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INSECTS

Soybean Aphid Update

This article was written as an update between issues no. 21 and 22 (August 15 and 22, 2003) and appeared on the Web site. As a matter of policy, we include update articles in the next printed issue.

As we near the end of August, soybean aphids are still the main cause of concern in many soybean fields. Several past issues of the *Bulletin* have highlighted the captures of winged aphids in suction traps in northern Illinois. A capture of 6,775 aphids in the DeKalb suction trap during the week of August 1 was remarkable, but 4,920 from the Eureka trap and 1,912 from the Freeport trap a week later are impressive as well. The movement of winged aphids has brought these insects to all areas of the state. Suction traps in the southern half of Illinois are now reporting levels of soybean aphids similar to those in northern Illinois. These are the counts from suction traps for the week ending August 22:

Freeport	1,347	Monmouth	2,690
Eureka	921	Perry	620
DeKalb	264	Brownstown	4,113
Urbana	1,131	Dixon Springs	2

The counts illustrate the movement of the aphids and increased numbers in the newly affected areas. Judging by the numbers of phone calls and e-mail messages we have received, several Illinois areas are seeing no reprieve from the intense aphid populations, while others are just beginning to experience economic levels. These discoveries lead to the question, Just how long will populations remain high? Several callers have noted an abundance of natural enemies and parasitized “mummies” found in soybean fields. Others have noted a population “crash” in their fields. However, these reports seem to be few and far between. Dr. David Voegtlin, Illinois Natural History Survey, reports that only about 1% to 2% of aphids observed in fields around central Illinois are alatoid nymphs (aphids that are forming wings), indicating that the populations in central and southern Illinois are likely to stay throughout the remainder of the growing season.

Many of the soybean fields in southern Illinois are in full bloom, with a range in maturity from R1 to R6. Also, the Illinois Agricultural Statistics Service reports that as of August 24, 90% of the soybeans in Illinois have set or are in the process of setting pods. Determining the need for insecticide sprays can be quite challenging. With many soybean plants in the later reproductive stages, producers should think twice about insecticide applications. It is essentially unknown what level of aphid numbers a soybean plant can tolerate and still fill seed, or what benefit insecticide application has on stages of soybeans R5 and beyond. Another consideration at this time of year is the preharvest interval associated with insecticide applications. Nearly all the insecticides labeled for soybean aphids have at least a 3-week preharvest interval (Table 1).

Table 1. Pre-harvest intervals associated with insecticides labeled for control of soybean aphids.

Product	*Pre-harvest interval (days)*
Asana XL*	21
Baythroid 2E*	45
Furadan 4F*	21
Lorsban 4E*	28
Mustang Max*	21
Penncap-M*	20
Nufos (chlorpyrifos)	28
Warrior*	45

*Restricted-use pesticide.

Ultimately the decision to spray is left up to growers, based on their individual situations. However, if you do decide to spray, we recommend leaving a check strip untreated to compare yields. As always, feel free to share any of this information with us.—*Kelly Cook*

Soybean Aphid Story: 2003

After a notable absence in 2002, the soybean aphid made itself known in soybean fields across Illinois in 2003. In fact, aphid densities were at their highest since the insect was first observed in 2000. Let's recap how things transpired this past summer.

The first winged soybean aphid adults in Illinois this year were found by Dr. David Voegtlin, research entomologist with the Illinois Natural History Survey. He and his coworkers had been monitoring *Rhamnus cathartica* (a buckthorn species), the overwintering host for soybean aphids. On April 23, hundreds of soybean aphids were found on some of the small plants. At that point in time, these aphids had not begun their movement to soybeans, as there were none in the vicinity.

However, almost a month later, aphids were spotted on soybeans for the first time by Jeff Wessel, farm manager of the J.F. Richards Demonstration and Research Farm at Joliet Junior College. On May 29, he found varying numbers of soybean aphids and as many as 40 aphids on one V2–V3 stage soybean plant. A natural area on the college campus has a significant number of buckthorn plants. This discovery indicated that soybean aphids had begun their move to the early-planted soybeans in this area. Reports similar to this occurred in other midwestern states around the same time.

- Marlin Rice, extension entomologist at Iowa State University, reported that soybean aphids were found on V1-stage soybeans in a field in northeastern Iowa on June 5.
- In Michigan, extension entomologist Chris DiFonzo, Michigan State University, reported soybean aphids on V0-stage soybeans on June 3 on the MSU campus.
- On June 2, University of Minnesota entomologists found a few soybean aphids on soybean plants near the campus.

During June, reports of spotty aphid infestations made their way to our desks by e-mail or phone. One very important recurring theme in these messages was the noted absence of natural enemies such as lady beetles. During this time, Drs. David Voegtlin and David Onstad (entomologist with the Department of Natural Resources and Environmental Sciences) and crew began their township surveys. Kendall Township in Kendall County and St. Joseph Township in Champaign County are the two townships sampled in this ongoing survey. Sampling in Kendall Township began on June 24 this year, compared to early July the previous two years. Even though sampling began earlier than the two years before, 100% of the fields examined were infested with soybean aphids. Approximately 29% of the soybean plants were infested with soybean aphids in Kendall Township, compared to 3% in early July 2002.

For the next few weeks the numbers of soybean aphids in northern Illinois continued on the increase, with no sign of slowing down. Reports that filtered in had similar findings—low densities across many fields, with "hot spots" embedded throughout the area. Our neighbors to the north (Wisconsin, Minnesota, and Michigan) all echoed similar findings. As the densities of aphids increased and infestations became severe, aphids began moving from the top of the plants to lower within the canopy. The aphids distributed themselves on stems and lower leaves deeper in the canopy. While aphid populations were widespread across northern Illinois, the presence, or should we say absence, of natural enemies was still a concern.

The presence of winged aphids (alates) was common among soybean plants in mid-July. It is alates developing on soybean plants that will leave those plants and fly to other soybeans to feed and reproduce. It was also common to find all stages of soybean aphids—alates, alatoid nymphs, and nymphs—on plants, indicating that winged individuals were landing on plants and producing offspring regardless of the size of the population on the plant.

Another indication that the aphid flight was greater and earlier than previous years was the capture of winged aphids in suction traps. Winged aphids were found for the first time this year in the Freeport, Joliet, and DeKalb traps the week ending July 11. As soybean aphid densities continued to increase, the movement of winged adults from field to field also increased, as indicated by the enormous numbers found in the soybean aphid suction traps. As we progressed from July to August, aphids made their way downstate, aided by northerly winds.

Soybean aphids took central and southern Illinois by storm. The first week in August saw many reports of heavy infestations south of I-80, primarily in Champaign, Ford, Kankakee, Iroquois, and Livingston counties, with many other counties on the western side of the state also reporting the presence of aphids. Several reports indicated aphid densities in hundreds per leaflet and thousands per plant in central Illinois on R3–R6 stage soybeans. By the end of the week, numbers of aphids in southern counties had begun to increase, as well. Over the course of the next two weeks, aphid populations increased dramatically. Suction traps operating in the southern half of the state began capturing exceedingly high numbers of alates just as the northern Illinois traps had earlier in the season. Traps in Brownstown, Monmouth, and Perry all had around 1,500 aphids the week ending August 15. Soybean aphid alates were also found in the Dixon Springs suction trap.

Soybean aphids were still a major concern for much of Illinois a little over a week ago. While most activity in northern Illinois had died down, soybean aphids in other parts of the state showed little signs of slowing. Captures of winged aphids were still at record highs in many of the suction traps across the state. Very little of the population (less than 1% to 2%) on soybean plants in central Illinois was composed of alatoid nymphs (aphids that are forming wings), indicating that these populations were going to be around for a while.

The torrential downpours and continuous rain over Labor Day weekend will undoubtedly affect many aphid populations. That, combined with an increase in natural enemies in many areas, will play a part in how the populations rebound in the next several days.

This past summer was very frustrating at many different levels. There were several questions running through the minds of producers: When is the best time to spray? How long should I wait before I treat? At what stage do I get the most benefit from treating? What level of aphids can a soybean plant tolerate and still be unaffected? What benefit do insecticides have on soybeans stage R5 and beyond? The decision to spray or not to spray probably caused many a sleepless night this summer. It was frustrating from our end too; many of these questions plagued the minds of researchers as well.

The soybean aphid is a relatively new pest to North America. Though reported in Illinois in 2000, it was seen at economic levels for the first time in many areas in this state. Many unanswered questions still remain. Research is being conducted in many areas of the Midwest, and hopefully in 2004 we'll know more about this insect. Ron Estes, coordinator of the Insect Management and Insecticide Trials, has completed an insecticide efficacy trial for soybean aphids.

As a part of the efficacy trials, a soybean aphid trial was conducted at the Kellogg farm outside of Yorkville, Illinois. The trial consisted of eight insecticide treatments, each replicated four times. The treatments (plots) were four rows by 30 feet in size. The spray solution was applied at a volume of 30 GPA, via a two-row hand boom. Aphid counts were taken at five plants from every plot. Three trifoliates, from the upper, middle, and bottom third of each plant, were counted. Average aphids per trifoliate were calculated from these counts. Prior to insecticide application, the average number of aphids per trifoliate was 48 across all plots. Table 2 gives the average number of aphids per trifoliate at 0, 7, 14, and 21 days after insecticide treatment (DAT).

Initially, all products performed equally well, with Nufos showing slightly better control after one week. By 14 days after treatment, all products, with the exception of Nufos, had aphid numbers increasing to 20 per trifoliate. While these densities may not be at economic levels, the differences are still noteworthy. At 21 days after treatment, the Asana and Warrior treatments were statistically the same, as were Lannate and the untreated check. Overall, Nufos showed the greatest residual control of the products tested. Although there were statistical differences among products, only Lannate showed an increase in aphid numbers that reached a level of 25 aphids per leaflet.

Additionally, we realize that the trial shows a very limited comparison of the array of products that are available. However, in the spring when our insecticide studies were planned, industry representatives and growers alike showed little interest in the soybean aphid. This was likely because of the low aphid populations in 2002, as previously mentioned.

Further research on the soybean aphid is ongoing both here and at other University of Illinois research farms throughout the state. Information will be available later this year. As the soybean aphid story of 2003 comes to an end, we look forward to hearing from our readers about their own experiences with this insect.—*Kelly Cook and Ron Estes*

Table 2. Average soybean aphids per trifoliate.

Product	*Rate of application*[1]	*Average aphids per trifoliate*[2,3]			
		0 DAT	*7 DAT*	*14 DAT*	*21 DAT*
Asana XL 0.66EC	6 oz	31.60 bc	9.67 bc	22.37 a	20.67 b
Asana XL 0.66EC	7 oz	35.17 abc	8.96 bc	48.09 a	24.95 b
Asana XL 0.66EC	8 oz	51.83 ab	10.45 bc	26.60 a	17.30 b
Lannate SP	0.45 lb ai	48.38 abc	15.97 ab	43.03 a	104.58 a
Nufos 4E	1 pt	25.47 c	0.75 d	10.48 b	4.62 c
Nufos 4E	2 pt	60.57 ab	0.46 d	2.53 c	0.32 d
Warrior 1CS	0.025 lb ai	62.65 ab	7.26 c	38.93 a	31.17 b
Untreated check		66.08 a	44.39 a	60.42 a	99.35 a

[1]All products applied at a volume of 20 gallons per acre.
[2]Statistical analysis based on transformed data. Actual mean aphid counts are given.
[3]Means followed by the same letter do not differ significantly according to Duncan's New Multiple Range Test, $P = 0.05$.

Fly-Free Date Reminder

As growers prepare to plant wheat for 2004, we once again send out the reminder to plant after the fly-free date. In late summer and early fall, Hessian fly adults begin to emerge from wheat stubble. Fly-free dates typically occur after the peak emergence of Hessian fly adults. When wheat is planted after the fly-free date, there is not a suitable host for females to lay eggs on. These females die without laying their full complement of eggs. Eggs that are laid on wheat hatch and larvae feed between leaf sheaths and stems until they pupate in midautumn. Infested plants become weakened and fail to tiller. Plants may also lodge during grain fill.

The Hessian fly has not caused significant problems in Illinois for many years because of the availability of commercial wheat varieties that have genes for resistance to this insect. Unfortunately, biotypes of the Hessian fly have overcome some of these genes for resistance over the past years. The biotypes develop in response to selection pressure by exposure to wheat varieties that carry specific resistance genes. The Hessian fly population evolves, eventually rendering resistance genes in wheat ineffective. During 1995 to 1998, USDA-ARS entomologists from West Lafayette, Indiana, sampled wheat fields in Illinois and indicated that flies collected from southwestern Illinois were primarily Biotype L. This biotype is able to infest and damage wheat varieties that carry one or more of the four resistance genes available in soft winter wheat varieties.

We encourage wheat growers to plant wheat in 2003 after the fly-free dates that are provided in Table 3 to prevent economic losses in 2004. By using fly-free dates with resistant wheat varieties, producers reduce selection pressure on the Hessian fly to develop additional resistant biotypes and should be able to effectively manage the Hessian fly.—*Kelly Cook*

Table 3. Average dates of seeding wheat for the highest yield (fly-free dates).

County	*Average date of seeding wheat for the highest yield*	*County*	*Average date of seeding wheat for the highest yield*
Adams	Sep. 30–Oct. 1	Lee	Sep. 19–21
Alexander	Oct. 12	Livingston	Sep. 23–25
Bond	Oct. 7–9	Logan	Sep. 29–Oct. 3
Boone	Sep. 17–19	Macon	Oct. 1–3
Brown	Sep. 30–Oct. 2	Macoupin	Oct. 4–7
Bureau	Sep. 21–24	Madison	Oct. 7–9
Calhoun	Oct. 4–8	Marion	Oct. 8–10
Carroll	Sep. 19–21	Marshall-Putnam	Sep. 23–26
Cass	Sep. 30–Oct. 2	Mason	Sep. 29–Oct. 1
Champaign	Sep. 29–Oct. 2	Massac	Oct. 11–12
Christian	Oct. 2–4	McDonough	Sep. 29–Oct. 1
Clark	Oct. 4–6	McHenry	Sep. 17–20
Clay	Oct. 7–10	McLean	Sep. 27–Oct. 1
Clinton	Oct. 8–10	Menard	Sep. 30–Oct. 2
Coles	Oct. 3–5	Mercer	Sep. 22–25
Cook	Sep. 19–22	Monroe	Oct. 9–11
Crawford	Oct. 6–8	Montgomery	Oct. 4–7
Cumberland	Oct. 4–5	Morgan	Oct. 2–4
DeKalb	Sep. 19–21	Moultrie	Oct. 2–4
DeWitt	Sep. 29–Oct. 1	Ogle	Sep. 19–21
Douglas	Oct. 2–3	Peoria	Sep. 23–28
DuPage	Sep. 19–21	Perry	Oct. 10–11
Edgar	Oct. 2–4	Piatt	Sep. 29–Oct. 2
Edwards	Oct. 9–10	Pike	Oct. 2–4
Effingham	Oct. 5–8	Pope	Oct. 11–12
Fayette	Oct. 4–8	Pulaski	Oct. 11–12
Ford	Sep. 23–29	Randolph	Oct. 9–11
Franklin	Oct. 10–12	Richland	Oct. 8–10
Fulton	Sep. 27–30	Rock Island	Sep. 20–22
Gallatin	Oct. 11–12	St. Clair	Oct. 9–11
Greene	Oct. 4–7	Saline	Oct. 11–12
Grundy	Sep. 22–24	Sangamon	Oct. 1–5
Hamilton	Oct. 10–11	Schuyler	Sep. 29–Oct. 1
Hancock	Sep. 27–30	Scott	Oct. 2–4
Hardin	Oct. 11–12	Shelby	Oct. 3–5
Henderson	Sep. 23–28	Stark	Sep. 23–25
Henry	Sep. 21–24	Stephenson	Sep. 17–20
Iroquois	Sep. 24–29	Tazewell	Sep. 27–Oct. 1
Jackson	Oct. 11–12	Union	Oct. 11–12
Jasper	Oct. 6–8	Vermilion	Sep. 28–Oct. 2
Jefferson	Oct. 9–11	Wabash	Oct. 9–11
Jersey	Oct. 6–8	Warren	Sep. 23–27
JoDaviess	Sep. 17–20	Washington	Oct. 9–11
Johnson	Oct. 10–12	Wayne	Oct. 9–11
Kane	Sep. 19–21	White	Oct. 9–11
Kankakee	Sep. 22–25	Whiteside	Sep. 20–22
Kendall	Sep. 20–22	Will	Sep.21–24
Knox	Sep. 23–27	Williamson	Oct. 11–12
Lake	Sep. 17–20	Winnebago	Sep. 17–20
LaSalle	Sep. 19–24	Woodford	Sep. 26–28
Lawrence	Oct. 8–10		

Root Ratings from 2003 Corn Rootworm Control Trials in Illinois

Through our Insect Management and Insecticide Evaluation program, coordinated by Ron Estes in the Department of Crop Sciences, we obtain quite a bit of efficacy data for products intended to control some of the major insect pests of alfalfa, corn, and soybeans in Illinois. Among the first data we provide, before our full report is completed, are the root-rating data from our corn rootworm control trials. We conduct three rootworm control trials at outlying farms operated by the Department of Crop Sciences: Northern Illinois Agronomy Research Center (Shabbona, near DeKalb); Northwestern Illinois Agricultural Research and Demonstration Center (near Monmouth); and Crop Sciences Research and Education Center (Urbana). Each year we establish trap crops of late-planted, mixed-maturity corn hybrids, sweet corn, and pumpkins to attract corn rootworm females that will lay eggs in the plot areas. The following year we establish our product efficacy trials where the trap crops were planted the previous year. Consequently, we usually have substantial rootworm larval damage in our trial areas, ensuring that the rootworm control products are "put to the test."

Table 4 shows the average root ratings from our three rootworm control trials in 2003. The root ratings are from the 1-to-6 scale, introduced by Hills and Peters at Iowa State University in 1971 (Hills, T. M., and D. C. Peters. 1971. A method of evaluating post-planting insecticide treatments for control of western corn rootworm larvae. *Journal of Economic Entomology* 64:764–765). The whole number root ratings are as follows:

1—no damage, or only a few minor feeding scars;

2—feeding scars evident, but no roots eaten off to within 1-1/2 inches of the plant;

3—several roots eaten off to within 1-1/2 inches of the plant, but never the equivalent of an entire node of roots destroyed;

4—one node (or the equivalent) of roots completely destroyed;

5—two nodes (or the equivalent) of roots completely destroyed;

6—three or more nodes (or the equivalent) of roots completely destroyed.

Most entomologists use a root rating of 3.0 to distinguish between acceptable root damage (<3.0) and less-than-acceptable root damage (≥3.0). However, the relationship between root ratings and yield may be altered depending on environmental conditions and corn hybrid. For example, when corn plants are stressed by a lack of moisture, root ratings less than 3.0 may result in some yield loss. On the other hand, when corn plants have plenty of moisture and the corn hybrid has the ability to compensate for rootworm injury, root ratings greater than 3.0 may not result in yield loss. With this explanation of root ratings as background, you can place the performance of rootworm control products in our trials in 2003 in context.

The rootworm larval damage in all of our untreated checks at all three locations in 2003 resulted in root ratings greater than 4.0. Rootworm damage at our Monmouth and Urbana locations was particularly severe in the untreated checks. Please note that we used two hybrids as untreated check plots this year—a DeKalb hybrid and a Northrup King (NK) hybrid. We intend to take yields from these 4-row plots, so we needed to include a nontransgenic DeKalb isoline to fairly compare yield with the MON 863 event in the DeKalb YieldGard Rootworm hybrid. At this point, I cannot easily explain the significantly different average root ratings in the two untreated checks at Monmouth and Urbana.

Table 4. Average root ratings[1] from corn rootworm control trials in Illinois, 2003.

			Average root ratings[1,3]		
Product	*Rate of application[2]*	*Placement*	*DeKalb*	*Monmouth*	*Urbana*
Aztec 2.1G	6.7 oz	Band	2.15 bc	2.70 fgh	2.10 e–h
Aztec 4.67G[4]	3.0 oz	Band	2.10 bc	2.75 fg	2.15 d–h
Aztec 4.67G[4]	3.0 oz	Furrow	NA[6]	2.45 gh	2.30 c–h
Capture 2EC[5]	0.35 oz	Band	2.70 b	3.20 ef	2.55 c–g
Counter CR	6 oz	Band	2.45 b	2.20 gh	1.90 h
Cruiser FS (seed treatment)	—	—	3.50 a	4.20 c	2.70 cde
Empower	8.0 oz	Band	NA[6]	4.15 c	2.75 cd
Empower	8.0 oz	Furrow	NA[6]	4.01 cd	2.60 c–f
Force 3G	4.0 oz	Band	2.20 bc	2.70 fgh	2.20 d–h
Fortress 2.5G	7.4 oz	Furrow	2.20 bc	2.40 gh	2.00 fgh
Fortress 5G[4]	3.7 oz	Furrow	2.50 b	2.45 gh	2.55 c–g
Fortress 5G[4]	4.5 oz	Furrow	2.55 b	NA[6]	1.95 gh
Lorsban 15G	8.0 oz	Band	2.65 b	2.56 fgh	2.10 e–h
Poncho 1250 (seed treatment)	—	—	3.50 a	3.45 de	2.90 c
MON 863 (DeKalbYieldGard Rootworm hybrid)	—	—	1.45 c	2.05 h	1.35 i
Untreated check (DeKalb hybrid)	—	—	4.06 a	5.75 a	5.45 a
Untreated check (NK hybrid)	—	—	4.20 a	4.95 b	4.60 b

[1]Root ratings are from the 1-to-6 root-rating scale developed by Hills and Peters (1971).
[2]Rates of application are oz per 1,000 ft of row.
[3]Means followed by the same letter do not differ significantly according to Duncan's New Multiple Range Test, $P = 0.05$.
[4]Aztec 4.67G and Fortress 5G were applied through the SmartBox closed handling system.
[5]Capture 2EC was applied at a volume of 5 gallons per acre.
[6]NA = product not applied in the trial.

For the most part, rootworm control products performed very well in our three trials in 2003. All products held the average root rating to less than 3.0 at the Urbana site (planted on May 13), a fairly impressive feat given the severe damage in the untreated check.
I suspect that the rainfall pattern at the Urbana site was beneficial for all products tested. We will examine and share rainfall data in our full report to be published on the Web later this year.

The rootworm larval damage at the Monmouth site (planted on May 16) was quite severe, and under the conditions at that site, most products performed quite well. However, the average root ratings for plots treated with Capture 2EC, Cruiser FS, Empower (a granular formulation of bifenthrin, the same active ingredient as in Capture), and Poncho 1250 were greater than 3.0. The average root rating for plots treated with Capture 2EC (3.2) was not significantly different from several products that held the average root rating to less than 3.0.

The rootworm larval damage at the DeKalb site was less than at the other two sites, probably because rainfall prevented us from planting on a reasonable planting date. The trial at DeKalb was planted on May 28, right about the time when rootworm larvae were hatching. Consequently, all products but the seed treatments Cruiser FS and Poncho 1250 held the average root ratings to less than 3.0. In fact, the average root ratings in plots treated with Cruiser and Poncho were not significantly different from the average root ratings in the untreated check plots. It's possible that the active ingredients of Cruiser and Poncho did not have enough time to come off the seed and get into the soil to provide optimal control of rootworm larvae.

Although we have received a fair number of reports of unacceptable performance of soil insecticides in producers' fields this year, the granular insecticides applied in our trials (with the exception of Empower) continued to provide the most consistent control of rootworm larvae. Control of corn rootworm larvae with Capture 2EC was acceptable at all three locations. And as we have experienced in the past, the performance of the insecticidal seed treatments was challenged by heavy rootworm larval pressure, with the notable exception of their performance at the Urbana site.

The MON 863 transgenic event for rootworm control provided excellent control of corn rootworms, although it's worth noting that some root injury in the MON 863 plots at the Monmouth site led to a root rating of 3.0 on individual roots. Because MON 863 is a low- to moderate-dose event, some rootworm larval injury on YieldGard Rootworm hybrids is to be expected.

These data clearly indicate that the interaction among products, environment, and rootworm larvae can create situations in which some products do not provide consistent control. When we prepare our report, we will include percentage consistency of all products in the trials.

One more note: Our planting times were not to our liking this year. In fact, one could argue, and justifiably so, that our mid- to late-May planting dates are not reflective of producers' planting dates. We agree, and we intend to plant our plots earlier in 2004. It's possible that insecticides applied in early April will not hold up well against severe rootworm pressure when larvae begin feeding in late May and early June. Consequently, we need to get our trials in the ground earlier than we have done in the past. In addition, we will include a time-of-planting study among our trials to determine how control of rootworm larvae compares among soil insecticides, seed treatments, and transgenic hybrids. We want to make certain that results from our trials are useful for the people with whom we share the information.—*Kevin Steffey*

PLANT DISEASES

White What? White Mold in Illinois Soybean Fields

Although white mold has been sporadic and inconsequential in most Illinois soybean field over the past few years, this disease is now appearing in soybean fields in parts of Illinois. Jim Morrison, Extension educator at the Rockford Center, has reported white mold near Freeport, and other reports have come in from the northern third of the state. White mold, also called Sclerotinia stem rot, is caused by the fungal pathogen *Sclerotinia sclerotiorum*.

This disease can be very destructive, especially during cool and moist weather and when growing conditions favor high yields, and it can be one of the easiest soybean diseases to diagnose. The names of the disease are descriptive in that infection and disease development by the pathogen *Sclerotinia sclerotiorum* result in soft rot and darkening of stem, leaf, and pod tissues and can usually be recognized by the white moldy growth on the infected plant parts. These symptoms are often preceded by gray to brown discoloration and wilting of the upper leaves. In addition, as the fungus grows and infects soybean tissue, it produces sclerotia, which are gray to black spherical to elongated structures about 1/8 inch to 1/4 inch around or in length.

Even though white mold has only recently started appearing in Illinois soybean fields this season, much of the disease was initiated earlier in the summer when the nights were cool and moist in July. In simple terms, the life and disease cycles of *S. sclerotiorum* are as follows. The sclerotia are the resting and overwintering structure of this fungal pathogen and are a key to the life cycle. Sclerotia are produced on or in infected tissues and are released at harvest into field soil where they can survive for many years. The sclerotia near the surface of the soil germinate and produce small mushroom-shaped structures (apothecia), and the apothecia produce numerous spores when conditions are favorable. The spores land on senescing flowers and initiate infections, which spread on the stem or other plant parts. Infection typically occurs during cool and moist weather conditions when plants are flowering and after the canopy has partially closed.

Management of white mold in fields with a history of this disease is based primarily on decisions made prior to planting. A first step is to choose soybean cultivars with the highest levels of partial resistance; many cultivars are rated for their reaction to white mold, and information on resistance to white mold and other diseases can be found at the Varietal Information Program for Soybeans (VIPS) Web site at www.vipsoybeans.org/v2CompVar/v2CompVar1.cfm.

In addition, several cultural practices can help to reduce white mold incidence and severity. These include late planting, wide row spacing, low plant populations, moderate to low soil fertility, good control of broadleaf weeds, and avoiding rotation with sunflowers and other bean crops. Fungicides have been shown to be ineffective or inconsistent for management of white mold of soybeans. In a recently published study with results from Illinois, Indiana, Ohio, and Wisconsin (Mueller et al., Plant Disease. 2002), the fungicide Topsin M applied at the R1–R3 growth stages did reduce disease severity when disease pressure was low but provided inconsistent control when disease pressure was high. Thus, white mold cannot be easily managed when environmental conditions are favorable for disease development and fields contain large numbers of sclerotia in the soil, but these steps can be made to reduce disease damage under less severe circumstances.

At this point in the season, soybean fields should be scouted to determine whether and where different diseases, including white mold, may be damaging the crop. Remember, once soybean plants are dead and decomposing, it can be very difficult to diagnose the problem and determine what may have contributed to suboptimal yields.
—*Dean Malvick*

Stalking the Corn Stalk Rots in Illinois

Conditions have occurred this summer that may result in increased corn fungal stalk rots in Illinois. Fields should be scouted to determine whether stalk rot is present, and early harvest should be considered if scouting efforts suggest stalk rot may be a significant problem. Stalk rots cause decay of the internal pith tissues of the stalk. They can affect yield by killing plants prior to maturity by causing lodging that results in decreased harvesting efficiency and by promoting increased ear rots after lodging occurs.

Why might stalk rots be a problem this year in many fields? Plants predisposed and weakened by a number of different stress factors are more susceptible to stalk rot. Some of the stresses and other factors that have been linked to increases in stalk rot include water stress, high-yielding hybrids, susceptible hybrids, root damage, leaf disease, conservation tillage, high plant populations, insect damage, early maturation, low N in mid- to late summer, high fertility (especially very high N), and low P and K.

This season, good growing conditions in much of Illinois resulting in large ears early in the season combined with drought conditions across much of Illinois in July and August may be predominant stress factors that could enhance stalk rot. One scenario goes like this: Large ears with many kernels require lots of energy and nutrients to fill the grain; however, drought conditions reduce photosynthesis and carbohydrate production by the plants. When photosynthesis is reduced, the main source of nutrients for the ears is also reduced, and the plant is forced to rob the stalk of nutrients, which makes the stalk more susceptible to stalk rots.

Four types of stalk rot in Illinois are anthracnose, diplodia, giberella, and fusarium stalk rots, all caused by pathogens that also cause ear rots. Charcoal rot is another type of stalk rot that occurs primarily under hot and dry conditions. The pathogens that cause stalk rots tend to be widespread and opportunistic fungi that take advantage of plants weakened by various stresses. The pathogens survive in infested stalk debris on or near the soil surface. Thus, no-till environments and continuous or short rotations out of corn can favor survival and infection by the stalk rot pathogens.

The first symptom of severe stalk rot is often seen as leaves changing to dull green or gray. This discoloration can be followed by wilting, drooping of the ears, straw-colored lower stalks, and internal pith tissue that is decayed and discolored. Anthracnose stalk rot often appears earlier than other stalk rots, prior to normal senescence. Several internodes may rot, and a shiny black color develops on the outer stalk.

Don’t confuse irregularly shaped purple to brown discolored patches on and under leaf sheaths with stalk rot. This is called purple leaf sheath and is caused by growth of fungi, bacteria, and yeasts on pollen and other nutrients trapped between the leaf sheath and stalk. Purple leaf sheath does not infect the stalk and is not damaging.

Scouting should be done soon for stalk rot. Plants should be inspected with the “pinch” or “push” test in each field. Twenty plants should be tested in five different parts of a field. If stalk rot is well developed, the lower internode will easily compress when pinched firmly, and/or stalks will break or remain bent over when pushed 10 inches to the side at ear height. If 10% to 15% of plants in a field have stalk rot, then the potential for significant lodging is high, and early harvest at about 24% grain moisture should be considered.

Damage from stalk rots can be reduced by avoiding or reducing as many stresses as possible, managing balanced fertility throughout the season, and harvesting early to minimize losses from lodging. Stalk rot is a recurring problem that occurs in many Illinois cornfields each year.—*Dean Malvick*

Brown Stem Rot: A Sneaky But Manageable Disease

Brown stem rot (BSR) of soybeans has the ability to cause yield losses greater that 30%. A yield loss of 17% was attributed to BSR at U of I's Northwestern Illinois Agricultural Research and Demonstration Center (NWRC) near Monmouth in 2002, even though very few foliar symptoms of the disease were visible. Greater yield loss to BSR has been observed when foliar symptoms are present. The disease is more prevalent in the northern soybean-growing region, partially because the cooler temperatures are more favorable for the development of disease symptoms and survival of the fungus. Though it can be found in all of Illinois, the likelihood of yield loss to BSR increases progressively north through the state.

The fungus that causes BSR, *Phialophora gregata*, produces toxins that cause the browning of pith tissue in the stems and the interveinal chlorosis and necrosis in the leaves characteristic of BSR. The stem and foliar symptoms generally become evident after the pods begin to form (growth stage R4). The stem-browning symptoms are first evident as faint browning at the lowest nodes of the plant, working progressively up the stem and causing browning between the nodes. The foliar symptoms usually are most visible around stage R6 (soybeans have filled pod) or later, which can begin in mid- to late August. From the road, a field infested with BSR can look like it is just maturing a couple of weeks early. The cooler nights during pod fill that favor yield also favor the development of foliar symptoms of BSR. The foliar symptoms of BSR have not been very visible the past several years at NWRC and other locations in Illinois because of above-normal temperatures in August and September, though yield loss has still occurred. Dean Malvick, plant pathologist at the U of I, is investigating the effects of BSR on yield when foliar symptoms are not expressed.

The foliar symptoms of BSR are almost identical to those caused by sudden death syndrome (SDS) of soybeans. They cause both yellowing and death of leaf tissue between the veins. Splitting the stems can help distinguish between BSR and SDS, though a lab test may be necessary to confirm which pathogen caused the symptoms. Soybean plants have been collected from NWRC containing both of the fungi that cause BSR and SDS.

Phialophora gregata survives between soybean crops in soybean residue. Management practices that reduce the amount of infested residue remaining in a field when the next soybean crop is planted are very effective at reducing the severity of BSR. Longer crop rotations out of soybeans and incorporating the residue through tillage are methods of reducing the amount of infested residue. Research conducted in Wisconsin has shown that *P. gregata* could still be isolated from soybean residue that had been buried for 1.5 years and over 2.5 years later from residue left on the soil surface. The ability of the fungus to survive in soybean residue can explain why the corn/soybean rotation is not long enough to eliminate the yield loss to BSR. Planting a soybean variety that is resistant to BSR will reduce the yield loss to BSR and will also reduce the amount of infested residue that could infest the following soybean crop.

Correct identification of BSR is important for managing this disease. Many areas of the state that have BSR also have SDS. As previously mentioned, there are management practices that are very effective at reducing yield loss to BSR; however, these same practices have not been shown to be effective against SDS. Managing to reduce infested residue and choosing from varieties with good resistance to BSR are effective tools. With SDS, however, crop rotation and residue incorporation have not been shown to be effective, nor is the level of resistance as high for SDS as it is for BSR in varieties currently available.—*Eric Adee*

Table 5. Comparison of wheat seed treatment fungicide active ingredients.

Active ingredient	*General seed/seedling pathogens*	*Pythium*	*Loose smut*	*Common bunt*	*Seed-borne scab*	*Fall foliar diseases: Powdery mildew*	*Fall foliar diseases: Rust*
captan	G-F	P	N	P	F	N	N
carboxin	F-P	P	G	N	P	N	N
difenoconazole	G	N	G	G	P	G	G
fludioxonil	G	P	N	N	G	N	N
imazalil	F	N	N	N	G	N	N
mefenoxam/metalaxyl	N	G	N	N	N	N	N
PCNB	G-F	N	N	F-P	F	N	N
tebuconazole	G-F	N	G	G	G	G	N
thiabendazole (TBZ)	G-F	N	N	G	G	N	N
thiram	G	P	N	F	G-F	N	N
triadimenol	F	N	G	G	F-P	G	G

Ratings: G, good; F, fair; P, poor; N, no activity.

Wheat Seed Treatments for Fall 2003

Many variables come into play when deciding whether or not seed treatments pay off, including seed cost, seed treatment cost, crop value, seed condition, seed bed condition, time of planting, anticipated disease and insect pressure, intended crop use, and options for disposal of excess treated seed. Because many of these variables are difficult to predict with much accuracy before planting, most folks looking for "cheap insurance" either plant wheat a little heavier or use an inexpensive seed treatment. Just like car insurance, you buy the coverage you need based on product performance and your particular situation and desired comfort level.

There are many different seed treatments registered for use on wheat. As with most pesticides, each active ingredient has strengths and weaknesses, which is why premixed fungicide products are so common. In addition, an insecticide may be included or used alone to control insect pests. Typically, seed treatments will last only about 10 to 14 days beyond planting. However, certain active ingredients can protect the seedlings considerably longer when applied at the highest labeled rate. For example, difenoconazole and triadimenol can protect against fall-season foliar disease such as powdery mildew and rust. In addition, imidacloprid may be included or used alone to control aphids that transmit the barley yellow dwarf virus. Although these long-lasting systemics offer a good deal of protection, they are relatively expensive.

Common seed treatment active ingredients and the fungi they control are listed in Table 5. Table 6 provides a current, but likely incomplete, list of seed treatment pesticides labeled for treating wheat seed. Check with local dealers to determine what products are available in your area and at what cost. Also, consult the *Illinois Agricultural Pest Management Handbook* for further information. Several of these

Table 6. Incomplete list of common wheat seed treatment fungicides and insecticides.

Product	*Application notes*	*Active ingredient(s)*	*Company*
Allegiance Dry	drill-box (dry)	metalaxyl	Trace
Allegiance FL, Apron FL	mist/slurry	metalaxyl	Gustafson
Allegiance LS	mist/slurry, drill-box (liquid)	metalaxyl	Gustafson
Apron XL LS	mist/slurry	mefenoxam	Syngenta
Baytan 30[b]	mist/slurry[a]	triadimenol	Gustafson
Captan 30-DD, 400, 400-C	mist/slurry	captan	Gustafson
Cruiser 5FS	mist/slurry	thiamethoxam*	Syngenta
Dividend	mist/slurry	difenoconazole	Syngenta
Dividend Extreme, XL, XL RTA	mist/slurry	difenoconazole, mefenoxam	Syngenta
Enhance	drill-box (dry)	captan, carboxin	Trace
Enhance Plus	drill-box (dry)	carboxin, lindane*, maneb	Trace
Flo-Pro IMZ	mist/slurry	imazalil	Gustafson
Gaucho 480, 600	mist/slurry	imidacloprid*	Gustafson
Gaucho XT	mist/slurry	imidacloprid*, metalaxyl, tebuconazole	Gustafson
Grain Guard	drill-box (dry)	mancozeb	Trace
Grain Guard Plus	drill-box (dry)	mancozeb, lindane*	Trace
Kodiak	mist/slurry	*Bacillus subtilis* GBO3 (biological)	Gustafson
Kodiak HB	drill-box (dry)	*Bacillus subtilis* GBO3 (biological)	Trace
Lindane 30C	mist/slurry	lindane*	Gustafson
LSP	mist/slurry[a]	thiabendazole (TBZ)	Gustafson
Maxim 4FS	mist/slurry	fludioxonil	Syngenta
Mertect LSP	mist/slurry	thiabendazole (TBZ)	Syngenta
Prevail	drill-box (dry)	carboxin, metalaxyl, PCNB	Trace
Raxil MD, XT	mist/slurry	metalaxyl, tebuconazole	Gustafson
Raxil MD Extra	mist/slurry	imazalil, metalaxyl,	Gustafson
Raxil-Thiram	mist/slurry	tebuconazole, thiram	Gustafson
Rival Flowable	mist/slurry[a]	captan, PCNB, TBZ	Gustafson
RTU Baytan-Thiram	mist/slurry[a]	triadimenol, thiram	Gustafson
RTU Flowable Fungicide	mist/slurry	TBZ, thiram	Gustafson
RTU-PCNB	mist/slurry	PCNB	Gustafson
RTU-Vitavax Extra	mist/slurry	carboxin, imazalil, TBZ	Gustafson
RTU-Vitavax-Thiram	mist/slurry, drill-box (liquid)	carboxin, thiram	Gustafson
Terra-Coat LT-2N	mist/slurry[a]	PCNB	Gustafson
Thiram, many names	varies	thiram	Many
Vitavax 34	mist/slurry	carboxin	Gustafson
Vitavax 200; Vitaflo 280[a]	mist/slurry	carboxin, thiram	Gustafson
Vitavax-PCNB	mist/slurry[a]	carboxin, PCNB	Gustafson
Vitavax T-L	drill-box (liquid)	carboxin, thiram	Trace
Vitavax-Thiram-Lindane	mist/slurry	carboxin, lindane*, thiram	Gustafson

[a]For use by commercial seed treaters only.
[b]Treatment may result in slightly slower emergence—do not plant deeper than 1.5 inches.
*Insecticide.

products are available only to commercial seed treaters. Although there are many convenient premix products in the market, should you decide to create your own combination, be sure to read and follow the labels of each product and contact the manufacturer(s) if you need clarification.

To learn more about the biology of seed and seedling pests, consider purchasing the current *Field Crop Scouting Manual*, available at your local University of Illinois Extension office. For a comprehensive seed treatment resource, consider purchasing *Illinois Pesticide Applicator Training Manual: Seed Treatment (SP 39-4)*, also available through University of Illinois Extension. The seed treatment manual was revised in November 2001 and addresses common seed and seedling pests, seed treatment active ingredients, safety issues, and seed treating equipment and calibration.*—Bruce Paulsrud and Wayne Pedersen*

CROP DEVELOPMENT

The Curtain Falls on the 2003 Crop

I doubt that anyone needed the 6 to 8 inches of rain that fell in some places in Illinois over the past week, but rain was very welcome in areas that had received little rain in August and none since the first week of the month. Here are some questions and answers as we approach the final weeks of the crop year.

Will the rain help increase yields?
The answer to this depends, in both corn and soybean, on how much healthy green leaf color remains on the crop. Many early-planted or drought-stressed cornfields have little green color left, and husks are starting to dry even if there is some green leaf area. The fact that this crop will probably reach (or has reached) maturity in fewer GDDs than predicted will be reflected in lower yields, though many yields will still be good. Even at the end of grain filling, though, a "charge" of water (and nitrogen) will help the crop pack in some more bushels, as long as it has some green leaf area to make this happen. Once the sun comes out and warm temperatures return, the crop will be back up and running if it still has the ability to do so. Most soybean fields are in better shape to take advantage, though maximum temperatures in the low 70s will delay maturity and retard filling in both crops. Where canopy color was lost, it won't come back, and those fields or areas will likely have smallish seeds, with yields to match. Overall, though, the rain came at a good time for the soybean crop, and I expect every day with sun and good temperatures to add around 2 bushels per acre, as long as the canopy stays green, up to physiological maturity.

Any guesses on yields?
We're approaching the time when we can harvest and won't have to guess about yields. In the meantime, the longer we wait, the better our estimates ought to be. For both corn and soybean, I suggest counting plants and seeds per plant in order to estimate seed number per 1/1000 of an acre, then dividing this number by expected number of kernels in (a thousandth of) a bushel to give bushels per acre. Doing this late should give better estimates of seeds that are actually filling and should also allow us to better guess at eventual seed size, thus fine-tuning our estimate. A useful calculator to do this for corn is located at the Web site http://www.ag.uiuc.edu/iah/ch2/est_corn_yield.html. This site suggests how to make seed size adjustments, and it will do the calculations for you from counts you make. The ear weight method takes more time, and many people do not have the scales to weigh ears accurately, so it is less desirable in most cases than the kernel counting method.

We do not have an equivalent site for soybean, but the numerical yield estimation technique takes longer and is less accurate for soybean than for corn. It is possible that simply guessing at yields based on a subjective look at plant numbers, pods per plant, and whether most pods have 2, 3, or 4 seeds filling might be as accurate as counting. For soybean, count plants per 20 square feet (8 row feet of 30-inch rows, 16 row feet of 15-inch rows, 32 row feet of 7.5-inch rows), and count seeds per plant on 10 randomly selected plants. You might exclude from both the count and the sampling plants that are spindly and have few if any pods. Average the counts to get seeds per plant, then multiply the number of plants per 20 square feet times seeds per plant times the factor 2.18 to give number of seeds per 1/1000 of an acre.

Now the tricky part: Soybean seed size varies a lot depending on the number of seeds filling and the conditions. We can start with an estimated 180 seeds per 1/1000 of a bushel (3,000 seeds per pound), and move that number down to perhaps 120 for very large seeds and up to perhaps as high as 250 if the seeds look like they will end up very small. Divide the number of seeds per 1/1000 of an acre by this number. As an example, if we count 65 plants in 20 square feet and get an average of 78 seeds per plant, and we guess that seeds will be of average size, we would calculate a yield of 65 x 78 x 2.18/180 = 61.3 bushels per acre. If it looks like the seeds are small and the canopy is starting to lose its color, then we might divide by 210 instead of 180 and get a yield estimate of only 52.6.

Is there anything we should watch for?
There have been a lot of warnings about possible stalk quality problems in corn, and it would be useful to walk into fields as they reach black layer and push on stalks to see if they still have strength. Without strong winds, even weak stalks will probably stand reasonably well until harvest, but most people would prefer to harvest at 25% or higher moisture and pay to dry than to face a down and tangled mess at harvest. Given the way the last month has gone, we might have fields that reach black layer and still have green stalks and leaves. Stalk strength will remain high in such fields, but grain

will probably dry relatively slowly due to restricted air movement through the canopy. In soybean, continued cool weather might delay maturity considerably, and the possibility of green stem is usually (but not always) higher when maturity is late. Be sure to check grain moisture on soybean once pods have lost their color; it may be preferable to harvest with tough stems instead of waiting for stems to dry, in which case grain moisture could fall to 10% or less and harvest losses could increase greatly.

How will the 2003 season be remembered?
As is usually the case, some will probably prefer not to remember it much at all, especially in those areas where planting was delayed, it turned dry, and the canopy deteriorated before it could be revived by rain. We expect that a very good start to the season in many parts of Illinois will be tempered by yield loss from dryness in August, but for many people the season will go down as a good one, even if few yield records get broken. There were a lot of "good days" for crops throughout the season, and we will benefit from those.—*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, 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

Hot, dry weather the past several weeks has reduced expected yields for corn and soybeans, particularly corn. Numerous areas in the region had little to no rainfall during the past 5 weeks. Some growers have expressed concern about potential high nitrate levels in corn to be harvested for corn silage.

Numerous soybean fields were treated for soybean aphids in mid-August, but insecticide treatment has declined during the past few weeks. Several reports have been received of sudden death syndrome and white mold disease in soybeans. Also, gray leaf spot has been reported in corn.

Producers are encouraged to bring soil samples to soybean cyst nematode screening clinics scheduled for September 16 in Carroll County and JoDaviess County and September 26 in Stephenson County. Contact local Extension offices for times and locations.

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