Bt Refuge Compliance: Grower Stewardship Vital to Maintain Durability of This Technology

As the percentage of Bt stacked corn hybrids continues to increase significantly across the Corn Belt, it will become even more important for growers to implement refuges according to prescribed guidelines. Even though there has been considerable discussion and debate about the merits of the “refuge-in-the-bag” concept, this resistance management strategy has not been approved for the 2009 growing season. At the 2009 Corn and Soybean Classics meetings, we asked producers (utilizing Turning Point Technology to gather responses) to describe their level of refuge compliance in 2008. According to their anonymous answers, 83%, 85%, 85%, 85%, 76%, and 76% of those responding in Mt. Vernon (n = 87), Champaign (n = 124), Bloomington (n = 110), Springfield (n = 161), Moline (n = 90), and Malta (n = 88), respectively, who planted a Bt hybrid in 2008 implemented a 20% refuge according to recommended guidelines. This represents an overall 82% refuge compliance rate for the 660 producers who responded to this question.

Although the great majority of producers are to be credited for their stewardship of this technology, many thousands of acres that should have been devoted to a refuge were not. The escalating use of Bt hybrids, even on those acres with very low pest densities, along with the lack of refuge compliance on some farms will heighten the selection pressure for resistance development by European corn borers and/or corn rootworms. Also, it is important to remember that each kernel of Bt seed is treated with a neonicotinoid (clothianidin and/or thiamethoxam) insecticidal seed treatment. By planting Bt seed, producers are placing selection pressure on many secondary insect populations (seed corn maggots, white grubs, wireworms) that may also develop resistance to this important class of insecticides.

On August 14, 2008, the USDA’s Federal Crop Insurance Corporation (FCIC) board of directors approved premium rate reductions for producers who use selected “seed technologies” during the 2009 growing season. A list of corn hybrids that qualify for this program can be found at the following website: www.rma.usda.gov/news/2008/08/fcicbiotech.html. This approved list is conditional and requires the applicant’s cooperation with the Risk Management Agency “to develop a single unified biotechnology endorsement and work out associated details.”

The following seed technologies were approved by the FCIC board for Illinois: YieldGard Plus with Roundup Ready Corn 2, YieldGard VT Triple, YieldGard VT Triple PRO, Herculex Xtra, Herculex Xtra RR2, Agrisure CB RW (stacked), and Agrisure 3000GT hybrids. Producers are encouraged to go to the website for additional details concerning eligibility requirements. According to the guidelines, “insured producers will be required to purchase a buy-up level of coverage and plant at least 75 percent of their insured corn acres in a unit to a qualifying corn hybrid.”
When we asked producers at the 2009 Classics whether a similar USDA crop insurance program influenced
their decision to plant a Bt hybrid in 2008, a majority (an average of 82%
of producers across the six locations)
said no. The number of respondents in
Mt. Vernon was 86; Champaign, 123;
Bloomington, 120; Springfield, 157;
Moline, 92; and Malta, 91.

We look forward to the upcoming
growing season and encourage pro-
ducers to implement refuges according
to prescribed guidelines. Producers
who detect unusual levels of insect
damage (root injury or stalk tunneling)
to Bt hybrids this season should be
sure to contact their appropriate seed
company representative and/or univer-
sity entomologist.— Mike Gray

Alfalfa Weevil Hatch Underway in Southern Illinois

A quick review of degree-day accum-
ulations (base 48 °F) from January 1
through April 7 indicates that alfalfa
weevils are hatching from eggs across
the southern third of Illinois. This
spring event occurs each year when
300 (base 48 °F) degree days have
accumulated from January 1. Degree-
day totals for a number of locations
through April 7 are as follows: Belle-
ville, 278; Carbondale, 335; Dixon
Springs, 324; Springfield, 282. First and
second instars are very likely already
causing some light leaf-feeding injury,
especially on slopes warmed by the
sun.

I encourage readers to visit the degree-
day calculator website to keep track of
alfalfa weevil development throughout
the spring: www.isws.illinois.edu/
This site also should be helpful to
track the development of many other
insect pests of field crops. Life cycle
information and scouting protocols
have been thoroughly described for
alfalfa weevils and can be viewed at
www.ipm.uic.edu/fieldcrops/insects/
alfalfa_weevil/index.html. If you are
observing significant alfalfa weevil ac-
tivity, please share your observations
with us.— Mike Gray

WEEDS

Wheat Growth Stage and
Herbicide Applications

Recent crop condition reports indicate
that approximately 75% of the Illinois
winter wheat crop is rated as good or
excellent. Herbicide applications to
control certain winter annual and pe-
rennial weeds must be properly timed
to provide good weed control and
minimize the potential for crop injury.
Applications made to actively growing
weeds and during periods of warm air
temperatures generally provide more
effective and complete weed control
as compared with applications made
during cold, cloudy conditions.

The labels of all herbicides commonly
used for weed control in Illinois wheat
have application restrictions based
on wheat developmental stage. Most
products commonly used in Illinois
indicate that applications must be made
before the wheat jointing stage. Table
I presents information derived from
the herbicides labeled for use in small
grains. Before making any herbicide
application, consult the respective herb-
icide label for additional information.

If you are considering applying a
herbicide with liquid nitrogen as the
carrier, be sure to consult the label
beforehand. Not all herbicides allow
applications with liquid nitrogen as the
carrier, and those that do might have
specific recommendations with respect
to including or excluding other spray
additives or their application rates.

Turn Out the Lights—The Party’s Over

The utility of glyphosate for post-
emergence weed control in glypho-
sate-resistant crops has contributed
to an unparalleled level of technol-
gy adoption. This technology has,
in many respects, “simplified” weed
control for soybean farmers in various
ways. A single active ingredient—
glyphosate—with application rate
flexibility easily adjusted according
to weed spectrum and size, controls
most broadleaf and grass weed species
without the need for tank-mix partners
or changes in spray additive selection.
This broad-spectrum weed control
has resulted in glyphosate’s use as a
“stand-alone” postemergence soybean
herbicide being much more common
than its application in tank-mix combi-
nations with other postemergence her-
bicides. While it is still relatively early
in the game with respect to adoption

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Crop</th>
<th>Maximum growth stage</th>
<th>Rate per acre</th>
<th>Legume underseeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4-D amine</td>
<td>Wheat, oats</td>
<td>Before joint</td>
<td>0.5–1.5 pt</td>
<td>Yes</td>
</tr>
<tr>
<td>2,4-D ester</td>
<td>Wheat</td>
<td>Before joint</td>
<td>0.5–1 pt</td>
<td>No</td>
</tr>
<tr>
<td>Airl 1.9EW</td>
<td>Wheat, oats</td>
<td>Up to joint</td>
<td>0.5–2 fl oz</td>
<td>No</td>
</tr>
<tr>
<td>Buctril</td>
<td>Wheat, oats</td>
<td>Boot</td>
<td>1–1.5 pt</td>
<td>Yes</td>
</tr>
<tr>
<td>Banvel, Clarity</td>
<td>Wheat, oats</td>
<td>Wheat: before joint</td>
<td>2–4 fl oz</td>
<td>No</td>
</tr>
<tr>
<td>Callisto 4SC</td>
<td>Oats</td>
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<td>3 fl oz</td>
<td>No</td>
</tr>
<tr>
<td>Harmony Extra XP or Harmony GT XP</td>
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<td>Before harvest</td>
<td>Wheat: 0.3–0.6 oz</td>
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</tr>
<tr>
<td>MCPA amine</td>
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<td>Oats: before joint</td>
<td>0.25–1.5 pt</td>
<td>Only up to 1/2 pt</td>
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<td>Olympus 70DG</td>
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<td>Boot</td>
<td>0.6–0.9 oz</td>
<td>No</td>
</tr>
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<td>Wheat</td>
<td>Joint</td>
<td>4.75 oz</td>
<td>No</td>
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<tr>
<td>Starane 1.5EC</td>
<td>Wheat, oats</td>
<td>Flag leaf</td>
<td>1/2–2/3 pt</td>
<td>No</td>
</tr>
<tr>
<td>Stinger 3S</td>
<td>Wheat, oats</td>
<td>Early boot</td>
<td>1/4–1/3 pt</td>
<td>No</td>
</tr>
</tbody>
</table>
of glyphosate-resistant corn hybrids in Illinois, observations to date suggest that a similar use pattern (i.e., glyphosate utilized as the sole postemergence herbicide) is developing in corn.

Several motifs are common in weed science. Some are intuitive and easily observed each season, such as the annual presence of weeds in the vast majority of Illinois crop acres. Other motifs, however, recur over much longer periods, such as the ability of weed species to adapt to widespread production practices. The time it takes for weed adaptations to occur depends on myriad factors. For example, many years elapsed following the introduction of atrazine before fall panicum became a significant and problematic weed species in corn, but only three to five years elapsed after the introduction of ALS-inhibiting herbicides before the first ALS-resistant weed biotype was reported. Prior experience also has demonstrated that weed adaptations occur faster in management systems that rely on a single practice or a limited number of them.

As biological systems (i.e., weeds) change in response to the widespread use of glyphosate, weed control practices utilizing glyphosate will undergo a concomitant change. The rapid adoption of glyphosate-resistant corn hybrids and weed spectrum changes in response to the near-ubiquitous use of glyphosate in soybean suggests the following thesis: the ability of glyphosate to be a stand-alone herbicide for weed management in soybean will (continue to) decline. In other words, the “simplicity” of glyphosate as a stand-alone weed management tool soon will be relegated to the annals of history. Soil-residual herbicides and glyphosate tank-mix partners will increasingly be needed to manage both current challenges and those lurking beyond the horizon.

Extension weed scientists often have discussed the merits of including soil-residual herbicides in glyphosate-resistant cropping systems, but they less frequently have discussed the advantages and disadvantages of including tank-mix partners with glyphosate. Are there instances when glyphosate tank-mixes might improve overall weed control? Are there instances when tank-mixes may not be advisable? The answer to both questions is yes.

**Advantageous Tank-Mixes**

**Glyphosate-resistant volunteer corn.** Volunteer corn is easily controlled with glyphosate—unless it carries the glyphosate-resistance trait. The number of acres planted with glyphosate-resistant corn hybrids in Illinois has been steadily increasing and will likely continue increasing into the foreseeable future. Soybean farmers thus will need to rely on an alternative herbicide to control volunteer glyphosate-resistant corn. This can be accomplished through the use of certain soil-applied herbicides, but control of this “new” weed often is more consistent by tank-mixing certain ALS- or ACCase-inhibiting herbicides with glyphosate.

Several postemergence herbicides provide excellent control of glyphosate-resistant volunteer corn. The ACCase-inhibiting herbicides (clodethion, quizalofop, fluazifop, sethoxydim) frequently are tank-mixed with glyphosate to control glyphosate-resistant volunteer corn. Be mindful that spray additive recommendations for ACCase inhibitors can vary depending on how the product is used (alone or in a tank-mix) or the type of glyphosate formulation with which it is tank-mixed. For example, additive recommendations can vary depending on whether a product is tank-mixed with a glyphosate formulation containing a “built-in” adjuvant system or if it is tank-mixed with a glyphosate formulation that itself requires additional surfactant.

**Enhanced control of certain herbicide-resistant weed populations.** Weed scientists in Indiana and Ohio have conducted extensive research to define management options for glyphosate-resistant giant ragweed in soybean. Extension weed scientists in those states recommend applying the maximum allowable rate of glyphosate (1.5 lb ae per acre) during the first postemergence application followed by a second application (if needed) within 3 weeks. They also have reported some success controlling giant ragweed populations resistant to both glyphosate and ALS-inhibiting herbicides by combining glyphosate with Flexstar or Cobra/Phoenix, followed by a sequential application of glyphosate 3 weeks later. The recommendations for glyphosate-resistant giant ragweed demonstrate glyphosate tank-mixes can be advantageous, but other glyphosate-resistant weeds may warrant a different approach.
Tank-Mixes Not Recommended

Glyphosate-resistant waterhemp. University of Illinois weed scientists do not recommend prophylactically tank-mixing other soybean herbicides with glyphosate for control of waterhemp that might be resistant to glyphosate. If a waterhemp population is known to be resistant to glyphosate but sensitive to PPO inhibitors, applying a PPO inhibitor first followed several days later with glyphosate will likely result in better overall control. Tank-mixing glyphosate with a PPO inhibitor might also provide better control than glyphosate alone. Otherwise, unless the population is confirmed as glyphosate-resistant, recommendations are to make the first glyphosate application when waterhemp plants are 3 to 5 inches tall, followed by field scouting no more than 7 days later to determine treatment effectiveness. If scouting reveals waterhemp control was inadequate and retreatment is necessary, farmers are encouraged to apply a PPO-inhibiting herbicide ( lactofen, fomesafen, aclonifen) at a full labeled rate and with recommended spray additives as soon as possible.

Why recommend glyphosate be applied alone when the herbicide sensitivity/resistance profile is unknown instead of being tank-mixed with a PPO inhibitor? There are several justifications for this recommendation:

1. Glyphosate-sensitive waterhemp plants 3 to 5 inches tall can be adequately controlled with 0.75 to 1.0 lb ae glyphosate per acre. (Variability in control with glyphosate, even for glyphosate-sensitive populations, tends to increase as plants become larger.) Be alert to any waterhemp plants (in the recommended size range) that survive this rate of glyphosate, especially if other weeds in the field are adequately controlled.

2. Research that has evaluated these tank-mixes specifically for control of a glyphosate-resistant waterhemp population is limited. University of Illinois field research in 2008 represented our initial effort to evaluate these tank-mixes on a confirmed glyphosate-resistant waterhemp population. One year of field-generated data is not sufficient from which to draw many conclusions, and lingering questions remain about tank-mixes of glyphosate and PPO inhibitors, including these:

- How likely is it that antagonism will occur when combining glyphosate (a translocated herbicide) with PPO inhibitors (contact herbicides)? If antagonism occurs, will the control of waterhemp (sensitive, PPO-resistant, glyphosate-resistant) or other weed species be affected?

- What spray additive(s) should be included with these tank-mixes? PPO inhibitors generally perform better with COC or MSO, while most glyphosate product labels allow only AMS or NIS.

- What type of spray nozzle, spray pressure, and volume should be used in conjunction with these tank-mixes? PPO inhibitors require more thorough spray coverage of the target vegetation for effective control than do translocated herbicides.

- At what rate should each tank-mix component be applied?

3. More PPO-resistant waterhemp populations have been confirmed in Illinois than glyphosate-resistant populations. A tank-mix of glyphosate and a PPO inhibitor would not improve control of PPO-resistant waterhemp over that of glyphosate alone.

In summary, glyphosate tank-mix partners can improve control of certain problem weed species over that obtained by glyphosate alone. However, in other instances tank-mixes may not be an advisable recommendation. As more data are generated from experiments designed to answer these lingering questions, extension weed scientists will be able to further refine these types of recommendations.

—Aaron Hager

PLANT DISEASES

Considerations for Using Fungicide Seed Treatments on Soybean

Use of fungicide seed treatments on soybean seed is not currently the norm for Illinois producers, but it has increased in the past few years. Beginning with the 2009 season, seed of some varieties (such as all Monsanto Roundup Ready 2 Yield varieties) are being sold pretreated with fungicide treatments, which eliminates the producer’s input on whether a fungicide seed treatment is needed and, if so, which product(s) to use.

For those who still have a choice, there are some factors to consider when deciding to use fungicide seed treatments on soybean. In general, there are two potential reasons to treat soybean seeds with a fungicide: if poor-quality seed is being planted, and to protect against seedling diseases.

Poor-quality seed. It is always recommended that the highest-quality seed be planted, but this is not always possible. Fungicide seed treatments may be able to help improve the stand establishment of a variety with poor-quality seed. This is especially true if the poor quality is due to infection by a fungal seedborne pathogen. If it is due to mechanical damage, a fungicide seed treatment will not increase the germination rate, but it may help in providing a more uniform stand, which could (but doesn’t always) translate into greater yields.

In 2008, a field research trial was conducted at Urbana to evaluate the effect of fungicide seed treatments on a soybean seed lot with a low germination rate. In this trial, fungicide seed treatments did improve the yield compared to the untreated check. In addition, some seeds were run through the seed treater without being treated with a fungicide to determine whether running the treater had a detrimental effect. In this trial, there was no significant difference between untreated
seed and seed run through the treater with no fungicide applied.

Protection against seedling diseases. Seedling diseases of soybean can be caused by pathogens such as *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Fusarium*. In some cases, a complex of these pathogens may affect soybean seedlings. Fungicide seed treatments can be effective in protecting seeds and seedlings from these pathogens for a short period of time, which may allow the seedings to become established and be productive plants. The risk of being affected by seedling diseases may increase when planting early (April to early May), when planting into a field with a history of seedling disease problems, and when weather conducive for seedling diseases (generally cool and wet) appears just after planting. A summary of University of Illinois soybean seed treatment trials conducted from 2001 to 2008 shows that the average increase in yield obtained with a fungicide seed treatment was 0.8 bu/A; however, the yield advantage became greater when fields were planted earlier (late April to first week of May).

**Which product(s) should I use?** If you decide to use a seed treatment on soybean, it is important to use a product that provides broad-spectrum control of many pathogens. The treatment should include one of the active ingredients mefenoxam or metalaxyl, which provide some protection against oomycete pathogens (i.e., *Pythium* and *Phytophthora*). In addition, the treatment should contain at least one other fungicide (fluioxonil, trifloxystrobin, pyraclostrobin) that will provide broad-spectrum control against *Fusarium* and *Rhizoctonia*. —Carl A. Bradley

**Applying Foliar Fungicides to Early-Stage Wheat**

Early applications (Feekes 5—just before jointing, when wheat begins growing rapidly) of reduced-rate fungicides are currently being discussed and promoted in some regions of the state. The possible benefit of applying a fungicide this early would be that it could potentially be applied with a herbicide. The potential downfall is that it may not be as effective as a single application later in the season for protection of the flag leaf (Feekes 9). Results from trials conducted at Southern Illinois University at Carbondale and Belleville from 2004 to 2007 (Dr. Bryan Young’s research) and at the University of Illinois in 2008 (my research) indicate that full-rate fungicides applied at Feekes 9 or 10 have shown a more consistent benefit than half-rate fungicides applied at Feekes 5. Unless leaf, stem, or stripe rust is already apparent at Feekes 5, an application this early will potentially have less benefit than an application at Feekes 9.

A trial conducted at Carbondale (SIU research by Dr. Bryan Young) in 2004 and 2005 evaluated Headline applied at 3 fl oz per acre at Feekes 5 and Headline applied at 6 fl oz per acre at Feekes 9. The study was conducted over 18 to 25 wheat varieties per year. In 2004, the full-rate application at Feekes 9 was more effective at controlling foliar diseases than the half-rate application at Feekes 5, and yields were also higher after the full-rate Feekes 9 application than after the half-rate Feekes 5 application or when untreated. In 2005, only small differences were detected between untreated and Headline-treated plots, regardless of the rate and application timing. Foliar disease pressure was much greater in 2004 compared to 2005, which is likely why Headline fungicide increased yield on several varieties that year. —Carl A. Bradley

**Corn Planting Date Revisited**

March 2009 was marked by swings in both temperature and precipitation in different parts of Illinois, with rainfall ranging from 2 to 3 inches above normal in the northern half of the state to 1 to 2 inches below normal in the southeastern part. Temperatures were above normal over most of the state, with departures ranging from 3 degrees or more in southern areas to less than 1 degree in northern areas. The weather changed rather quickly in the latter part of March, and the first week of April has produced temperatures of 5 to 7 degrees below normal and rainfall ranging from less than normal in western Illinois to an inch or more above normal in the eastern part of the state. So “on average” the spring weather so far hasn’t been too...
bad, but in most areas it has been less than ideal.

Some people took advantage of the warm, dry weather to plant in mid-March. Reports of planting were most numerous from parts of southwestern Illinois, including the “south of Springfield” area that often is among the earliest to report a start to planting. Some of this corn had emerged by the first of April, and since then it has suffered from the low temperatures, including temperatures below freezing on April 6 through 8 and daytime highs early this week in the 40s. Some light snow has helped frost the cake for some of these fields. Night temperatures in the mid- to upper 20s are not very friendly to emerged corn plants, of course, and it’s possible that some will be frozen to near seed depth. Very small corn plants may not survive this. Even those that do survive to grow back from the seed will have used up so much of the seed reserve (what has not in the meantime been lost to microbial action in cool, wet soils) that they may not come back with much vigor. As we learned in 2005, freeze damage that results in plants growing back slowly and without their normal vigor may well result in yield loss, even if stands end up okay. At this point, it would be prudent to have seed lined up to replant most fields that were planted in March.

Most of eastern Illinois has wet soils at present, though other parts of the state are starting to dry out. The first date of planting in our corn planting trials this year was made on Friday, April 3, at Monmouth, and the date at Perry was April 7. The cool temperatures will slow drying, however, and it’s unlikely that planting of large acreages will get underway unusually early this year. Especially when soil temperatures are well below 50 degrees like they are in most areas now, it is unwise to plant into soils before they are dry enough to work and plant well. Remember that soil at field capacity is at its most “compactable,” and even flotation tires can do some damage when they carry heavy equipment across soils that have not warmed up enough to dry out to below field capacity.

The 2008 growing season in Illinois was a very unusual one, with cool, wet conditions through May, adequate to excessive rainfall through July in many places, dry weather in much of August, and rainfall and favorable temperatures in September and October that allowed crops to fill well as they matured late. Yields were high. This affected the planting date work that we did in 2008, with flat or even increasing yields as corn was planted later in central and southern Illinois. At Perry, averaged over populations ranging from 30,000 to 40,000, corn planted on April 7 yielded 205 bushels per acre and that planted on May 30 yielded 215. The extreme example was at Brownstown, where the April 17 planting yielded 169 bushels per acre and the June 6 planting yielded 231.

These results are unusual enough to skew the response averaged over the four years of the study, even including data from other locations. As a compromise, I included the 2008 data from Perry and excluded that from Brownstown. But this serves as a reminder that all planting date responses ever assembled reflect the large amount of variability that occurs over years, and so they are not nearly as precise at predicting planting date responses as the numbers might seem to indicate. Averages over years and locations are the best we can do to make predictions, but the chances that these predictions will hold exactly in any given year are very small.

*Figure 1* gives the planting date response curves for northern Illinois (Monmouth and DeKalb), central Illinois (Urbana and Perry), and southern Illinois (Brownstown and Dixon Springs), updated—with the exception noted above—with the 2008 data. We used the same hybrid for the northern locations and Urbana, and a later-maturing one in the southern locations. The latest-planted corn matured with no difficulty in all years and locations, though some of the latest plantings might have had more insect or disease pressure than earlier plantings.

The responses shown in *Figure 1* are converted to numbers in *Table 2*, with average yields and the average loss in yield per day of delay during each 10-day period from early April to early June. According to this, yield losses reach 1 bushel per day by early May in northern and southern Illinois, while the loss is more gradual.
in central Illinois, reaching 1 bushel per day of delay only in the last third of May. Is central Illinois really this different? The answer is probably not, but including the data from Perry in 2008 effectively decreased the penalty predicted from delayed planting. Unless we know that a year like 2008 can never happen again, there’s no good reason to exclude the data.

Given the similarity of the responses to planting delay in southern and northern Illinois, it would not be unreasonable to use the yield losses from those regions to predict response to planting date anywhere in Illinois. That would mean losses of 1, 1.5, and 2 bushels per acre for each day of delay during the first, middle, and last third of May, respectively. Due to higher yields in northern Illinois, putting these losses on a percentage basis means greater rates of decline in southern Illinois than in northern Illinois. It’s an old debate about which method is better, but because “bushels pay the bills,” I tend to favor the use of bushels and not percentages.

Planting on May 1 is expected to yield only 7 or 8 bushels less than planting on the optimum date in the southern and northern parts of Illinois and less than that—only about a bushel less than planting on the optimum date (April 20)—in central Illinois. So delays in planting until past the end of April, though they cost some yield, do not automatically mean large yield losses. Planting even two or three weeks after the optimum date might well produce higher yields than planting into cool, wet, compacted soils closer to, or before, the optimum date.

Negative yield “losses” for the periods in early April mean that yields actually increase as planting is delayed during that period, because the “best” planting date is later than early April. Such yield penalties for planting very early are typically not large, but they are not uncommon—of 20 site-years (not counting sites with unusual circumstances such as delayed earliest plantings), the earliest planting yielded more than the second planting 11 times, the second planting yielded more than the first planting 8 times, and at one site there was no difference.

When the weather is consistently warm after the first planting emerges, early planting tends to do better relative to later planting. But if warm temperatures early are followed by cool or cold temperatures after corn has passed the 2- or 3-leaf stage (this would most commonly be the largest, earliest-planted corn), we think there can be a temperature-related decrease in yield potential. In 2006 at Urbana, where the first planting yielded almost 40 bushels per acre less than the second planting, there was a period in mid-May during which high temperatures averaged less than 50 degrees. In contrast, April and May 2008 were both cool months, and even though corn emerged and grew slowly from the first two or three planting dates, we did not see lower yields from the earliest planting dates at most locations. We do not know much about this phenomenon, but for now we can only hope that May (as well as the last half of April) turns out to be consistently warm. With the exception of the unusual year in 2008 (when May was like a typical April and June was somewhat like a typical May), two of the three highest corn yields in Illinois have come in years when May temperatures were above normal.—Emerson Nafziger

### Corn and Nitrogen Prices and Spring Nitrogen Management

The price of nitrogen (N) has moved rapidly in recent months. The price of corn has changed as well, and swings continue. As a result, we suggest that Illinois producers who have yet to apply N take a look at the rate calculator at extension.agron.iastate.edu/soilfertility/nrate.aspx as they set rates for this spring. The numbers for Illinois used in the calculator have been updated to use the 2008 data, so they represent the best information we have on N response for Illinois producers.

**Table 3** has guideline N rates and ranges for corn following corn and corn following soybean in northern, central, and southern Illinois, based on anhydrous ammonia price of $600 per ton and a corn price of $3.80 per bushel.

These numbers are different than they were when we ran the calculator last fall, due to the addition of new data (and some deletion of old data) and to the fact that the corn-to-N price ratio has changed. The changes have been modest in northern and central Illinois, but following the wet weather and highly responsive N rate trials in southern Illinois in 2008, plus the addition of some new data from previous years, guideline N rates increased in southern Illinois. Remember that the ranges given for each rotation and region provide support to adjust N rates based on experience and knowledge of the field and crop.

Cautions regarding spring application include not applying ammonia

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<thead>
<tr>
<th>Period</th>
<th>Northern IL</th>
<th>Central IL</th>
<th>Southern IL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg yield (bu/A)</td>
<td>Loss/day (bu/A)</td>
<td>Avg yield (bu/A)</td>
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<td>Apr 1–10</td>
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<tr>
<td>Maximum yield</td>
<td>April 12</td>
<td>April 20</td>
<td>April 11</td>
</tr>
</tbody>
</table>

Data are derived from those shown in Figure 1.
under the row shortly before planting, and not applying very much N solution in contact with, or very close to, seeds. Some producers have applied anhydrous ammonia as part of a spring strip-till operation in the past, only to experience damage as soils dried out after planting and ammonia was able to move up into the rooting zone, burning off roots or even killing small plants. When it stays as dry after planting, waiting a week or more after ammonia application to plant may not prevent damage. If it rains soon after application, damage is unlikely. Because this can’t be predicted, it is safer if producers can use GPS and assisted steering to apply spring ammonia between the corn rows, or between where the rows will be once they’re planted. Waiting to apply N until soils are dry enough to allow the ammonia to disperse better will also help, but this can mean a considerable wait.

Applying N closer to the time when the crop will take it up generally improves efficiency, by decreasing loss potential and by allowing N placement so that plants can access N easily. But claims that some forms of N are “more available” than others, or that the plants “prefer” some forms, are often shaky. Urea converts to ammonium quickly in the soil, and between urea, ammonia, and UAN (in which one-fourth of the N is nitrate), we apply mostly the ammonium form as fertilizer. Ammonium is converted to nitrate by bacteria as soils warm up, so the mix available to plants changes from more ammonium early to more nitrate over time. By the time rapid N uptake starts in June (plants with 6 or 7 leaves), much of the N from early-applied fertilizer is usually in the nitrate form. The supply of N released from soil organic matter also increases with soil temperatures, and this N is initially in the ammonium form. We know that plants don’t thrive when provided only nitrate, but the mixture of N forms in the soil is usually taken up and used by the plant with no problems. Attempts to keep more of the N as ammonium, including the use of N-Serve in the spring—especially at or after planting—are often unnecessary, given the short time between application and plant uptake.

Anhydrous ammonium is often a cost-effective form to use for side-dressing, but it’s not likely to be more effective than UAN or other nitrate-containing forms based on the fact that it changes the mixture available to the plant toward ammonium. N-Serve might be cost-effective if N is applied long before planting, in order to slow the conversion to nitrate.

Finally, urea is gaining in importance as an N source, and we need to manage it properly. The risk of loss from decomposition to ammonia and loss into the air is high if urea stays on a warm, dry soil surface for a number of days, especially if the soil surface has a lot of residue. This is true with both dry urea and for the half of UAN solution that is in the form of urea. Rainfall within a few days after application usually moves the urea into the soil and limits losses, but if it stays dry, incorporating urea that remains on the soil surface may be needed to preserve it. There are urease inhibitors that reduce the rate of breakdown, and also ESN, which is polymer-coated urea that is physically protected for some time against breakdown. The added cost for such protection needs to be weighed against other methods of protecting urea N from loss.—Emerson Nafziger and Fabián Fernández

<table>
<thead>
<tr>
<th>Illinois region</th>
<th>Corn following soybean (lb N/A)</th>
<th>Corn following corn (lb N/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MRTN ratea</td>
<td>Rangeb</td>
</tr>
<tr>
<td>North</td>
<td>148</td>
<td>134–163</td>
</tr>
<tr>
<td>Central</td>
<td>170</td>
<td>155–186</td>
</tr>
<tr>
<td>South</td>
<td>174</td>
<td>158–191</td>
</tr>
</tbody>
</table>

Calculations were made using the N rate calculator, with a corn price of $3.80 per bushel and anhydrous ammonia price of $600 per ton.

aThe N rate that produces the maximum return to N.

bThe range of N rates over which the return to N will be within $1 per acre of the maximum.

For the past three years we have had a project funded by the Fertilizer Research and Education Council (FREC) to look at corn N rate responses in on-farm, replicated strip tests. This has gone very well, thanks to great cooperators. While the project was scheduled to run for only three years, we do have some remaining funds that I would like to use to have more trials in 2009. Because so many of the trials over the past three years have been in central Illinois, I would like most of the 2009 trials to be in northern Illinois (close to or north of I-80) and in southern Illinois, close to or south of I-70. It would be great to have 10 to 12 trials in each region, plus the several that are already underway in central Illinois.

As in the past, we would like trials both on corn following corn and on corn following soybean. Cooperating producers (and in some cases their fertilizer dealers) conduct these trials using a simple design, with 5 N rates—0, 50, 100, 150, and 200 lb N/acre—applied in three different reps, for a total of 15 strips. Strips can be any reasonable size, from 8 to 16 rows wide by 300 to 1,000 feet long, as long as accurate rates can be applied and accurate yield measurements made. Additional N, such as that in MAP or DAP or in starter, can be applied to the whole trial area as long as total N applied this way doesn’t exceed 35 to 40 lb of N. Cooperators receive a payment for each trial completed.

Please contact me at 217-333-9658 or ednaf@illinois.edu if you are inter-
Sulfur Research: Call for Volunteers

Volunteers are needed throughout Illinois who would like to participate in on-farm research to measure corn response to sulfur applications. While not widespread, the frequency of sulfur deficiency in corn has increased over the years since it was first seen in Illinois more than three decades ago. This increase is likely the result of several factors, including less use of sulfur-containing fertilizers, insecticides, and fungicides; less atmospheric sulfur deposition; greater removal rates by increasing grain yields; increased use of conservation tillage, which may reduce sulfur availability; and fewer livestock operations, causing less application of manure.

Soil conditions. We are especially interested in light-colored soils (less than 2% organic matter, coarse texture, or both), but we would like to characterize sulfur response across the state, so we will consider other soils as well. Fields that have received manure or sulfur applications within the last 5 years will not be considered.

Equipment, sulfur sources, and time of application. Volunteers conducting these trials will follow a simple design applying 0 and 50 lb S/acre as a broadcast application. The rates will be applied in three different reps for a total of 6 strips. The strips will need to be georeferenced using GPS. Strips can be anywhere from 8 to 16 rows wide by 300 to 1,000 feet long. What is important is that the size of the strip allow accurate application of the rate and that the yields can be collected from the center portion of the strip (have border rows on each side).

Sulfur will be limited to one of three sources:

- ammonium sulfate (NH₄)₂SO₄ (21-0-0-24)
- MicroEssentials sulfur ME S15 (13-33-0-15)
- elemental sulfur (0-0-0-90)

If the sulfur source contains other accompanying nutrients, the corresponding rates of those nutrients will need to be applied to other treatment strips to avoid a differential response to nutrients other than sulfur.

Volunteers will not be required to take plant or soil samples, but they need to allow the researcher to visit the strips approximately three times during the growing season.

If you are interested in participating, please contact me at fernande@illinois.edu or 217-333-4426.—Fabián Fernández

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

Same report as the last several weeks: wet soil conditions and poor drying conditions are common throughout the northern region. Most of the area experienced rain, sleet, and snow on April 5, with some areas reporting 2 inches of snow accumulation. There have not been any reports of tillage or seeding.

Below-freezing temperatures at night have allowed dry fertilizer application to occur on frozen ground the following mornings. According to the Illinois State Water Survey, the 4-inch bare soil temperature at 10 a.m. on April 6 was 36 to 38 °F in the northwest portion of Illinois. Spring has been slow to appear in the northern region.

Jim Morrison, crop systems extension educator, reported wheat in the Rockford area at or approaching Feekes 3.

Southern Illinois

Fields are wet, and some show ponded water throughout much of the region. The northwest counties are somewhat drier, and some tillage and anhydrous ammonia applications resumed midweek. The forecast through the coming weekend is for near-normal temperatures and rain, which will put an end to any field work that has resumed.

Wheat is at Feekes stage 6 (jointing). Nighttime temperatures were at or below freezing earlier in the week, but they were not cold enough to cause major concern with the crop. Winter annuals are becoming more obvious on fields with thin stands where no herbicides have been applied.

Alfalfa new growth is at 11 inches or greater. Alfalfa weevils are on schedule based on GDU accumulations, and pinhole feeding
can be observed in more southerly counties. Scouting in those counties should begin now, with special attention focused on south-facing slopes that have had greater GDU accumulations.

**West-Central Illinois**

Frequent rain and cooler-than-normal temperatures have allowed very little field work to be done in the region. The 10-day forecast is for continued wetter and cooler conditions. This is going to make an even bigger challenge for spring fertilizer applications and field work, as the late harvest last fall prevented a lot of work that producers were hoping to get done this spring. It’s looking like a long and late planting season at this point.

There are several reports of alfalfa heaving in a band from Bloomington through Peoria to Galesburg. Many producers have reported heaving up to 3 or 4 inches. Producers should check fields soon, and if plants are heaved more than 1-1/2 inches and taproots are broken less than 12 inches below ground, those fields will likely need to be terminated immediately.

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