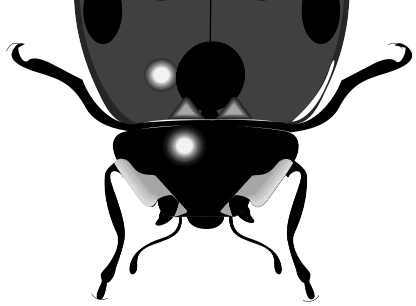

PEST MANAGEMENT & CROP DEVELOPMENT

BULLETIN

FOR IMMEDIATE RELEASE
No. 1 / March 16, 2001

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Available on the Web at http://www.ag.uiuc.edu/cespubs/pest/
For subscription information, phone 217.244.5166, or e-mail acesnews@uiuc.edu

In This Issue

Welcome to the First 2001 Issue of the *Bulletin*

Winter has lasted long enough, and it's time for spring. And despite the 2 to 5 inches of snow predicted at the end of the week of March 12, most of us in agriculture are getting excited about the forthcoming planting season. Within a very short while, producers will be planting, and we'll all be watching as the crops come up and insects, weeds, plant diseases, and associated problems begin to make their presence known. That's when we'll bring to bear all we learned during the "off season" about producing crops and managing pests more efficiently in 2001.

Several Extension specialists in the Department of Crop Sciences and Extension educators throughout the state will be writing articles for the *Bulletin* this year, and we all are prepared keep you informed about pest situations and crop development as the season unfolds. State specialists will provide information based on research trials, observations, and reports from all over the state, as well as from other sources in the Midwest. Extension educators will offer regional reports, keeping you apprised of more local developments in northern, west-central, east-central, and southern Illinois.

We are excited to announce that some new "players" will join us this year. Dr. Dean Malvick joined our department as an Extension plant pathologist in January 2001. Dean "hit the ground running" when he began giving presentations at the annual University of Illinois Corn & Soybean Classics, his first official day on the job! He and the rest of the plant pathology team will keep you informed about plant diseases and their management throughout the season. In addition, we anticipate adding a soybean cyst nematode specialist to our faculty some time this spring.

As the season unfolds, don't hesitate to send us reports about what you observe or learn when you scout fields, diagnose problems, and talk with others. We value your input. If you become aware of pest situations or crop conditions that would benefit others to know, give us a call or send an e-mail message so we can incorporate your observations into our articles and spread the word.

On behalf of all of the authors who contribute to the *Bulletin*, I thank you for your continued support of our efforts and your interest in the information we provide. We look forward to working with you and providing the most current, useful information possible.—*Kevin Steffey*

Changes in the *Bulletin* on the Web Are Forthcoming

"Hits" for the Web version of the *Bulletin* continued to increase at a significant rate in 2000. As more and more people become active on the Internet, we expect this trend to continue; therefore, we anticipate that electronic delivery of the *Bulletin* and associated information will increase dramatically. Consequently, we will focus a lot more effort on improving the manner in which we deliver information electronically.

Probably the most important asset of the *Bulletin* on the Web is its availability shortly after the authors write the articles and the editor compiles the current issue. Articles for the *Bulletin* are due in the editor's office on Wednesday morning. After the editing and formatting processes, the *Bulletin* is sent for printing, and it's usually mailed on Friday. The printed version arrives in mailboxes on Saturday, or in many cases, Monday of the following week. However, the most current issue of the *Bulletin* usually is available for viewing on the Web at some time on Thursday. So you can read the most current information well before the weekend.

Although subscribers to the printed version of the *Bulletin* won't see many changes in 2001, the Web version of the *Bulletin* continues to evolve. The *Bulletin* is being redesigned to make it more appealing and useful. At some point during the year, visitors to the Web site will find a new look, as well as new, helpful features that will enhance our ability to deliver information. Look for even more color photographs, more video clips, links to other important Web sites, and textual and audio updates in between issues. As the world of electronic technology continues to grow and offers new, exciting ways to deliver information, we will try to take advantage of features that will improve the *Bulletin*.

As always, we invite your feedback regarding any aspect of the *Bulletin* on the Web. The more feedback we get, the better we are able to serve your needs. So don't hesitate to give us your opinion. We can adapt our efforts on the Web relatively easily. Remember, our goal is to give you the information you need, when you need it.—*Kevin Steffey*

INSECTS

Will Another Mild Winter Promote Insect Problems?

Remember the cold temperatures of December? At that time, many of us were braced for a rather severe winter, which would have been a break in a string of mild winters dating back to at least 1997. Well, severe winter weather never really developed. Sure, it was cold in December, and we had a lot of snow on the ground that month. But freezing cold temperatures never set in for very long this winter. So, as is always the case, we (and a lot of others) wonder what effect the winter has had on a host of insects that often invade our fields. In this article, we'll offer a "snapshot" of some key insect pests of alfalfa, corn, and soybean and try to guess the impact of the winter environment on their survival.

The two key insect pests of alfalfa in Illinois are the alfalfa weevil and potato leafhopper. Only the alfalfa weevil overwinters in the Midwest. Potato leafhoppers arrive in the Midwest later in the spring, usually borne by prevailing winds and storm fronts. Therefore, winter conditions in the Midwest have no bearing on their survival.

On the other hand, alfalfa weevils spend most of the winter as eggs and adults in southern Illinois and as adults in northern counties. On warm (temperatures generally above 50°F) days during the winter, alfalfa weevil adults may break their winter dormancy and become somewhat active in alfalfa fields; females often lay eggs during extended periods of warm weather. In addition, mild winter conditions favor survival of overwintering eggs. Although ambient temperatures were low in December, the snow cover undoubtedly offered protective insulation. John Shaw, coordinator of the Insect Management and Insecticide Evaluation Program with the Illinois Natural History Survey, has already found a lot of healthy alfalfa weevil eggs in some projected plot areas in Champaign County. Although we have not sampled alfalfa fields in southern counties, we anticipate very good survival of alfalfa eggs in that region, too.

In southern Illinois, overwintering eggs hatch relatively early in the season, and larvae feed on the tender terminal leaves of growing alfalfa plants. Therefore, alfalfa growers in central counties should anticipate alfalfa weevil activity soon. Refer to the article "Alfalfa Weevil Will Be the First Insect We'll Watch For" in this issue of the *Bulletin* for more information.

In the past, our questions about the effect of winter weather conditions on insect pests of soybean have focused solely on bean leaf beetles in the Midwest. However, the discovery of the soybean aphid last year adds a new twist to our conjecture. Refer to the article "What Can We Expect From Soybean Aphids This Year?" in this issue of the *Bulletin* for more information about this invasive species.

We have known for a long time that mild winter weather conditions favor the survival of bean leaf beetles. The adults spend their winters beneath leaf litter and debris usually in wooded areas. So, the milder the winter, the better they survive. As mentioned previously for alfalfa weevils, snow cover insulates, reducing the potential negative effects of low ambient temperatures. Consequently, we anticipate significant numbers of bean leaf beetles this spring, especially in areas of Illinois where densities of bean leaf beetles were high late last summer. Entomologists in Iowa also reported very high numbers of bean leaf beetles toward the end of the summer last year. So, we should be ready early for these pests this year. When spring temperatures rise to daytime highs of 50°F or greater, bean leaf beetles will leave their overwintering quarters and fly to nearby fields of alfalfa or clover. Although bean leaf beetles feed on alfalfa foliage, the extent of their feeding is not sufficient to cause economic damage. As soon as soybean plants begin to emerge, bean leaf beetles leave alfalfa and clover fields to colonize soybean fields. The earliest planted fields usually have the heaviest infestations of bean leaf beetles.

The primary insect pests of corn are the European corn borer and western and northern corn rootworms. These pests usually are first and foremost on most corn growers' list of concerns every year. However, some of the secondary insect pests that attack corn early in the season have garnered considerable attention during the past few years. Consequently, inquiries about the potential effects of winter weather on many pests of corn have been numerous.

Corn rootworms overwinter as eggs in the soil. The depth at which adult corn rootworms deposited eggs last summer depends on species and levels of soil moisture. Western corn rootworm adults tend to lay their eggs deeper than northern corn rootworms do. However, eggs of both species can be found from just below the soil surface to depths of 12 inches or greater. During dry summers, adults of both species will crawl into drought cracks and lay eggs well below depths of 12 inches. In general, eggs of both corn rootworm species are well adapted to winter conditions in the Midwest. But survival of overwintering eggs that were deposited near the soil surface last summer may not be as good as survival of eggs laid deeper in the soil. This occurs most frequently when winter temperatures are unusually cold for prolonged periods of time and snow cover is lacking, so we doubt that mortality of corn rootworm eggs this past winter has been significant.

European corn borers overwinter in cornfield residue (stalks and cobs) as fully developed (fifth-instar) larvae. Like corn rootworms, European corn borers have adapted quite well to Midwestern winters, so their survival usually is not affected greatly by winter weather conditions.

Densities of corn rootworm and European corn borer are influenced more significantly by environmental conditions in the spring. In general, survival of these pests is benefited by spring weather that encourages early planting. We'll discuss other factors in forthcoming issues of the *Bulletin*.

Black cutworms do not overwinter in Illinois. Rather, the adults migrate into Illinois from southern states each spring. Therefore, winter weather in the Midwest has little impact on the potential for infestations of black cutworms during any given year. Anticipating black cutworm problems depends on when the moths arrive to begin laying eggs and the condition of fields at that time. We would appreciate hearing from any of you who use pheromone traps to monitor flights of black cutworms in the spring.

The most prominent so-called secondary insect pests of corn during the past few years have been the corn flea beetle, grape colaspis, southern corn leaf beetle, white grubs, and wireworms. It's unlikely that winter weather conditions have much impact on grape colaspis larvae, white grubs, and wireworms, all of which overwinter relatively deep (at least 8 to 10 inches or more) in the soil. Again, weather conditions in the spring are more likely to influence the impact of these pests. We believe that favorable spring weather that encourages early planting will increase the potential for these pests to cause significant problems.

On the other hand, corn flea beetles and southern corn leaf beetles overwinter as adults in debris on the ground surface. We know very little about the ecology of the southern corn leaf beetle, but we imagine their populations benefit from mild winters. We know quite a bit more about corn flea beetles. Although the corn flea beetle is not a major pest of hybrid corn, seed-corn inbreds are highly susceptible to Stewart's wilt, caused by a bacterium transmitted by the corn flea beetle. For years we have estimated the survival of the flea beetle by adding the average monthly temperatures for December, January, and February. If the sum is less than 90°F, survival of corn flea beetles is not low to moderate. If the sum is more than 90°F, survival of corn flea beetles is good. However, the snow cover in December may have insulated overwintering flea beetles, so use this rule of thumb cautiously. In the next issue of the *Bulletin*, we'll report the sums of the average temperatures during December, January, and February for all areas of Illinois.

So, there you have it; one size does not fit all. Although mild weather conditions during the winter enable some overwintering insects to survive, winter weather has little or no impact on other species. Therefore, predicting the potential for infestations of any insect pest is risky business. As the spring season unfolds, we should get a better handle on occurrences of all of our little insect foes and friends.—*Kevin Steffey and Mike Gray*

Wireworms

Wireworms are among the handful of soil-dwelling insect pests that concern corn producers each growing season. Although wireworms damage less than 1% of the corn crop in Illinois every year, growers with wireworm problems do not consider wireworms to be a secondary pest. However, concern about potential wireworm damage does not justify the widespread use of soil insecticides on first-year corn planted after soybeans. Therefore, it is important for growers to have some way to anticipate wireworm problems. Unfortunately, infestations of wireworms are difficult to predict. The occurrence of wireworms usually is related to the crops or weeds that were growing in the field 2 to 4 years before damage to the corn in the current growing season becomes obvious. Fields with the greatest potential for wireworm damage include corn planted after small grains (including corn planted after double-cropped soybeans) and grass sod.

Wireworms have very long life cycles and can live in the soil as larvae for 2 to 6 years. Adults (click beetles) can live for 10 to 12 months, preferring to lay their eggs in small-grain stubble, sod, or grass-infested fields. Low or poorly drained areas within fields may support wireworms because of the weed populations that tend to occur in those areas. In other instances, wireworms seem to be concentrated in high areas of the field. Crop residue also attracts female click beetles that are laying eggs. Unfortunately, when all is said and done, the relationship between wireworms and field conditions is not well understood.

The wireworm bait station video is available on the Internet (http://ipm.uiuc.edu/publications/videos/wireworm/wireworm.html) and on the IPM Online Companion CD. If you have a copy of the IPM Online Companion CD, place the CD in your CD-ROM drive before clicking on the link. You will need to install Quicktime on your computer to view this video. Individuals who do not have the CD and are not accessing this document via a T1 connection may experience time delays while downloading the video file.

Wireworms attack the seeds and the portion of the corn stem below ground, often damaging or killing the growing point. Infested fields usually have spotty stands with significant reductions in plant population in some areas. Because no effective rescue treatments for wireworms exist after the infestation has been discovered, you must detect their presence before planting if you want to take any preventive action. We recommend a baiting technique that aids in the detection of wireworms before planting.

Follow this procedure for establishing bait stations 2 to 3 weeks before the anticipated planting date:

1. Dig a hole about 3 to 4 inches deep and 9 to 10 inches wide at the soil surface.
2. Bury 1/2 cup of a mixture of equal parts untreated corn and wheat at the bottom of the hole. The germinating seeds attract wireworms.
3. Fill the hole and mound a "soil dome" over the covered bait to serve as a solar collector and prevent standing water.
4. Cover each mound with an 18-inch-square sheet of black plastic topped with a 1-yard-square sheet of clear plastic, and cover the edges with soil to hold the plastic sheets down. The plastic collects solar radiation and speeds germination of the corn and wheat.
5. A few days before planting, remove the plastic and soil covering the bait and count the number of wireworm larvae found at each station. Wireworm larvae are 1/2 to 1-1/2 inches long and are usually hard, smooth, dark reddish brown, and wirelike. However, some species are soft-bodied and are white or yellowish.

Table 1. Insecticides (not including seed treatments) suggested for control of wireworms in corn.

Insecticide	*Amount of product*	*Placement*
*Aztec 2.1G	6.7 oz/1,000 ft row	Band, furrow
*Capture 2EC	0.3 oz/1,000 ft row	Band
*Counter CR	6 oz/1,000 ft row	Band, furrow
*Force 3G	4 to 5 oz/1,000 ft row	Furrow
*Fortress 5G	3 0z/1,000 ft row	Furrow
*Lorsban 4E	4 pints	Broadcast, preplant incorporate
*Lorsban 15G	12 oz/1,000 ft row	Furrow
*Pounce 1.5G	8 to 16 oz/1,000 ft row	Furrow
*Regent 4SC	0.24 oz/1,000 ft row	Furrow
*Thimet 20G	6 oz/1,000 ft row	Band

Place about a dozen bait stations per 40 acres. Your placement of the bait stations should represent different areas of a field. If you find an average of one or more wireworms per bait station, consider the use of a registered seed treatment (Gaucho, Kernel Guard Supreme, Proshield with Force ST, lindane, diazinon + lindane) or a soil insecticide (Table 1). A seed treatment will protect the seeds but will not prevent wireworms from attacking the stem beneath the soil surface. To protect the seeds and seedlings in fields with wireworms infestations, it may be necessary to treat with a labeled soil insecticide. If your baiting procedure pinpoints wireworms in a specific area of the field, consider treating only the infested area rather than the entire field. You'll save money by reducing the amount of insecticide applied in the field. Results of the 2000 Insect Management & Insecticide Evaluations on wireworms are available on the Internet:

Efficacy of Soil Insecticides for the Control of Grape Colaspis, White Grubs, and Wireworms, in Field Corn in Menard County, Illinois, 2000
http://ipm.uiuc.edu/publications/evaluations/eval-2000/grape-colapsis.htm

Efficacy of Soil Insecticides for the Control of Wireworms, White Grubs, and Grape Colaspis in Field Corn, Logan County, Illinois, 2000
http://ipm.uiuc.edu/publications/evaluations/eval-2000/wireworm.htm

—Susan Ratcliffe, Kevin Steffey, and Mike Gray

Seed Treatments and Corn Rootworm Protection: Buyer Beware

As producers continue with preparations for spring planting, many are still unsure what to expect from seed treatments regarding corn rootworm protection. Although we have been very clear on this issue, questions continue to linger. Last year, in several issues of the *Bulletin* (17, 19, and 24), we provided data that indicated ProShield and the 1.3 milligram per seed rate of imidacloprid (Prescribe) did not provide consistent root protection at moderate to heavy infestations of corn rootworms. Please refer to the following Web site for more complete information on the efficacy of these seed treatments against corn rootworms in University of Illinois trials that were conducted in 2000: http://www.ipm.uiuc.edu/publications/evaluations/eval-2000/corn-rootworm.htm.

Last fall, we also presented efficacy data (*Bulletin* 24) from Iowa State University that pointed out the inconsistent nature of ProShield and Prescribe against corn rootworms. In 2000, ProShield and Prescribe provided only 22% and 9% consistency ratings, respectively, when averaged across six test locations in Iowa. Consistency was based on the percentage of times a product limited the node-injury rating to no more than 25% of a single node. Using this same benchmark, consistency ratings for other soil insecticides were as follows: Force 3G, T-band— 96%; Aztec 2.1G, T-band—96%; Fortress 5G, T-band—95%; Force 3G, furrow—94%; Counter 20CR, T-band—89%; Fortress 5G, furrow—86%; Lorsban 15G, T-band—83%; Counter 20CR, furrow—76%; Capture 2EC, T-band—75%; Thimet 20G, T-band—66%; and Regent 4SC, furrow, microtube—51%. Consistency in the check was 13% and not statistically different from either ProShield (22%) or Prescribe (9%).

These data, along with data from other university trials in the Corn Belt, clearly point out that seed treatments do not offer consistent corn-root protection against corn rootworm larvae. Potential buyers should be fully aware that depending on these products to provide consistent corn rootworm control could be a costly mistake. It is our opinion that these seed treatments, as currently designed and marketed, are not up to the challenge of protecting roots from injury against moderate to heavy pressure by corn rootworm larvae. Because most fields are never scouted, producers are typically poorly

Table 2. Summary of western corn rootworm monitoring program (Pherocon AM traps) in producers' soybean fields by county, 2000.

County	*Number of traps*[1]	*Trap capture avg.*[2]	*Number of fields*[3]
Bureau	4	0.09	5
Champaign	4	14.33	6
Champaign	12	5.42	6
Christian	4	0.04	2
Clark	4	0.56	1
Coles	4	0.43	5
Coles	12	2.10	1
DeKalb	4	0.31	13
DeKalb	12	0.10	1
DeWitt	4	1.41	1
DeWitt	6	2.77	8
DeWitt	12	1.92	11
Douglas	4	2.62	4
Douglas	12	2.58	9
Edgar	4	3.64	7
Edgar	12	3.40	1
Ford	4	8.72	3
Ford	12	4.78	3
Grundy	4	4.25	2
Grundy	12	3.24	2
Henderson	4	0.01	2
Henry	4	0.02	1
Iroquois	12	8.83	5
Kankakee	12	6.18	2
LaSalle	4	0.42	1
LaSalle	12	0.93	4
Lee	12	0.27	1
Livingston	6	10.32	1
Livingston	10	12.09	1
Livingston	12	7.60	23
Logan	4	2.06	2
Logan	6	0.10	1
Logan	10	0.08	2
Logan	12	0.27	5
Macon	4	0.35	3
Macon	12	0.45	1
McLean	4	2.43	2
McLean	12	2.78	62
Moultrie	4	0.38	2
Moultrie	10	0.31	1
Moultrie	12	0.49	3
Ogle	12	0.01	1
Peoria	4	0.03	3
Piatt	12	4.07	11
Piatt	16	0.73	1
Pike	12	0.82	1
Putnam	12	0.23	1
Shelby	4	0.06	1
Stephenson	12	0.06	1
Tazewell	4	0.98	1
Vermilion	4	10.84	6
Vermilion	12	10.84	2
Warren	4	0.02	1
Whiteside	4	0.08	9
Whiteside	12	0.02	1
Will	6	1.92	1
Woodford	4	4.43	2
Woodford	10	4.22	1
Woodford	12	3.25	6

[1]Number of Pherocon AM" traps distributed evenly within a producers' soybean field.
[2]Average number of adult western corn rootworms caught per trap per day throughout a 4-week monitoring period (late July through third week of August).
[3]Number of monitored soybean fields in a given county.

equipped to decide which fields support heavy to moderate infestations versus those fields with low infestations of corn rootworm larvae. So, the great majority of producers take out an "insurance policy" against corn rootworms. Make sure your coverage is up to speed.

For additional information on the performance of these seed treatments against corn rootworms, please go the following Web site: http://www.cropsci.uiuc.edu/classic/2001/Article1/index.htm.

—*Mike Gray and Kevin Steffey*

Western Corn Rootworm Populations in Soybean Fields 2000: Outlook for Larval Injury in Rotated Cornfields for 2001

In 2000, populations of western corn rootworm adults were very impressive in many soybean fields, especially those in east-central Illinois (Table 2). If corn rootworm larvae hatch under favorable soil conditions, root injury concerns could be a common story during the 2001 growing season. Corn rootworm larval survival tends to decrease if hatch occurs during wet springs and soils are saturated. In 2000, Susan Ratcliffe, Extension Entomologist in the Department of Crop Sciences, organized western corn rootworm monitoring data from 267 soybean fields in 35 Illinois counties. Producers and other agribusiness professionals reported western corn rootworm trap capture data directly to University of Illinois Extension via the Internet at http://www.aces.uiuc.edu/ipm/field/corn/imr/wcrscout/wcrscout.html. Western corn rootworm adult densities were monitored in producers' soybean fields with Pherocon AM traps. Although we recommend that producers evenly distribute 12 traps within their soybean fields, many elected to use fewer, especially in counties still outside the so-called "problem area" of east-central Illinois. Producers were asked to deploy their sticky traps in late July and continue their monitoring efforts through at least the third week of August. Once each week, new traps were positioned into fields. For more specific information on recommended scouting producers using Pherocon AM traps, please refer to our newly revised *Western Corn Rootworm Insect Information Sheet* at the following Web site: http://ipm.uiuc.edu/ipm/publications/infosheets/1-wcornr/wcornr.html.

How should the western corn rootworm capture averages (Table 2) be interpreted?

Initial on-farm research results suggested that average densities of two western corn rootworm adults caught per trap per day (Pherocon AM traps) could lead to economic root injury the following season in untreated (no soil insecticide used) first-year cornfields. More recent research indicates that average densities of five adults captured per trap per day in soybean fields may be required before root injury the following season in rotated cornfields (left untreated) approaches economic levels. Economic losses may occur when root injury across a cornfield is equal to an average root rating of 3.0 (moderate root pruning, never equivalent to one node) on the Iowa State 1 to 6 root injury scale. Recently published research indicates that when densities of western corn rootworms in a soybean field reach 10 adults per trap per day, root injury the following season may average 4.0 (one node of roots or the equivalent destroyed) in a first-year cornfield (if left untreated). When cornfields have average root injury that approaches 4.0, lodging and severe yield loss may occur. However, accurately predicting yield losses due to root injury is not easy. For instance, we know that interactions among soil moisture (especially during anthesis and after rootworm larval injury), corn hybrid chosen (root regeneration characteristics), and severity of root injury are complex. So an average root rating of 3.0, or even 4.0 in some years, will not always lead to economic losses. In some very dry and hot summers, certain hybrids that regenerate root tissue very poorly may suffer significant yield losses when average root ratings drop below 3.0. This is an important point: *the Pherocon AM traps and the suggested thresholds should be used only to predict root injury and not to predict economic losses*. In addition, *the traps and thresholds should not be used to trigger applications of insecticides to soybean fields to prevent oviposition (egg laying).*

Results outlined in Table 2 suggest that many producers' rotated cornfields are at economic risk if they remain untreated (no soil insecticide) during the 2001 growing season. As you review data within Table 2, remember that only county averages are presented. A considerable range of western corn rootworm adult densities occurred among soybean fields within the same counties. This variation can be observed more closely by looking at trap capture data for each field for each county. Township and section information also are provided for each scouting report in 2000 (http://www.ipm.uiuc.edu/publications/rootworm-2000/index.htm). When you examine this data set for the county of interest, you'll appreciate the importance of monitoring *each* field with Pherocon AM traps. The bottom line: be cautious with your interpretation of county averages presented in Table 2.—*Mike Gray*

European Corn Borer

With the continuing hoopla concerning transgenic crops and the question whether or not to plant a BT hybrid in 2001, it may be worthwhile to refresh your memory of the status of the European corn borer population in Illinois. Last fall (November 3), we published (*Bulletin*, No. 24) the county averages for the percentage of plants infested and the number of borers found per plant. Densities of overwintering borers have been very low for 2 consecutive years. The statewide average percentage of plants infested in 2000 was 41.8%. In 1999, the percentage of plants infested was even lower (24.3%). The statewide average number of borers found per plant was only slightly greater in 2000 (0.38 borers per plant) compared with 1999 (0.29 borers per plant). Entomologists at Purdue University also have reported finding very low overwintering densities of borers. The magnitude of these low populations can be placed in better context by examining densities of this pest over the past 20 years. European corn borer populations have been low in the past (well before the introduction of BT hybrids) and rebounded rather suddenly in some instances (1988 to 1989). No one knows for certain from year to year what the magnitude of corn borer infestations will be. This is especially true for the second generation of this pest. Because of the very low overwintering population of borers, I believe the spring flight of moths will be unimpressive this year. If environmental conditions are conducive to mating and egg laying this spring and midsummer, the second generation could provide some surprises. Of course, producers will always have the option of applying rescue treatments as needed.

With evidence that European corn borer densities are very low, is the use of a BT hybrid a sound pest-management approach for this spring? Is the use of a BT hybrid a good economic choice this spring? These are among many of the questions that producers undoubtedly were thinking about when they made seed selection choices this past winter. Given the following concerns: (1) continuing concerns (due in part to the extensive media coverage) about grain contamination and identity preservation issues, (2) uncertainty regarding the European and other overseas markets, and (3) the very low European corn borer population, anticipated demand for BT hybrids should continue to taper off. Until some of these issues are resolved, the anticipated commercialization of corn rootworm transgenic hybrids will continue to be slowed.—*Mike Gray*

What Can We Expect From Soybean Aphids This Year?

Consider that a mere 7 months ago we were embroiled in a lot of activity focused on an aphid that was not known to occur in North America before 2000. The soybean aphid, *Aphis glycines*, invaded soybean fields throughout the upper Midwest, primarily in northern Illinois, northwestern Indiana, southeastern Michigan, southwestern Minnesota, and southern Wisconsin. Surveys in August and September 2000 revealed that the aphid, an "import" from Asia, spread rapidly into other states as well: Iowa, Kentucky, Missouri, and Ohio. The aphid was found as far east as West Virginia.

We learned that the primary overwintering host for the aphids is buckthorn, several species of *Rhamnus*. Late in the summer, winged soybean aphids leave soybean fields to seek buckthorn plants, where the aphids reproduce sexually to produce eggs that will overwinter. In the spring, the aphids will spend two generations on buckthorn; the third generation will produce winged forms that will fly away to seek soybean as their summer host.

The burning question is, "Will the soybean aphid survive winters in the Midwest?" We suspect that they will; after all, they survive the winters in northeastern Russia and Korea. However, we are not certain if the soybean aphid will adapt to our native species of *Rhamnus*. If they do, we can anticipate more occurrences of soybean aphids in 2001.

We still have much to learn about this new pest of soybean, but we are poised to learn as much as we can in 2001 if infestations in soybean fields develop. A large team of scientists in the College of ACES at the University of Illinois, USDA-ARS in Champaign-Urbana, and the Illinois Natural History Survey is prepared to conduct a considerable amount of research this year. One of our initial efforts will be to establish tall suction traps that will sample flying aphids at six different locations in the state. Entomologists and plant pathologists in nearby states will embark on similar efforts. Trapping and field monitoring activities during the spring should enable us to determine when the aphids are leaving buckthorn for soybean. Hopefully this early-warning system will help us in our efforts to help you learn more about this intriguing pest.

Stay tuned for updates throughout the season.—*Kevin Steffey*

Alfalfa Weevil Will Be the First Insect We'll Watch For

As usual, the alfalfa weevil will receive considerable attention in the early issues of the *Bulletin* because it's the first insect pest of field crops in Illinois to become active each spring. As indicated in the article "Will Another Mild Winter Promote Insect Problems?", alfalfa weevils overwinter as eggs in southern Illinois. When spring temperatures consistently exceed 48°F, larvae hatch from the eggs and crawl to the terminal leaves, where they feed and develop.

Two distinct peaks of larval activity usually occur in southern Illinois, one from fall-deposited eggs and one from spring-deposited eggs. Hatching of overwintering eggs usually occurs when 200 degree-days (above a base temperature of 48°F) accumulate beyond January 1, and we suggest that scouting should begin when 250 to 300 degree-days accumulate. An early peak of third-stage larvae from overwintering eggs occurs after an accumulation of 325 degree-days; a second major peak of third-stage larvae from spring-deposited eggs occurs after an accumulation of 575 degree-days.

At the time this article was prepared, accumulated degree-days were not available from the Illinois Climate Network run by the Illinois State Water Survey. We will provide actual and projected accumulated degree-days in issue no. 2 of the *Bulletin*, which will be published during the first week in April. In the meantime, we encourage people in southern counties to begin watching for alfalfa weevils and signs of their feeding injury, especially if temperatures consistently exceed 48°F. At this time last year, some folks had already observed evidence of injury caused by alfalfa weevils. During most years, alfalfa weevil activity in southern Illinois begins in mid- to late March or early April.

At a forthcoming meeting of entomologists at the end of March, we will learn more about the status of alfalfa weevils in the north-central states. We'll report what we learn in a future issue of the *Bulletin*.—*Kevin Steffey*

WEEDS

Corrections for the 2001 Illinois Agricultural Pest Management Handbook

The following are corrections to Chapter 2 (*Weed Control for Corn, Soybeans, and Sorghum*) of the 2001 Illinois Agricultural Pest Management Handbook. In Table 16, *Soybean herbicides (soil- or foliar-applied): Grass and nutsedge control ratings* (page 67), the efficacy rating for Poast Plus on shattercane should be 8+. The efficacy ratings for Select on johnsongrass, wirestem muhly, and quackgrass should be 9, 8+, and 8, respectively. The efficacy rating for Raptor on shattercane should be 9, and there is no control of shattercane with Basagran (0).—*Christy Sprague and Aaron Hager*

Getting the Most From Your Grass Control Dollars

With increased nitrogen and fuel prices this year, many growers are wondering what are some ways to help reduce input costs. One option would be to maximize weed control by optimizing herbicide inputs. Currently, there are a number of growers and applicators considering early preplant (EPP) applications of acetamide herbicides for grass control in corn. These EPP applications have been widely used over a number of years. Many of these grass herbicides have labels that allow applications from fall to 45 days prior to planting as split applications, to 30 days prior to planting or planting as single applications, depending on the herbicide. However, in light of current economic considerations, when is the best time to apply these herbicides for optimal grass control in corn?

One reason EPP applications have become so popular is that they help spread out the workload for the herbicide applicator. Applying herbicides earlier in the spring gives the applicator more time to cover more acres. Another benefit to EPP applications is that they help reduce the risk of herbicide failure due to lack of precipitation following preemergence applications.

However, depending on application timing, many of these grass herbicides will need to be applied as split applications. These split applications would lead to another trip across the field, increasing herbicide application costs. Additionally, many of these herbicides need to be applied at higher rates the farther away from planting the application is made. These increases in herbicide rates lead to increased herbicide costs.

Another question is how EPP applications perform compared with applications closer to planting. Over the last several years many universities have examined the performance of these herbicides at different application timings. Some of the work conducted at the University of Illinois by Dan Parker and Dr. Bill Simmons has compared the performance of several grass herbicides at various application tim-

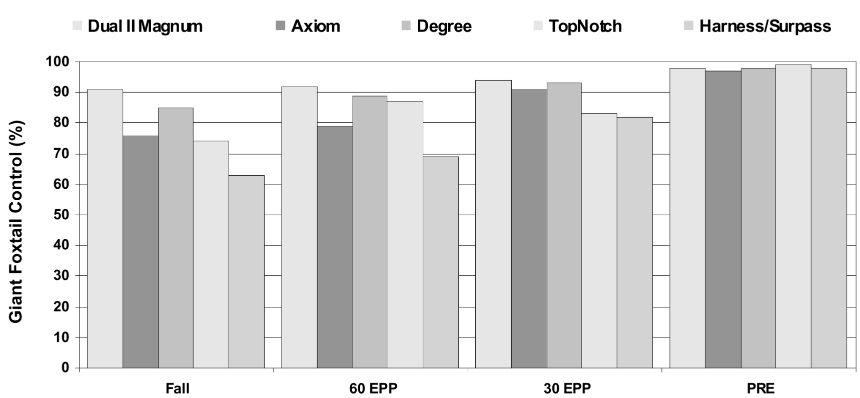

Figure 1. Influence of application timing on giant foxtail control 30 DAP with 5 grass herbicides.

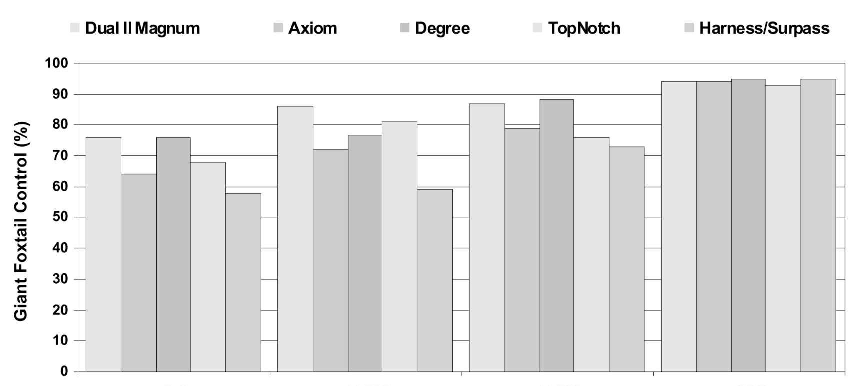

Figure 2. Influence of application timing on giant foxtail control 60 DAP with 5 grass herbicides.

ings. The four application timings examined were fall (mid-November), 60 days prior to planting, 30 days prior to planting, and at planting. These research trials were conducted at three locations in Illinois for 2 years. Evaluations were made on giant foxtail control 30 and 60 days after corn planting.

By 30 days after planting (DAP, Figure 1), giant foxtail control was greater than 97%, with all herbicides applied at planting. When herbicide applications were made 30 days prior to planting, only three herbicides provided greater than 90% giant foxtail control, and when applied 60 days prior to planting, only one herbicide provided greater than 90% control. By 60 days after planting (DAP, Figure 2), only the at-planting herbicide applications provided greater than 90% giant foxtail control. The average giant foxtail control decreased the further away from planting time the herbicides were applied.

So how can you get the most out of these soil-applied herbicides in these tight input times? The simple answer: the closer these herbicides are applied to planting, the better the season-long grass control.—*Christy Sprague and Aaron Hager*

A Roundup of Glyphosates—What Are the Differences?

Few would argue with the statement that the commercialization of glyphosate-resistant soybean varieties has dramatically changed how weeds are managed in soybean-production systems. When first commercially available during the 1996 growing season, there were only limited options with respect to which glyphosate-containing product could be used for in-crop applications. However, numerous glyphosate-containing products are now available for postemergence use in glyphosate-

Table 3. Glysophate formulations and product equivalents.

Trade name	*Company*	*Active ingredient/acid equivalent per gallon or pound*	*Product rate equivalent to 0.375 lb ae*	*Product rate equivalent to 0.5625 lb ae*	*Product rate equivalent to 0.75 lb ae*	*Crop*[a]
Roundup UltraMax 5L	Monsanto	5 lb ai/3.83 lb ae	12.6 fl oz	18.8 fl oz	25 fl oz	C&S
Roundup Ultra 4L	Monsanto	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Roundup UltraDry 71.4WDG	Monsanto	0.714 lb ai/0.649 lb ae	9.24 oz	13.9 oz	18.5 oz	C&S
Roundup Original 4L	Monsanto	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Roundup Custom 5.4L	Monsanto	5.4 lb ai/4 lb ae	12 fl oz	18 fl oz	24 fl oz	C&S
Roundup D-Pak 6.42L	Monsanto	6.42 lb ai/4.75 lb ae	10 fl oz	15 fl oz	20 fl oz	S
Touchdown 5 5L	Syngenta	5 lb ai/3.426 lb ae	14 fl oz	21 fl oz	28 fl oz	S
Touchdown 3AE	Syngenta	3.7 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Glyfos 4L	Cheminova	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Glyfos X-Tra 4L	Cheminova	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Glyphomax 4L	Dow Agro	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Glyphomax Plus 4L	Dow Agro	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Credit 4L	Nufarm	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	S
Gly-Flo 4L	Micro Flo	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	S
Glyphosate Original 4L	Griffin	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	S
Acquire 4L	BASF	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	S
Silhouette 4L	Cenex/Land O'Lakes	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Rattler 4L	Helena	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Mirage 4L	UAP	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Buccaneer 4L	Several	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Rascal 4L	Several	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S
Honcho 4L	Several	4 lb ai/3 lb ae	16 fl oz	24 fl oz	32 fl oz	C&S

a Labeled for use in Roundup Ready (glysophate-resistant) designated corn (C) and/or soybeans (S).

Example calculations to determine products rates equivalent to 0.5625 lb acid equivalent:

Liquid formulations:

$$\frac{0.5625\ lb\ acid\ equivalent}{acre} X \frac{1\ gallon\ of\ product}{?\ lb\ acid\ equivalent\ per\ gallon} X \frac{128\ fluid\ ounces}{gallon}$$

Dry formulations:

$$\frac{0.5625\ lb\ acid\ equivalent}{lb\ of\ product} X \frac{1\ lb\ of\ product}{?lb\ acid\ equivalent\ per\ lb} X \frac{16\ ounces}{lb}$$

For example, to determine the product rate of Credit equivalent to 0.5625 lb acid equivalent:

$$\frac{0.5625\ lb\ acid\ equivalent}{acre} X \frac{1\ gallon\ of\ Credit}{3lb\ acid\ equivalent\ per\ gallon} X \frac{128\ fluid\ ounces}{gallon} \bullet 24\ fluid\ ounces\ of\ Credit$$

For example, to determine the product rate of Roundup UltraDry equivalent to 0.5625 lb acid equivalent:

$$\frac{0.5625\ lb\ acid\ equivalent}{acre} X \frac{1\ lb\ of\ Roundup\ UltraDry}{0.649\ lb\ acid\ equivalent\ per\ lb} X \frac{16\ ounces}{lb} \bullet 13.9\ ounces$$

resistant soybean varieties as well as glyphosate-resistant corn hybrids. While all these options contain the same ingredient (glyphosate) that controls the weeds, other differences exist that may influence the level of weed control obtained. What are some of these differences and how would they influence weed control?

Determining Equivalent Product Rates

Is 1 pint of glyphosate product X equivalent to 1 pint of glyphosate product Y? The simple answer is that it depends. Equivalent rates of herbicides containing the same ingredient are usually calculated based on equivalent amounts of *active ingredient*. With glyphosate-containing products, however, equivalent rates must be calculated on the basis of comparable *acid equivalents*. The acid equivalent represents only that portion of a herbicide formulation that is physiologically active in the plant. All glyphosate formulations commercially available for use in glyphosate-resistant crops are formulated as salts to enhance absorption into the plant. Once the formulation (acid + salt) is absorbed into the plant, the salt portion is cleaved off, leaving only the acid portion to block the site of action. The primary salts used in formulated glyphosate products include isopropylamine, monoammonium, trimesium, and diammonium. Different formulations may contain different salts. For example, Touchdown 5 contained the trimesium salt, whereas Touchdown contains the diammonium salt. Roundup Ultra Max contains the isopropylamine salt, whereas Roundup Ultra Dry contains the monoammonium salt. These different salts can influence the amount of active ingredient/acid equivalent contained in a gallon of formulated product because they have different molecular weights. Table 3 lists many commercially available glyphosate formulations along with the amount of active ingredient and acid equivalent contained in 1 gallon of formulated product. Equivalent product application rates based on acid equivalent are also presented. Some example calculations following the table are provided to show how to determine equivalent product rates based on acid equivalents.

Is a surfactant formulated with the product, or does a surfactant need to be added?

Several glyphosate products contain a surfactant already in the formulation so no additional surfactant is required. Other glyphosate products require the user to add the appropriate amount of surfactant. Surfactant selection may influence the level of weed control achieved, so choose a high quality surfactant based on past experience or per manufacturer recommendations. Each respective glyphosate-containing product label will indicate whether surfactant should or should not be added. Virtually all glyphosate products, however, recommend the addition of a spray grade ammonium sulfate (AMS).

The labels for most of these glyphosate-containing products are similar; however, some minor label differences may exist (for example, rain-free intervals). Even though these labels are similar, you should always consult the respective product label for specific product recommendations.

In many university trials, the various glyphosate-containing products have performed very similarly. If equivalent application rates are calculated based on acid equivalents and a high-quality surfactant is added when recommended on the label, few if any differences in weed control should result.—*Aaron Hager and Christy Sprague*

New Guide on Early Spring Weed Identification and Control (NCR 614)

There is a new, color North Central Regional Publication on identification and management of vegetation commonly found in no-till fields. This publication is an excellent guide to aid in identifying those hard-to-identify weed problems in no-till fields, such as winter annuals and biennials. This 22-page guide contains more than 130 color photographs of vegetative and reproductive stages of 45 weeds common to field crops across much of the Midwest. The guide also contains a taxonomic key to aid in identification and a table listing the sensitivity of various species to selected herbicides. The guide is available from University of Missouri, Extension Publications, 2800 Maguire Road, Columbia, MO 65211-0001 or by calling (573)882-7216.—*Christy Sprague and Aaron Hager*

New Herbicides and Label Changes for 2001

Aventis

Define 60DF (flufenacet) is labeled for use in field, white, and seed corn. Define controls several annual grass weed species and contains the same active ingredient as one component of Axiom, Domain, Epic, and Axiom AT. Applications may be made early preplant (up to 45 days prior to planting), preplant incorporated, or preemergence (after planting but before crop emergence). Application rates are determined by soil texture, organic-matter content, and application timing, and range from 12 to 21 ounces per acre. Control of broadleaf weed species can be enhanced by tank-mixing Define with a broadleaf herbicide.

Balance PRO 4SC (isoxaflutole) is a liquid formulation of the active ingredient in Balance WDG. Applications may be made early preplant (21 days prior to planting or up to 30 days prior to planting when used in a sequential program), preplant incorporated (do not incorporate deeper than 2 inches), or preemergence (before crop emergence). Applications made after corn emergence can result in severe corn injury. Corn should be planted at least 1.5 inches deep, and the seed must be completely covered with soil and furrow-firmed. Failure to thoroughly close and firm the seed furrow may allow the herbicide to directly contact the seed, which can cause injury. Application rates are based on soil texture, organic-matter content, and application timing, and range from 1.5 to 4.5 fluid ounces per acre. To convert the old WDG rate to the 4SC rate, multiply the WDG rate by 1.5. For example, 1 ounce of Balance 75WDG would be equivalent to 1.5 fluid ounces of Balance PRO. Corn hybrids vary in their tolerance to isoxaflutole.

BASF

Outlook 6E (dimethenamid-P) contains the resolved isomer of dimethenamid. The product is labeled for use in corn (field, seed, pop, and sweet), soybean, and grain sorghum (treated seed). Outlook may be applied up to 45 days prior to planting, preplant incorporated, preemergence, or postemergence (up to 12-inch corn, between first and third trifoliolate soybean, *but not postemergence on grain sorghum*). Outlook will not control emerged weeds, so a tank-mix partner will be needed to control emerged weeds. Lay-by applications in corn (but not sweet corn) between 12 and 36 inches in height are also allowed. Application rates range from 10 to 21 fluid ounces per acre (depending on soil texture and organic-matter content) and are approximately 55% of the Frontier 6E rates. Outlook will be available in limited quantities during 2001.

Guardsman Max 5L (dimethenamid-P + atrazine) contains the same active ingredients as Guardsman but is formulated with the resolved isomer of dimethenamid (Outlook). Application rates range from 2.4 to 4.6 pints per acre, depending on soil texture and organic-matter content. Guardsman Max may be applied from 45 days prior to corn planting until corn reaches 12 inches in height. The product is also labeled for use in grain sorghum if the seed was previously treated with an herbicide safener. Guardsman Max will be test marketed in limited quantities during the 2001 growing season; however, full conversion from Guardsman to Guardsman Max is expected for the 2002 growing season.

Bayer

Everest 70WDG (flucarbazone) is labeled for postemergence applications in wheat. The grass control spectrum is fairly narrow (green and yellow foxtail, wild oats, ryegrass species), and a tank-mix partner is needed for broadleaf control. Use rates range from 0.41 to 0.61 ounce per acre. Applications should be made when wheat has between 1 and 6 total leaves (1 to 4 leaves on the main stem plus 2 tillers) and must include a nonionic surfactant (0.25% v/v).

Dow AgroSciences

Hornet 68.5WDG (flumetsulam + clopyralid) will replace Hornet 85.6WG. The change in formulation will result in application rates ranging from 2 to 6 ounces per acre. Some confusion may exist with respect to the amount of active ingredient contained in this formulation. Hornet *78.5* represents the active ingredient content of flumetsulam and clopyralid, while *68.5* represents the active ingredient content of flumetsulam and the acid equivalent content of clopyralid.

The maximum postemergence application rate of *FirstRate 84WG (cloransulam)* has been increased from 0.3 ounce to 0.6 ounce per acre.

Last November, Dow AgroSciences announced it had acquired the *acetochlor herbicide product line* from Zeneca. Under the agreement, acetochlor brands that are now Dow AgroSciences's include Surpass, FulTime, and TopNotch.

DuPont

Steadfast 75WDG (nicosulfuron + rimsulfuron) contains the active ingredient of Accent and rimsulfuron in a 2:1 ratio. Steadfast may be applied at 3/4 ounce per acre to corn up to 12 inches in height or exhibiting less than six leaf collars, whichever is most restrictive. Steadfast controls several annual grass and broadleaf weed species. However, because both premix components are ALS-inhibiting herbicides, Steadfast may not provide satisfactory control of ALS-resistant weed biotypes. Applications must include either a crop-oil concentrate or nonionic surfactant as well as an ammonium nitrogen fertilizer. Do not apply Steadfast to corn grown for seed, popcorn, or sweet corn.

Harmony GT 75DF (thifensulfuron) contains the same active ingredient as Pinnacle 25DF, which has been discontinued. Harmony GT may be applied to soybean and cereals. In wheat and barley, the application rate of Harmony GT ranges from 0.3 to 0.6 ounce per acre, and applications should be made after the crop is in the 2-leaf stage but before the flag leaf is visible. Applications to cereals should include a nonionic surfactant (0.25 to 0.5% v/v), unless a liquid fertilizer solution is used as the total carrier. For soybeans, Harmony GT may be applied at 1/12 ounce per acre after the first trifoliolate has expanded fully. Always include a nonionic surfactant or crop-oil concentrate (under dry conditions or during cool weather) and an ammonium nitrogen fertilizer. Soybean injury is more likely when a crop-oil concentrate is used.

A reduced rate (0.25 ounce per acre) of *Synchrony STS 42DF (chlorimuron + thifensulfuron)* may be applied to any soybean type, including non-STS varieties. When applying 0.25 ounce of Synchrony STS to non-STS soybean varieties, add nonionic surfactant (0.25% v/v) instead of crop-oil concentrate.

FMC

Several label changes have been made to the *Aim 40WDG (carfentrazone)* product label to reduce the likelihood of significant corn injury. These changes include (1) do not make applications within 6 to 8 hours of precipitation, (2) spray tips should be a minimum of 18 inches above the crop and sprayers operated to avoid the application of excessive herbicide directly over the rows or into the corn whorls, and (3) use drop nozzles only in seed-corn production fields. Aim may also be applied postemergence to grain sorghum (through 6-leaf stage) at 1/3 ounce per acre, and soybean (up to third trifoliolate) or wheat (up to jointing) at 1/3 to 2/3 ounce per acre. *Do not* include crop-oil concentrate with postemergence applications. The label recommends a post-directed application in soybean, as severe soybean injury can result if Aim comes in contact with soybean foliage.

Command Xtra (3 lb a.i. clomazone and 4 lb a.i. sulfentrazone) will be available as a co-pack in 2001. Command Xtra is a soil-applied herbicide for control of certain grass (Command) and broadleaf (Authority) weed species. Application rates will vary according to soil texture and range from 0.25 lb to 0.375 lb a.i. sulfentrazone and 0.5 to 0.75 lb a.i. clomazone per acre.

Gauntlet is a co-pack containing the active ingredients of FirstRate (0.84 lb a.i.) and Authority (0.75 lb a.i.). Gauntlet may be applied early preplant (up to 30 days prior to planting), preplant incorporated, or preemergence (prior to soybean emergence) for control of broadleaf weed species. Application rates are determined by soil organic-matter content and range from 0.25 to 0.31 lb a.i. sulfentrazone and 0.6 to 0.75 lb a.i. cloransulam.

Monsanto

Amplify 84WDG (cloransulam) contains the same active ingredient as FirstRate. Application rates range from 0.6 to 0.75 ounce per acre soil-applied or 0.3 ounce per acre postemergence.

Roundup Ultra Max (glyphosate) will replace Roundup Ultra. Ultra Max contains 5 lb a.i./3.71 lb acid equivalent/gallon, whereas Roundup Ultra contains 4 lb a.i./3 lb. acid equivalent/gallon. Ultra Max contains the same formulated additive system as Ultra.

Syngenta (formed by the merger of the agricultural divisions of Novartis and Zeneca)

Gramoxone Max (paraquat) will replace Gramoxone Extra. Max contains 3 lb a.i./gallon compared to 2.5 lb a.i./gallon in Extra.

Touchdown (glyphosate) contains the same active ingredient as Touchdown 5 but is formulated as the diammonium salt instead of the trimesium salt. Touchdown contains 3 lb acid equivalent/gallon, whereas Touchdown 5 contains 3.4 lb acid equivalent/gallon. Touchdown can be applied postemergence to glyphosate-resistant soybean varieties and corn hybrids. Common postemergence application rates will be in the 1.5- to 2-pint range.

Callisto (mesotrione) registration is expected during the third quarter of 2001.

Valent

Valor 51WDG (flumioxazin) registration is expected sometime during the spring of 2001. Valor will be labeled as a soil-applied soybean broadleaf herbicide with a similar mode of action as sulfentrazone (Authority).—*Aaron Hager and Christy Sprague*

New Color-Enhanced Herbicide Site-of-Action Bulletin

The University of Illinois Extension bulletin, "Utilizing Herbicide Site of Action to Combat Weed Resistance to Herbicides," establishes a color-coded herbicide site-of-action classification system based on 14 sites of action. This three-page bulletin is intended to enhance the ability of growers to rotate herbicides based on site of action to slow further development of herbicide-resistant weed biotypes. The front cover explains the importance of using a site-of-action classification scheme for herbicide-resistance management. The inner table separates herbicide sites of action into 14 "primary" colors. Herbicide chemical families sharing a particular site of action are coded in shades of the respective site-of-action family "primary" color. The bulletin also includes common and trade names of herbicides commonly used in agronomic production systems in the Midwest. The back page of this bulletin includes corn and soybean herbicide premixes, with individual premix components coded with the appropriate color based on their respective site of action. The order numbers and prices for this bulletin are CS1 ($2) for individual publications and CS1-PK ($25) for packages of 25. This bulletin may be ordered through Information Technology and Communication Services, University of Illinois, Marketing and Distribution, 1917 South Wright Street, Champaign, IL 61820, or by calling 1-800-345-6087, or by e-mailing acespubs@uiuc.edu.—*Christy Sprague and Aaron Hager*

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The *Pest Management & Crop Development Bulletin* is brought to you by University of Illinois Extension and Information Technology and Communication Services, College of Agricultural, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign. This newsletter is edited by Erin Cler and formatted by Oneda VanDyke, ACES/ITCS.

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