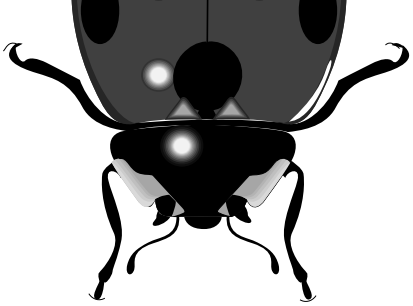

PEST MANAGEMENT & CROP DEVELOPMENT

BULLETIN

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In This Issue

INSECTS

Questions About Japanese Beetles Abound

The unknowns about Japanese beetles and their potential effect on corn yields seemed to outweigh the knowns this past week. We have received numerous calls about infestations of Japanese beetles in cornfields, but few people have a good handle on whether this pest is having a significant effect on pollination. Japanese beetles are notorious silk clippers, but they also move around a lot. Consequently, after they have clipped silks from one ear, the silks continue to extend after the beetles leave for another food source. If the field has adequate moisture and silk extension is not impeded, silks that are 1/2 inch or longer can still intercept pollen.

And then there's the question about the uneven distribution of Japanese beetles in a field. Most reports have indicated that the beetles usually are prevalent along field edges. However, we also have received reports that Japanese beetles are spread throughout the field. In at least one instance, a grower had only the perimeter of a cornfield sprayed because of very high numbers of Japanese beetles. Within a couple of days, Japanese beetles were found clipping silks throughout the interior of the field. In the article "Japanese Beetles Are a Widespread Concern in Illinois" in last week's issue of the *Bulletin* (issue no. 16, July 11, 2003), I addressed the challenge of scouting and determining average densities of Japanese beetles when they appear in clumps in a field.

We've written numerous words about Japanese beetles in corn, but we've said very little thus far about Japanese beetles in soybeans. Suffice it to say that Japanese beetles also have been found in abundance in some fields of soybeans in Illinois. Rich Metzger, crop specialist with Madison Service Company, observed a section of a soybean field that was completely stripped of leaves. Others have observed significant defoliation of R1-R2–stage soybeans. Defoliation of soybeans during bloom and pod fill is more critical than defoliation of vegetative-stage soybeans.

It's important to scout fields of flowering soybeans to determine the presence of Japanese beetles and percentage of defoliation if you wish to determine whether control is justified. In general, for all defoliating insects, the threshold is 20% defoliation between bloom and pod fill. This number can be adjusted depending on the value of the soybeans and cost of control. Insecticides suggested for control of Japanese beetles in soybeans are listed in Table 1. If you decide to apply an insecticide to control Japanese beetles when soybeans are in bloom, keep in mind that bees visiting the soybean flowers can be killed. Please coordinate with local beekeepers before applying insecticide sprays. Insecticide applications early in the morning or late in the evening are preferential. Bees are less likely to be present in flowering soybeans at those times of day.

In issue no. 15 (July 3, 2002), Mike Gray wrote an article titled "Novel (Amusing) Insect Sampling Technique Reported in Britain." Apparently this article inspired our own Emerson Nafziger, crop specialist in the Department of Crop Sciences. He offered the following information after driving through

Table 1. Insecticides suggested for control of Japanese beetles in soybeans.

Product	*Amount of product per acre*
*Ambush	6.4 to 12.8 oz
*Asana XL	5.8 to 9.6 oz
*Baythroid 2	1.6 to 2.8 oz
*Mustang Max	2.8 to 4 oz
*Penncap-M	2 to 3 pt
*Pounce 3.2EC	2 to 4 oz
Sevin XLR Plus	1/2 to 1 qt
*Warrior	3.2 to 3.84 oz

southern Illinois: "As you know, Japanese beetles make a distinctive click when a speeding windshield hits them —most satisfying in that they almost certainly died, but they don't leave much windshield residue to clean off. On a trip of 400 miles through southern Illinois yesterday, I would estimate the Interstate Japanese Beetle Contacts per Mile (IJBCM) to have been about 4 to 5, with high variability. They were on crops at Belleville, but I did not note presence or absence on a map. There is also a time-of-day correction that needs to be incorporated in this index (I didn't contact many before noon), which I did not do." A few more reports like these and we may have to consider a statewide effort.—*Kevin Steffey*

Western Corn Rootworm Emergence Delayed

Jared Schroeder and Nathan Wentworth, graduate research assistants in the Department of Crop Sciences, reported that the emergence rate of adult western corn rootworms has "picked up" this week. Even though emergence is well under way, it is delayed compared with recent years. Typically, we begin our evaluation of soil insecticides in mid-July. This year, we intend to begin our assessment of product performance (traditional granular products, seed treatments, transgenic hybrids) during the last week of July. We have indicated many times in previous issues of the *Bulletin* that added pressure is placed on soil insecticides when planting occurs in early April and the larval feeding period is extended through mid- to late July. This scenario is occurring in many areas of central Illinois. Shawn Jones, field sales agronomist with Pioneer, recently observed that severe root injury and lodging had occurred in a first-year cornfield located in Moultrie County. The field had numerous western corn rootworm adults and had not been treated with a soil insecticide at planting. Shawn also observed severe root injury and lodging in a first-year cornfield located in Macon County (west of Highway 51). This field was not treated with a soil insecticide at planting.

In August, we intend to conduct a survey of first-year corn rootworm larval injury in more than 30 counties of Illinois. Ten rotated cornfields per county are selected at random, and five roots per field are evaluated for injury. We organized a similar survey last year. Root-injury data in 2002 clearly indicates that the likelihood of first-year corn rootworm larval injury continues to creep westward each year. We are interested in learning of confirmed cases of larval injury in first-year cornfields, especially in western and northwestern counties of the state. So please pass along your observations from the field.—*Mike Gray*

The Moths of Summer Are Back

As we near the end of July, the "Leps" of summer will soon be descending on cornfields throughout the state. Corn earworm, southwestern corn borer, fall armyworm, and second-generation European corn borer are four of the prominent moth pests of corn. Corn earworm flights are already heavy in some areas. Dan Fournie, Collinsville, has seen an increase in moth numbers and reported a one-night catch of 189 corn earworm moths on July 10. Ron Hines, senior research specialist, Dixon Springs Agricultural Center, also reports this week that flights of corn earworm, fall armyworm, and European corn borer are coming on strong, while a second flight of southwestern corn borer moths is beginning.

As flights increase, be aware that moths are searching for locations to lay eggs. Corn earworm moths will be most attracted to cornfields that are currently silking. Moths prefer to lay eggs on newly emerged silks but will also lay eggs on the upper and lower leaf surfaces, tassels, and stalks of corn plants. In Illinois, the economic importance of the corn earworm is generally limited to sweet corn and seed corn. Early instars feed on leaves, leaving small pinholes on the leaf surface. Older larvae, ranging in color from light green or pink to dark brown or nearly black, feed on leaves, causing defoliation. More important, they feed on silks and developing kernels. Earworm larvae that are able to penetrate the ear not only destroy kernels but also predispose the ear to secondary pests and microorganisms that may produce mycotoxins. It's also of importance to note that the corn earworm is cannibalistic, and rarely will more than one larva survive per ear. Damage of kernels due to earworm feeding can result in loss of yield. Injury such as this in sweet corn results in an unsalable product, especially in the fresh market. Sweet corn processors often accept damage to some extent; corn earworm feeding is commonly limited to the ear tips, which can be cut off before processing.

The southwestern corn borer does not occur in much of the Corn Belt. In Illinois, it has been found as far north as Effingham, with economic populations occurring as far north as State Highway 50. In most years, economic populations are limited to areas south of Interstate 64. Injury caused by second generation southwestern corn borer is caused by larval feeding on the ear, ear shoots, and leaf sheaths. Larvae will also tunnel in the stalk. In the late fall, larvae chew out the inside of the stalk in a thin ring just above ground level. They tunnel into the root, which can cause the stalk to lodge. Treatment should be considered when 25% of the plants have egg masses or larvae on the leaves. Other factors such as yield,

value of corn per bushel, and the cost of insecticide also should be considered in any management decisions.

Fall armyworm larvae are similar in appearance to true armyworm larvae. Color varies from light brown to green, with three yellow stripes down its back. The fall armyworm can be distinguished from the true armyworm by a distinct white or yellow inverted "Y" on its head. Fall armyworm larvae cause damage similar to that of the corn earworm. Tassel, ear, and leaves of the upper part of the plant may be partially or completely destroyed. They also feed on kernels as the ear develops. Infestations of fall armyworm are generally not economical. There is some uncertainty to how much yield loss is truly caused by fall armyworm feeding, but the current threshold recommends treatment when 75% or more of the plants are damaged and worms are still present.

Finally, even though we saw little activity from the first generation of European corn borers, the second generation is on its way. Pay attention for egg laying to occur in late-planted or late-maturing fields. Second-generation larvae will feed on leaf sheaths, collars, and midribs until they enter the stalks. Yield loss can occur from lodging and stalk breaking, ear dropping, and secondary invasion of stalk rots. An in-depth article about second-generation European corn borers will be in next week's *Bulletin*. Stay tuned for updates on these summer pests of corn.—*Kelly Cook*

Notes on Other Insects

As summer rolls along, some insects pick up steam, while others lose steam. Following are some insect information capsules that summarize the current and pending status of insects still on our radar screen.

Bean leaf beetle. Beginning the week of July 7, we started to receive reports of first-generation bean leaf beetles emerging in soybean fields in central and northern Illinois. Thus far, their feeding activity has been overshadowed by the presence of Japanese beetles. However, bean leaf beetles are capable of causing considerable defoliation all by themselves. In addition, concern about bean pod mottle virus (real or imagined in Illinois) has some growers on edge. Many growers remember the large numbers of bean leaf beetles that occurred in their soybean fields late last summer, and the memory lingers. Keep in mind, however, that second-generation beetles were the cause for concern last year, not first-generation beetles. As more about bean leaf beetles and bean pod mottle virus unfolds, we'll keep you apprised. In the meantime, please try to keep this perceived problem in perspective.

Soybean aphid. The heavy rains that fell in northern Illinois during the week of July 7 had a negative effect on some populations of soybean aphids. As you will recall from previous articles in the *Bulletin*, infestations of soybean aphids were relatively widespread in northern Illinois, and natural enemies seemed to be on vacation. (With the low densities of soybean aphids in 2002, multicolored lady beetles had less food to eat, so their populations were lower, too.) However, Steve Doench, agronomist with Pioneer Hi-Bred International, reported that many soybean aphid populations have "crashed" as a result of the heavy rains. He did note, however, that some infestations remained fairly high, especially in Bureau, Carroll, Lee, and Whiteside counties. So keep tabs on population changes (increases or decreases) as the season advances. Many soybean fields are approaching or are in the R1-R2 stages of development, the critical time for assessment of soybean aphid densities. If a decision to apply an insecticide is made, please keep in mind the importance of protecting bees that are visiting soybean flowers. Refer to comments about this in the article "Questions About Japanese Beetles Abound."

Twospotted spider mite. Despite recent rainfall in some areas, pockets of twospotted spider mites are apparent in some fields that have not been blessed with plenty of moisture. Kevin Black, with Growmark, reported that a small area of Warren County has some soybean fields infested with spider mites. At this time of year, a number of factors can cause soybean leaves to turn yellow. You should check suspicious yellow areas to determine the cause. If twospotted spider mites are causing the yellowing, their populations can be dealt with relatively easily with well-timed spot treatments of insecticides, assuming the infestation is not field-wide. Injury caused by twospotted spider mites in soybeans begins with yellow stippling, followed by browning of the leaves, and, ultimately, leaf necrosis if the densities of spider mites are high. Look for the little creatures (adults are 0.3 to 0.4 mm long) and their webbing on the undersides of soybean leaves. An extended period of hot, dry weather will allow their populations to increase in size, and the consequences, as we have learned from past experience, can be significant.

Keep the reports coming. Many times, you are our eyes and ears in the field. We'll be embarking on a few weeks of concentrated fieldwork soon, so it's really important that we stay in touch with what's happening around the state. We sincerely appreciate your willingness to share your observations. —*Kevin Steffey*

PLANT DISEASES

Phytophthora sojae Sensitivity to Metalaxyl and Mefenoxam

Seed treatments are frequently used to manage Phytophthora seed rot and damping-off in soybean. Metalaxyl (Allegiance-FL) and mefenoxam (ApronXL) are the only compounds used to treat soybean seed for control of *Phytophthora sojae*. Metalaxyl has been used for many years in several formulations, and mefenoxam is a similar chemical with the same site of action that was introduced in the past 5 years for soybean seed treatment.

A number of other *Phytophthora* species have developed insensitivity to these two compounds, most notably, the late blight pathogen of potato and tomato, *P. infestans*. Questions have been raised recently concerning the possibility of resistance to metalaxyl or mefenoxam in *Phytophthora sojae*. To address this question, plant pathologists in the north-central region have initiated studies funded by the North Central Soybean Research Program to determine whether *P. sojae* is losing sensitivity to these compounds.

Isolates of *P. sojae* were collected from multiple locations in Illinois, Ohio, and Ontario, and were tested in the laboratory for sensitivity to metalaxyl and mefenoxam. The research is ongoing, but the preliminary results suggest that *P. sojae* is highly sensitive to these compounds in all of these areas. In Illinois, 34 isolates from 20 different counties were tested, and all were sensitive to 1 μg/ml of metalaxyl and mefenoxam. In Ohio, 33 isolates from different locations were tested, and all were sensitive to 5 μg/ml of metalaxyl. In Ontario, 40 isolates of *P. sojae* from six counties in eastern Ontario have been evaluated on 5 μg/ml of mefenoxam, and all were sensitive at that concentration. Additional isolates from this region will be evaluated during the summer and fall. These preliminary results are very promising and indicate that metalaxyl and mefenoxam continue to be effective compounds for control of early-season infection of soybean seed and seedlings by *Phytophthora sojae* over a wide geographic area in the north-central region.—*Dean Malvick, Anne Dorrance (Ohio State University, dorrance.1@osu.edu), Terry Anderson (AAFC/Harrow, Ontario, andersont@agr.gc.ca), and Albert Tenuta (OMAF/Ridgetown, Ontario, albert.tenuta@omaf.gov.on.ca)*

Root Rot in Soybeans

Rain makes diseases feel right at home, and we are clearly seeing that in soybeans this week. Across the central part of the state, especially, Phytophthora has reared its head. Nancy Pataky, director of the University of Illinois Plant Clinic, reports that several recent samples have tested positive for the "fungus-like organism" that causes the root rot *Phytophthora sojae*.

Yes, I said, "fungus-like organism." I suppose the acronym for that would be FLO. The fungi (former) that we have always referred to as the water molds, such as *Pythium* sp. and *Phytophthora* sp., have been reclassified by plant pathologists into the new "fungus-like organism" classification category. For those aficionados of plant pathology terminology, you may recall that for nearly 30 years plant pathologists had a class of disease-causing organisms that they referred to as "mycoplasma-like organisms," or MLOs. That class of organisms was then, without the fanfare you would expect after 30 years, named "phytoplasmas." This is fascinating information for taxonomists; the rest of the population probably isn't quite as thrilled by it. However, I want you to be aware that, regardless of how a taxonomist may classify *Phytophthora* sp. or whether it is a fungus or just fungus-like, it is still the same pathogen.

This disease is a tricky one. It doesn't have a limited season of infection like many of our key pathogens. *Phytophthora sojae* can attack and kill soybeans throughout the season. What we are seeing now is the phase of the disease that attacks mature plants. Typically, an infection of a mature or nearly mature plant is expressed as wilting and death of the top of the plant, significantly rotted roots, and a diagnostic dark brown or black canker extending from the soil line up the stem. The symptoms so far this season are maybe just a bit different from what you are used to seeing, though. The canker seems to be missing, and the roots aren't quite as badly rotted as one would expect on the affected plants we've seen so far this season. Additionally, foliar symptoms on the lower leaves of these affected plants look typical of very early SDS symptom expression. Odd. Now it could be that the plants were caught early in Phytophthora symptom development, and, additionally, the unfortunate plants could potentially have early SDS; but the symptoms are remarkable, and we need to keep an eye open for this somewhat nontypical symptom development when scouting.

Management of *Phytophthora* relies on several factors, as Dean Malvik pointed out in issue no. 12 (June 13, 2003) of the *Bulletin*. For future seasons, drainage needs to be addressed in problem fields. But our primary method of managing the disease is with use of resistant varieties. Soybean varieties with specific resistance to *Phytophthora* should be selected to grow. The major resistance genes Rps1c or Rps1k should be effective in most fields. However, Dean noted that there are resistance genes no longer effective in some parts of Illinois. Races (pathotypes) of *Phytophthora* occur in some parts of Illinois that kill soybeans with Rps1a, Rps1c, and Rps1k. Many of the *Phytophthora* isolates from Illinois soybean fields can defeat Rps1a, and a smaller number can defeat Rps1c. A smaller number can defeat all of the common resistance genes (Rps1a, Rps1c, and Rps1k) available in commercial varieties for Illinois. So far, research shows that the aggressive isolates are causing damage but do not seem to be widespread in Illinois.—*Suzanne Bissonnette*

CROP DEVELOPMENT

A Good Day in the Field

Today, July 16, 2003, is one of those "best" days that crops sometimes experience in the middle of the growing season. There are exceptions across Illinois, but in most places the corn and soybean crops are in good shape, there is adequate soil water from rains during the past week, and there are relatively few diseases, though insects are posing a threat to leaves and silks in some places.

What makes today such a good day? First is the temperature range: low 60s this morning, with a high expected to be about 85°F. These are nearly ideal temperatures for corn. The low was perhaps a bit low for soybean, but that crop is still not into its most critical time when temperatures will affect yield. For corn, night temperatures in the 60s prevent excessive loss of sugars through respiration. The low humidity that accompanies low night temperatures is also useful, in that it helps reduce disease development and means more rapid opening of stomata in the day (see the following).

The second factor that plants will respond positively to today is sunlight; it is supposed to be bright all day long. So today the crop will receive light energy in the visible range (plants use light in about the same range of wavelengths [colors] as we see with our eyes) at a rate of about 50 watts per square foot. (At 50% efficiency, that's a 100-watt bulb for every square foot.) Over the 11 hours or so of bright sunlight today, the visible light energy that will fall on the field is equivalent to about 450 kilocalories, or about the energy in two regular-sized Hershey chocolate bars, per square foot. If all of this energy were converted to sugar through photosynthesis at 100% efficiency, that would amount to about 1/4 pound of sugar per square foot, or some 10,000 pounds of sugar per acre. Because of various factors, most of which cannot be changed, field efficiency of photosynthesis tops out at less than 10%, even for the most photosynthetically efficient plants like corn, sugarcane, and grain sorghum. Even 8% efficiency, though, would mean about 800 pounds of sugars produced per acre on a good day like today.

If we produced 800 pounds of sugars per day for the 50 or so days of grain-filling in corn, that would mean about the dry-weight equivalent of 16 bushels per day, or 800 bushels per acre for the crop. Why don't we get closer to this number than we do? One of the less changeable factors is that corn kernels contain oil and protein, which take more energy to form than starch, which is just sugar molecules strung together. So just the conversion to corn kernels would use up perhaps 15% of the sugars produced. The plant also has to maintain itself, taking up nutrients and maintaining root, stalk, and leaf tissue. This may take another 15% of the sugars produced, bringing us down to about 11 bushels per acre for our "best" days and to about 560 bushels per acre for the crop if every day were a really good one.

Why don't we usually produce more than 30% or 35% of this "best possible" yield, even with our good soils and careful management? The main reason is that "best" days—days like today—are so rare. Most days are "stressful" for the crop, at least to some degree. I define stress as anything that reduces the amount of photosynthesis. In the field, sources of stress are numerous. Temperatures are usually not ideal, especially when night temperatures are high (above the low 70s), or, more rarely, when day temperatures are too low, below the mid-80s. Disease and insects can reduce the rate of photosynthesis through damage to the leaves. Cloudy weather can substantially reduce the amount of sunlight energy that falls in a day. Finally, lack of adequate soil water over time can reduce plant leaf area, and on a daily basis can cause leaf curling and reduced light interception, or can simply reduce photosynthetic rates when the leaf cannot get enough water to maintain transpiration.

Transpiration is the loss of water vapor through the leaves, and the rate at which it happens is directly proportional to the rate of photosynthesis; we cannot have a productive field without losing a lot of water from the soil to the air. Rapid transpiration means that the stomata (tiny openings) in the leaf surface are open to allow carbon dioxide gas in for photosynthesis, and it also means that the rapid evaporation of water from cell surfaces inside the leaf is helping to cool the leaf. This is all good, but it means that the crop uses up soil water fast, and so soil water depletes quickly if there isn't frequent rain to replenish it. Today, the crop will lose perhaps 0.2 inch of water, which is about 5,500 gallons per acre or about 1-1/2 pints per plant. If temperatures and windspeed were higher, this rate of loss would go up, even to the point where the roots might no longer be able to supply water fast enough, and stomata would close partway, reducing photosynthetic rate and raising leaf temperature. If soil water supplies decrease, this reduction in transpiration and photosynthetic rates happens even on otherwise good days. It's no mystery, then, why water supply is so critical.

As the result of a lot of good days so far this season in most areas, the crop is in very good condition, with more than 75% rated as good or excellent. Whether or not it stays there will have little to do with anything other than the number of "good days" we get for the crop during the next 50 days. Let's hope there are a lot of them.—*Emerson D. 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, Rich-

land, 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

Scattered thunderstorms occurred almost daily throughout the region from July 5 through July 11. In some areas, the thunderstorms were accompanied by high winds and hail. Much of the earlier-planted corn began to tassel from July 11 through July 15. As corn begins to silk, there is concern about potential silk clipping from rootworm beetles and Japanese beetles. Producers are encouraged to scout fields for possible silk clipping, particularly in areas of large populations of Japanese beetles.

Insect activity has begun to increase throughout the region. Lodged corn from high winds experienced on July 8 has "goosenecked" back up to nearly erect. However, on further investigation of lodged corn located in LaSalle and Putnam counties, there has been confirmed rootworm larvae injury in first-year corn, which had granular insecticide applied at planting.

We have received numerous reports early this week of yellow, chlorotic soybeans throughout the region. Numerous causes reported include manganese or iron deficiencies, field ponding, and soybean cyst nematode infestations. Also some chlorotic fields have rhizoctonia root rot as well. Soybean aphids have been reported from several northeastern counties. However, there have been no reports of insecticide treatment.

West-Central Illinois

Most of the region received much-needed rainfall from several different storms that passed through the region last week. In some areas, winds and hail caused some damage to both soybeans and corn, but extensive damage was localized to relatively small areas.

Rainfall received in combination with favorable temperatures has resulted in excellent conditions for pollination. The probability of an excellent corn crop is high at this point. Most of the corn is actively pollinating, and some of the earlier-planted corn is as far advanced as R3 (milk stage). Soybeans also look very good in most areas, and are in full bloom.

Wheat harvest is complete, and reports of yields in the 80- to 100-bushel-per-acre range are very common. Double-cropped soybeans have emerged quickly with the recent rains and appear to be off to a good start.

Developments in insects and diseases have been relatively minor, but reports of the presence of Japanese beetles have been made in some areas of the region where they had not been noticed in past years, Quincy and Macomb in particular. In addition, a number of alfalfa fields that were harvested within the past few weeks have been recently sprayed for potato leafhopper.

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