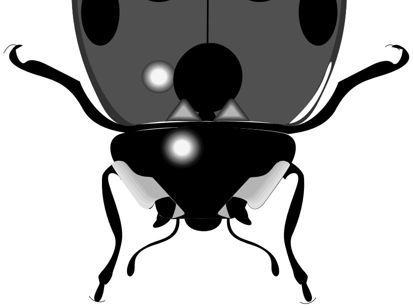

PEST
MANAGEMENT
&
CROP
DEVELOPMENT
BULLETIN

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UNIVERSITY OF ILLINOIS
EXTENSION

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INSECTS

Root Injury Ratings for Corn Rootworm Trials Have Begun—Overall Western Corn Rootworm Numbers Are Down

Our annual “root digs” have been under way the past week to evaluate the efficacy of various treatments aimed at protecting the root systems of corn plants from corn rootworm larval injury. So far we have completed the root injury ratings in our standard corn rootworm trials at University of Illinois Research and Education Centers located near Monmouth, Perry, and Urbana.

Overall, rootworm “pressure” was low to moderate in Monmouth and Perry. Injury in the check treatments was greater in Urbana. On July 29 our crew led by Ron Estes, senior research specialist, is traveling to the Research and Education Center near DeKalb to dig roots from our standard experiment and return them to Urbana for washing and rating. I look forward to sharing the results of these evaluations later this fall and winter with clientele throughout the state.

A general observation shared by many entomologists this season has been the overall low density of several insect pests, including western corn rootworms. Joe Spencer, a research entomologist with the Illinois Natural History Survey, indicates that exceedingly low numbers of western corn rootworm adults are being caught on Pherocon AM traps in east-central Illinois production fields. The numbers of beetles being trapped are considerably below economic thresholds, suggesting that many corn fields in 2010 will have low corn rootworm pressure. Yet most producers are not monitoring for western corn rootworm adults and will automatically decide to use either a Bt hybrid, a soil insecticide, or both next year. Not exactly a fundamentally sound IPM approach. This accelerated use of insect management inputs, regardless of insect abundance, will have unintended consequences at some point. This has been the history of western corn rootworms to date.

Why are we seeing such low numbers of western corn rootworm adults? One of the weak links in the life cycle of corn rootworms occurs when larval hatch takes place in saturated soils—precisely the scenario that unfolded in many areas of the state this year. Another potential explanation is the increasing use of Bt stacked hybrids targeted at the lepidopteran complex and corn rootworms. Despite the heavy use of soil insecticides in continuous corn throughout the 1960s, ’70s, ’80s, and mid-’90s across the northern third of Illinois, western corn rootworm populations flourished. Why? Recall that the granular soil insecticides were applied in a band (7-inch) or in the seed furrow. Rootworm larvae outside of this soil insecticide zone, in essence between corn rows, were not exposed to these products. Consequently, adult emergence was typically plentiful each season, setting the stage for more corn rootworm challenges the following year. Soil insecticides applied in this fashion did their “job”—that is, they protected the root system near the base of the plant and prevented lodging. In addition, producers were unwittingly utilizing a refuge strategy each season by banding soil insecticides and leaving larvae unexposed to toxins between corn rows. This explains why resistance to these soil insecticide products has not emerged despite decades of heavy use. Where insecticide resistance has occurred, such as in Nebraska, the explanation was repeated use of broadcast insecticide treatments to suppress egg laying by adult western corn rootworms.

As the usage of Bt stacked hybrids accelerates and refuge size is reduced, I anticipate overall reductions in corn rootworm populations across the state. Unlike the granular soil insecticides applied in a band, or in-furrow, Cry proteins are expressed throughout the root systems of Bt plants and therefore expose corn rootworm larvae both in the row and between corn rows. In future years, several Cry proteins will be aimed at corn rootworms within the same root system of corn plants. This should result in less root injury and adult emergence. We have witnessed the historically low densities of European corn borers across Illinois and some nearby states that are now believed to be linked to the widespread adoption of Bt corn hybrids. Will we see a similar phenomenon unfold with western corn rootworms? I suspect we might be headed down this road. Will western corn rootworms adapt as they have repeatedly done so in the past? If we don't integrate management tactics, we could have the answer sooner than we would like.—*Mike Gray*

Soybean Aphid Numbers Remain Low in Illinois and Many North-Central Areas

Reports of soybean aphid infestations remain very low across Illinois. To date, I have not received any reports of fields reaching the economic threshold and requiring a treatment. This trend continues despite the very mild summer we have had so far. Based on a July 27 teleconference with other extension entomologists, the main challenges presented by soybean aphids this season have occurred in Ontario. August is still in front of us, and we know that aphid populations can build very rapidly; however, for now let's hope that the natural enemies keep aphid densities in check. If any readers are aware of treatments being applied for soybean aphids, please share these observations with me. Thanks.—*Mike Gray*

PLANT DISEASES

Get to Know the Common Foliar Diseases of Soybean

Some foliar diseases of soybean have been present for the past several weeks, and if frequent rainfall continues, disease spread likely will continue as well. Several of the most common foliar diseases of soybean are described here. Photographs are available in the version of this article that appears at *the Bulletin* online (ipm.illinois.edu/bulletin).

Bacterial blight. Bacterial blight, which is very common every year, is already present in Illinois soybean fields this season. Symptoms are small angular lesions on the leaves surrounded by yellow halos. Some soybean varieties have good levels of resistance to bacterial blight, while others are susceptible. A bacterial blight race survey conducted in Illinois in 2007 indicated that race 4 was the most prevalent in the state, and most soybean varieties are susceptible to it. In general, bacterial blight is not considered to cause much yield reduction to soybean in a typical year.

Bacterial pustule. Bacterial pustule generally is less common than bacterial blight in Illinois soybean fields. However, bacterial pustule observations have already occurred this year. Symptoms of bacterial pustule are very similar to those in bacterial blight—angular lesions on the leaves with yellow halos—except that pustules are also formed. Because it can be difficult to see the pustules with the naked eye, a magnification device (hand lens, microscope, etc.) is needed for diagnosis. The pustules formed by the bacterial pustule pathogen look very similar to those formed by the soybean rust pathogen, except that with bacterial pustule, pustules can be on both the upper side and underside of the leaves. With soybean rust, pustules are formed on the under side of the leaves only.

Septoria brown spot. Septoria brown spot is observed every year in almost every soybean field in Illinois. Because of the frequent rainfall this year, the disease is already widespread. Symptoms are observed as brown spots on the leaves, which coalesce as time goes on. Leaf yellowing begins to occur, and eventually affected leaves turn completely chlorotic (yellow) and fall off prematurely. In most years, Septoria brown spot only causes defoliation of the lower leaves, and no resultant yield loss. However, in years with frequent rainfall in July and August, yield loss can occur.

Soybean rust. Soybean rust has been observed in Illinois every year since 2006; however, all of these observations occurred very late in the season, and yield was not affected. Symptoms of soybean rust are small, dark, circular lesions on the leaves, with pustules present on the underside of the leaves. These pustules are extremely difficult to recognize with the naked eye, and magnification is needed to diagnose soybean rust. Any suspicious leaves should be sent to the University of Illinois Plant Clinic for diagnosis. Information on the monitoring effort for soybean rust in Illinois and in North America was published in issue 13 of *the Bulletin* (June 19).

Frogeye leaf spot. In some years, frogeye leaf spot can be observed across the entire state, but it is most common in southern Illinois. Frogeye leaf spot symptoms are circular tan to gray spots on the leaves, surrounded by very pronounced dark purple margins. Under severe disease pressure on susceptible varieties, these spots can also be found on the stems and pods. Varieties differ in their susceptibility to frogeye leaf spot. Research has indicated that the *Rcs3* gene for resistance is effective against all races of the disease present in Illinois.

Cercospora blight. Cercospora blight can be observed throughout the entire state in wet years. Cercospora blight symptoms appear as leaves that are discolored purple to dark maroon. Affected leaves can defoliate prematurely, causing yield loss under severe disease pressure. The fungus that causes Cercospora blight also causes purple seed stain of soybean seed.

Downy mildew. Downy mildew is another common soybean disease found frequently in Illinois. It appears as light yellow "blotches" on the upper leaf surface, with gray "tufts" appearing on the lower leaf surface directly under the yellow blotches. In general, downy mildew is not considered to cause much yield loss of soybean in our state.

Foliar fungicides will protect against Septoria brown spot, soybean rust, frogeye leaf spot, and Cercospora blight, but not against the other diseases just described. In University of Illinois and Southern Illinois University foliar fungicide trials on soybean (conducted by Dr. Jason Bond), the biggest yield benefits have been observed when moderate to high disease pressure is present (an average yield benefit of 3 bushels per acre in low disease pressure vs. 9 bushels per acre in moderate to high disease pressure).

Appreciation is extended to the Illinois Soybean Association for providing funding to conduct foliar fungicide research trials throughout the state.—*Carl A. Bradley*

CROP DEVELOPMENT

Soybean Growth and Development: Late-July Update

Two weeks ago, I indicated that soybeans planted in early June were growing and developing as if planted in mid-May due to the mild temperature patterns of June and early July. Last week, Dr. Chad Lee at the University of Kentucky also wrote about small soybeans resulting from late planting and cool temperatures (graincrops.blogspot.com/2009/07/worrying-about-small-soybeans.html). There is no doubt that a little more heat would help our midwestern crops produce better yields and take more advantage of the adequate soil moisture.

Dr. Lee noted two main points that I want to reiterate. First, the most important growth analysis by yield factor in soybean is that full canopy closure is attained by flower development (blooming). Some yield is surely lost if sunlight is reaching the ground during the reproductive growth stages. Second, foliar applications of fertilizer and/or fungicides are no substitute for sunlight and temperature, so they are not likely to buy instantly larger beans and closed canopies. I'm not saying they shouldn't be used, but they are no replacement for sunlight and heat.

USDA NASS Weather and Crops reports have indicated that soybean reproduction (flower development) was 11% on July 12, 24% on July 19, and 46% on July 26. These figures contrast with 22%, 37%, and 51% for the same weeks in 2008 and 51%, 69%, and 81% for the previous five-year averages for those weeks. According to the Illinois State Climatologist Office (www.isws.illinois.edu/atmos/statecli), July 2009 has been the coolest July on record in Illinois. As of July 27, the statewide average temperature for the month has been 70.2 °F, which is 5.7 degrees below normal.

What does this mean for the outlook on soybean yields? It is too early to tell for certain, though as already indicated we know a little more heat would be good. Last year, the state soybean yield average was about 4 bushels above an "expected" average when yields were regressed on the dates that 50% of the state soybean acres were completely planted. A graph of this was published as Figure 3 in issue 6 of *the Bulletin* (May 1). The 1996 state soybean yield average was 40.5 bushels per acre and was about "average" for yields regressed on 50% completed statewide planting dates. So while the cool temperatures and slow reproductive soybean development are apparent, yields at or above expected levels when accounting for delayed planting still seem attainable. Another way of putting it is that delayed planting date is still a good indicator of yield expectation. Since we continue to have mostly adequate or above-adequate soil moistures in most of the state, let's keep hoping for a little more heat through August to maximize crop development. The cool weather has at least made for pleasant outdoor activities and field day educational events.—*Vince M. Davis*

Hail Damage in Northern Illinois

Jim Morrison, extension educator in crop systems located at the Rockford Extension Center, indicated that strong storms in northern Illinois on Friday, July 24, produced large hail and damaged corn and soybean crops in its path. Jo Daviess and Stephenson counties were hit particularly hard; one producer said hail was 1.5 inches in diameter. Windows and siding on homes were damaged in addition to crops. Hail damage occurs in isolated areas just about every year; as a general rule, the later in the season hail falls, the more severe the yield penalty.

In quick review, the first reproductive stage (R1) begins with the first flower formed on the main stem. Successively, a flower on one of the two uppermost nodes with a fully developed leaf is R2, a 5-mm pod on one of the four uppermost nodes with a fully developed leaf is R3, a 20-mm pod on one of the four uppermost nodes with a fully developed leaf is R4, and a 3-mm seed in a pod on one of the four uppermost nodes is R5. A green seed that fills the pod cavity on one of the four uppermost nodes is R6, one pod on the main stem that has reached its mature pod color signifies beginning maturity (R7), and nearly all pods reaching mature pod color signifies maturity (R8). Not all plants will be at the same maturity level at the same time, so the percentages of plants at different levels are used to indicate the maturity at the "field level." For example, if 50% of plants are R6 and 50% are R7, the field is R6.5.

It is critical to assess yield losses field by field because several factors are at play. The biggest factors are the amount of leaf defoliation, soybean growth stage, and—the most difficult to assess—stem and pod damage. Soybeans are most vulnerable to hail damage that occurs between R5 and R6.5.

At R2, 90% leaf defoliation can occur and 80% of the expected yield can still be produced. Yield can be reduced to two-thirds and one-third of the expected level if 90% defoliation occurs at R4 or R6, respectively. In general, yield losses are usually less severe than the producer fears right after the storm; again, yield loss estimates need to be done on individual fields. If you find yourself in this situation, contact a trained crop adjuster and give the crop several days to recover before making any rash management decisions you hope will improve the situation.—*Vince M. Davis*

Do More Corn Plants Need More Nitrogen?

The Illinois corn crop continues to develop slowly, with just over 50% silking as of July 26. It's truly a unique experience to reach the end of July with as much as a third of the Illinois crop yet to reach the pollination stage. Moisture has been good and the crop canopy continues to improve, though the percentage of the crop rated good or excellent continues to languish in the low 60s. The fact that this rating hasn't been moving much reflects the unevenness in many fields, with ongoing water damage and compaction effects, and often with yellow and stunted corn. It doesn't help that temperatures remain below average, though as we said in 2008, cool days during the growing season can be okay as long as we get enough of them.

The range of yellow to dark green within and among corn fields is a reminder that nitrogen is one of the really difficult things to manage in corn production. We know that soils with higher organic matter can provide a great deal of N to the corn crop; each percentage point of organic matter represents about 1,000 pounds of organic N in the top 7 inches of soil, and between 1% and 3% of this N can become available to the crop in a year as a result of microbial action. Over the range of soils, weather, and crop conditions in Illinois fields, the amount of N provided by the soil in an average year ranges from less than 20 or 30 pounds to more than 150. A 200-bushel corn crop takes up about 240 pounds of N, and fertilizer N needs to make up the difference between crop need and soil supply. It's little wonder we see so much variation in response to fertilizer N.

One part of estimating how much fertilizer N the crop requires is trying to determine how much the crop will need. While we can't really guess at this without knowing the yield level, some management factors do often affect yield, and hence affect N uptake. One such factor is plant population. We have heard a consistent message that "higher" plant populations are needed to reach the yield potential of modern hybrids. If that's the case, wouldn't higher populations always need higher rates of N fertilizer?

The idea that higher corn plant populations must have more fertilizer N to avoid deficiency seems so obvious that many would wonder why we'd even ask the question. Articles in the popular farm press have explained how each additional plant in the field needs just so much more N. In calls I've received about planting errors that result in populations of 50,000 or more, the first impulse seems to be to put more N on so that yields won't suffer so much.

We conducted a study over 10 site-years where we varied N rate from 60 to 240 pounds per acre and plant populations from 20,000 to 40,000 per acre (final stand). Across the seven locations where there was a response to N rate (the study years included 2006, where N responses were reduced by carryover N following the dry 2005), the response to N was not consistently affected by population level (**Figure 1**). The lowest populations seemed to require less N, but the two higher populations (33,300 and 40,000 plants) needed about the same amount of N to maximize yield.

So why didn't 40,000 plants respond to a higher N rate more than 33,300 plants? Some might think it was just a fluke, or that we didn't choose the "right" hybrids, or that we just messed up. I don't think any of these is a good explanation. Instead, I think we simply see here that different things limit yields in different fields and years, and

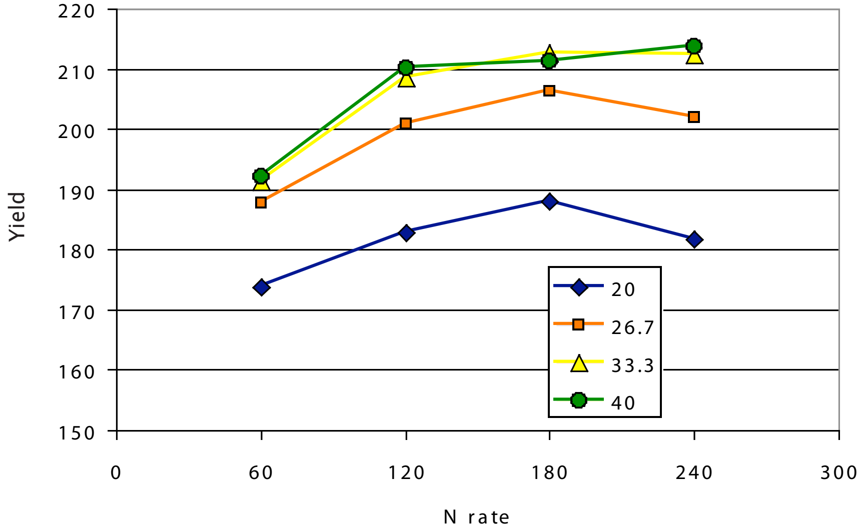

Figure 1. Nitrogen fertilizer rate response at different plant populations (shown in thousands), averaged over 7 Illinois site-years.

that we aren't very good at guessing, or controlling, what that will be. For example, water often limits yields, and when this happens fewer plants are needed, and higher N rates can actually reduce yields in some cases by increasing leaf area and photosynthetic (and transpiration) rates, thus accelerating the onset of drought. So when water is short, more plants and more N can both contribute to yield loss, and the strategy of boosting both can backfire.

So what do you do with N rate if you end up with high plant population, whether by accident or intent? Treat it exactly as you would with a more "normal" population. Understand that corn may well start to "fire" if it runs out of water, but that shortage of N is not the direct cause of such firing. In other words, understand what limits yields, and manage accordingly. From a common-sense standpoint, raising populations from, say, 32,000 to 35,000 would normally increase yields by only 5 to 10 bushels, and this would likely require less than 10 pounds of additional N to be taken up. That small amount of N can easily be "lost" given that higher populations mean slight changes in plant size, harvest index (proportion of grain weight to plant weight), root growth patterns, and so on.

For more dramatic evidence on this point, note that some of the low-lying areas in wetter parts of the state have both low populations and light green or yellow leaves, even though we would expect the N supply to be better per plant at low populations. Some of this yellowing is a result of N loss, but in many cases root growth is also compromised, and N uptake may be affected more by root damage than it is by loss of N.

This is the time of the season when looking at such things as N and population responses can help us to sharpen our management. Remember: Canopy counts—we will not harvest good yields if leaf cover is not very complete and if leaves don't have the good, green color that indicates high photosynthetic capacity.—*Emerson Nafgizer*

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

Numerous corn fields are in full tassel throughout the region. Moderate temperatures and frequent rainfall persist, which has been beneficial for pollination. However, with later-planted fields there is some concern about whether they will accumulate enough heat units prior to frost. Several reports have been received of low foliar disease pressure in corn, which is surprising due to the frequent rainfall during the growing season. Jim Morrison, crop systems extension educator, reported considerable hail damage to crops and buildings in the northwest corner of the state as the result of a storm on the evening of July 24.

Extension educators continue to catch western bean cutworm (WBC) moths daily in the western portion of the region. Extension staff have monitored WBC moth traps annually for the last four or five years. The highest daily consistent moth catches since initiation of the trapping program have been recorded in the past 10 days. No observations of economic levels of soybean aphids or Japanese beetles have been reported in soybeans. To date, soybean aphid populations have been lower than expected.

Some wheat is still being harvested, as high humidity has hindered harvest completion.

Southern Illinois

Relatively dry and somewhat warmer weather is allowing soils to dry and crop progress to accelerate. In fields of both corn and soybean it is easy to find compromised root systems contributing to the uneven growth patterns. There have been reports of some corn showing significant pressure from gray leaf spot. Wheat producers are expressing concern about the potential for poor seed quality this fall due to the amount of Fusarium head scab in this year's crop. Planting "bin run" seed that has not been thoroughly cleaned, treated, and germination-tested will be risky.

West-Central Illinois

While a lot of variation still persists in corn fields, most corn is in the pollination stage.

Nitrogen deficiency symptoms are beginning to appear in some corn.

Gray leaf spot is exceptionally variable as well, but some fields display lesions above the ear leaf. However, corn prices have tapered producer excitement over calling in aerial applicators even in those fields.

While Japanese beetles can still be found, the peak for the pest appears to have passed.

Downy mildew, septoria, and even bacterial blight can be found in beans, and most of that crop is in the R1 to R2 stage. Soybean aphids can be found in the area.

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