of when the rootworm hatch is under way. As of this writing, I have not seen one firefly!

**Southern Illinois**

**Wheat:** Some fields have been combined, but the bulk of the grain harvest will begin sometime in the next 7 to 10 days, depending on rain.

**Corn:** Lots of variation in growth stage. Earlier-planted corn looking good. Some of the later-planted corn has shown retarded growth. Relatively cool nights over the last couple of weeks coupled with insect damage have slowed these fields. Quite a number of insects are affecting some fields. Thrips damage has set back quite a few of the later-planted corn across the region. Grape colaspis has been found in a number of poor-looking fields.

**Beans:** Seems to be progressing well.

**Other:** The grasshopper hatch has been very high. Most feeding has been confined to noncrop areas, but the potential for some significant
feeding in beans and corn exists.

**West-Central Illinois**

- Rain fell in most of the region during the week with reports of up to 5 inches in some areas. Only minor crop losses occurred as a result.
- With the abundant moisture and warm temperatures, crops are growing rapidly. Some cornfields are in V9 stage and beyond, and some soybean fields are in V3 to V5 stages.
- Weed-control efforts are confined to postemergence application on soybean. Most herbicide applications on corn are completed.
- Soybean seedling diseases such as Rhizoctonia, Fusarium, and Pythium can be found in many fields. However, there have been no reports of replanting because of those diseases.
- Soil compaction, especially on lighter-colored soils, is somewhat common this year in some cornfields. Dry-weather stress may result earlier in the growing season due to the predominant horizontal root growth.
- Wheat is maturing rapidly with harvest beginning very soon in the southern part of the region. Harvest usually does not begin until the last week of June.
- Potato leafhoppers are abundant in alfalfa fields.

**Contributing Authors**

**Suzanne Bissonnette**
(bissonnettes@mail.aces.uiuc.edu),
Champaign Extension Center,
(217)333-4901

**Mike Gray**
(m-gray4@uiuc.edu),
Extension Entomology, (217)333-6652

**Emerson Nafziger**
(ednaf@uiuc.edu),
Crop Sciences, (217)333-4424

**Kevin Steffey**
(ksteffey@uiuc.edu),
Extension Entomology, (217)333-6652