The New 7400 TerrainCut Trim & Surrounds Mower. At last, have the flexibility to handle every part of the rough, with the push of a button. Shift from a 68” to 74” width of cut, right from the seat. Shift a deck out 15” to trim around trees or bunkers. Or climb and cut with the GRIP all-wheel drive and best-in-class horsepower. Demo one. And never look at your trim mower the same way again.
Continued from page 49

This damage often results in initial yellow areas that grow larger and coalesce into patches of brown or tan turfgrass. The most severe damage often occurs in late summer and early fall and in the same areas each year.

Ongoing projects at North Carolina State University and the University of Florida have been set up to monitor adult activity throughout the year and find the presence of larvae in the turf to gain insight into the hunting billbug’s lifecycle in the Southeast. While adult billbugs can be collected in large numbers easily, locating larvae in the field has been next to impossible. The few larvae we found in 2007 were 6 inches below the surface, deeper than the 4 inches previously reported for billbug larvae.

During intense monitoring in North Carolina during 2007, large numbers of adults were present in the fall just prior to and during occurrence of damage. The damage is a result of the large number of adults feeding on the surface during a time of the year when most warm-season grasses are stressed. At this time, larvae are too small to cause damage on this scale, and adults are ravenously feeding to build fat stores for overwintering — or in the case of females, egg production. Only the locations that receive intense feeding result in the “dry patches” during the summer and fall with the majority of damage going unnoticed until the following spring.

During early March 2008, late instar larvae were found in the thatch rather than the soil of dormant zoysiagrass. Traditional knowledge holds that early instars feed in and on the crowns of grass while late instars feed on the root system below the surface. It is assumed these larvae were in the thatch to feed, but this is the first behavior of this kind recorded.

Containment and control

If we are to effectively manage this pest, we need to elucidate more clearly some of this critical information. We need to know which stage causes the damage and have a clear picture of the presence of each life stage. Control of the larval stage can most likely be accomplished with an effective grub insecticide if it is timed properly. Adults can possibly be controlled with a number of the pyrethroid insecticides, such as Talstar, DeltaGard or Scimitar. In the absence of a thorough knowledge of pest biology and ecology, the use of combination products, such as Allectus or Aloft, could cover all the bases. For example, the bifenthrin in Allectus will have activity against the adults, and the imidacloprid should control the larvae. Given our ignorance of pest biology at this time, combinations might be the best insurance treatment available until our knowledge base improves.

It has long been known that effective control of white grubs and mole crickets requires knowledge of pest biology, a means to monitor activity and timely applications of the best product(s) for control. The same is true for the hunting billbug. This knowledge will be gained through comprehensive field and laboratory studies that outline its lifecycle and behavior in the warm-season turfgrass areas.

In the coming years, we will continue to monitor adult activity with linear pitfall traps, not only in warm-season grasses, but expand to include cool-season grasses such as fescue and bluegrass. Greenhouse studies are being conducted using field-collected adult billbugs to gain a clearer understanding of lifecycle length and potential generations per year. Laboratory studies will provide new information on the damaging stages and adult behavior. In addition, studies tracking the movement and location of adults on the surface, in the thatch and in the soil before, during, and after overwintering will be conducted using innovative tracking methods. As our knowledge of this pest increases, our ability to manage it and prevent the damage that we are seeing more frequently on bermudagrass and zoysiagrass will also improve.

Dr. Rick Brandenburg is the co-director of the Center for Turfgrass Environmental Research and Education and at North Carolina State University. Jake Doskocil is a research assistant in the entomology department. He is working toward his Ph.D. on the biology and ecology of the hunting billbug.

REFERENCES


Gene Flow in Genetically Altered Crops Helps Progress Transgenic Turfgrass

By David Gealy

Gene flow in a larger context

Gene flow is only one of several mechanisms by which plants or seeds become intermixed at low levels with other plants or seeds where humans did not intend them to be. This type of unintended mixing occurs with both transgenic and nontransgenic plants and crops. Other mechanisms include inadvertent physical dispersal or mixing of seed, quality-control failures and inevitable human mistakes. Low or trace levels of commingling via all of these mechanisms is virtually unavoidable in...
### TABLE 1

Examples of useful traits being imparted to plants using all available approaches, and estimates of the probable consequences from gene flow

<table>
<thead>
<tr>
<th>New characteristics being imparted to crop plants</th>
<th>Potential grower/agricultural problems</th>
<th>Potential nonagricultural/human safety problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Potential for natural selection process to transform crop into unmanageable &quot;weed&quot; or &quot;volunteer&quot;</td>
<td>Potential for natural selection process to worsen existing problem or create new agronomic problems resulting from gene flow to wild/compatible relative</td>
</tr>
<tr>
<td>Herbicide tolerance</td>
<td>med&lt;sup&gt;1&lt;/sup&gt;</td>
<td>low-med&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Insect tolerance</td>
<td>low-med</td>
<td>med</td>
</tr>
<tr>
<td>Disease tolerance (fungal, bacterial, viral)</td>
<td>low-med</td>
<td>med</td>
</tr>
<tr>
<td>Nematode tolerance</td>
<td>low-med</td>
<td>low-med</td>
</tr>
<tr>
<td>Salt tolerance</td>
<td>low-med</td>
<td>low-med</td>
</tr>
<tr>
<td>Drought tolerance</td>
<td>low-med</td>
<td>med</td>
</tr>
<tr>
<td>Cold/freezing tolerance</td>
<td>low-med</td>
<td>low-med</td>
</tr>
<tr>
<td>Improved nitrogen use efficiency</td>
<td>low</td>
<td>low-med</td>
</tr>
<tr>
<td>Early season vigor</td>
<td>low</td>
<td>low-med</td>
</tr>
<tr>
<td>Increased growth rate</td>
<td>low</td>
<td>low-med</td>
</tr>
<tr>
<td>Reduced plant height</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>Seed shattering resistance</td>
<td>neg</td>
<td>neg</td>
</tr>
<tr>
<td>Altered flowering time</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>Male sterility in crop plant</td>
<td>neg</td>
<td>neg</td>
</tr>
<tr>
<td>Yield/yield components</td>
<td>neg</td>
<td>neg</td>
</tr>
<tr>
<td>Altered maturity date</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>Altered fruit shape/flavor</td>
<td>neg</td>
<td>neg</td>
</tr>
<tr>
<td>Seed protein or oil content or quality</td>
<td>neg</td>
<td>neg</td>
</tr>
<tr>
<td>Plant-made pharmaceuticals (PMPs) (many traits)</td>
<td>neg</td>
<td>neg</td>
</tr>
<tr>
<td>Industrial compounds</td>
<td>neg</td>
<td>neg</td>
</tr>
</tbody>
</table>

1. Approaches include transgenic as well as traditional, nontransgenic classical breeding approaches that use long-established methods to introduce and select for desirable traits in crops. All traits are eventually manipulated through classical breeding methods before commercialization.

2. Estimates compare the most probable outcomes relating to gene flow. Outcomes of gene flow listed here may differ among transgenic crops; some crop/weed species combinations are more likely than others to have high outcrossing or gene flow; and some weed species are inherently more aggressive than others.

3. Key for degree of problem expected (author estimates). Negligible, "neg"; low, "low"; medium, "med"; high, "high." The degree of the problem is likely to vary for a given characteristic or trait depending on the reproductive biology of the species, the trait itself and the cropping system in which it is used.

Source: Council for Agriculture Science and Technology
When It Comes To Turf Quality, Ask Those Closest To It.

"I heard Nitroform® fertilizer gets really high scores in tests by independent labs—that includes me."

— Angus, Randy Moody's Black Lab

Slow-release Nitroform® fertilizer has made quite a positive impact on Superintendent Randy Moody and his dog, Angus, at Georgia's Longshadow Golf Club. "It's consistent, with no surge growth or flushes, so we save time and labor," says Randy.

To please the players on your course—both the two- and four-legged kinds—ask your Agrium Advanced Technologies rep or call 800.422.4248. Tell us what your dog thinks at agriumat.com/dog and win great prizes for you and your pooch!
Continued from page 53

commercial-scale plant production. Thus, requirements for unrealistically low occurrence of unwanted substances, such as transgenic seed, can lead to progressively higher overall costs to industry and consumers without a measurable benefit.

Gene flow from transgenic crop plants to weedy or wild relatives can be an issue if they are sexually compatible. Thus, one way to view gene flow issues in a global context is from the perspective of the important worldwide food/feed crops and the weedy or wild species with which they are sexually compatible. About 200 plant species account for essentially all of the significant economic activities for humans worldwide, and approximately 10 percent of these account for almost all of the human caloric consumption. Among the world’s worst weed species, only five groups — related weeds of rice, sorghum, rapeseed, sugarcane and oats — are sexually compatible with the most important crops. The potential for gene flow between crop and weed species might not become actual gene flow due to differing habitats or geographic distribution, genetic barriers to outcrossing, etc. The number of combinations of transgenic crop/weed or transgenic crop/nontransgenic crop that are likely to develop highly troublesome gene flow problems is quite small globally. Problems with particular weed or crop species, however, could occur locally or regionally for certain traits conferred by transgenics.

The biology of the transgene trait will largely determine consequences of gene flow to sexually compatible nontransgenic crops, weeds and wild relatives. Outcrossing from herbicide-tolerant transgenic crops can produce progeny that is highly favoredin areas where the particular herbicide is used, but not in other areas. However, ordinary selection pressure from repeated herbicide use in herbicide-resistant crops may lead to a greater development of weed resistance (in the absence of gene flow) than gene selections attributable to gene flow between the crop and weed.

Importation of weeds or other plants from foreign lands is an historic problem, but instances in which fully domesticated crops have become weed nuisances are rare. The chances that transgenic modification of a single trait in a domesticated crop would change the crop into a successful weed also is low, and gene flow from the majority of transgenic crops probably will have minimal ecological impacts outside of agricultural areas.

Transgenes that confer tolerance to stresses — such as drought, diseases, insects and Salty soil — might require different or additional evaluation because gene flow into nontransgenic crops or weedy relatives can provide selective advantages in both agricultural and nonagricultural settings.

Risk assessment for transgenic crops

Before transgenic crops are approved for commercial use, law requires that they pass extensive testing addressing any significant food safety, environmental protection and human/animal health issues. Once approved, concerns about low-level presence of transgenes from gene flow or other mechanisms mostly revolve around economic issues, such as contract specifications and consumer expectations.

Risk assessment is an early step in the approval process for transgenic crops. Risk is the possibility of harm occurring. For a risk to be realized, there must be something harmful or adverse and also a likelihood that it will occur. Hazards do not pose risks unless there is significant exposure. Likewise, significant exposure does not constitute a risk if it poses a very low hazard. Gene flow fits the exposure part of the risk equation. Risk assessments of transgenic crops in the United States use accepted scientific methods and analyses. They are case by case; conclusions are examined in light of new and established information, and they are comparative, using the nontransgenic crop or plant as the basis for characterizing risk. The vast majority of gene flow events between transgenic crops possessing a wide array of transgenic traits and nontransgenic crops or weeds likely will not lead to a hazard. The transgenic crops approved for commercial

Continued on page 60
YOUR TURF NUTRITION PLAN MAY NOT BE WORKING AS WELL AS IT COULD

Which means your turf is probably not as strong as you need it to be. That is why for nearly 20 years, Floratine has used only the purest ingredients and has patented foliar and soil nutrition technologies to help you get vital nutrients onto, into, and moved around your turf. And to help manage common yet challenging turf issues, Floratine has developed Turf Action Plans. Customized TAP Packs feed up to one full acre, providing an efficient, effective nutrition program that ensures you have the strongest turf. Now that's nutrition at work.

To learn more, talk to your Floratine distributor or visit www.floratine.com

www.floratine.com
Triton™ is here.

Turf disease, on the other hand is leaving.
Chipco Triton is a new broad-spectrum fungicide that is descending on turf diseases everywhere. Now you'll be able to get rid of anthracnose, brown patch, and dollar spot while keeping your turf healthy and green. Even better, when you combine Triton with other Bayer products containing StressGard, like Chipco Signature, you get unbeatable protection against the stress your golf course faces, even in the summer heat.

As always, you're Backed by Bayer. And that means our team of professionals is your team of professionals. All of our research and support is to ensure you have the most effective products available. Superior products and superior support - only from Bayer.
Continued from page 56

use in the United States to date have been shown to pose no or minimal risk to health and the environment.

Developing uniform seeds for planting is a major economic concern for producers and suppliers of transgenic and nontransgenic seed. For many decades, procedures for maintaining genetic integrity in seed production have been in place for nontransgenic crops, but some amount of admixture — via pollen flow or mechanical mixing — occurs with all seed-production operations. Seed certification programs, which began in the United States in the early 1900s, typically use a pedigree system that begins with the breeder and progresses to foundation seed, registered seed and certified seed, which is then sold to farmers for planting the commercial crop. Despite numerous precautions, seed laws recognize that achieving zero-tolerance thresholds is not possible.

Isolation of production fields to varying degrees has been used to minimize the inflow and outflow of pollen to and from these fields. This principle can be used with seed production fields, transgenic crops or both. Although this practice can restrict pollen flow substantially, it cannot assure zero gene flow on a landscape level. Novel molecular approaches to further prevent unwanted transfer or spread of transgenes are being developed and could be implemented where warranted. Among these are: 1) insertion of transgenes into organelles — such as chloroplasts — that do not pass along their genes through pollen; 2) adding a male sterility trait that prevents seed production in crop/weed plants that receive transgenic pollen; 3) genetic use restriction technologies, which cause sterility in second-generation seeds; and 4) tightly linking desired transgenes to a gene that is deleterious to reproductive fitness so transgenic weedy or volunteer populations cannot build up after an outcrossing event.

David Gealy is a plant physiologist with the USDA-ARS Dale Bumper's National Rice Research Center, where he specializes in biology control and gene flow of weeds in rice. He previously worked as a plant physiologist at the USDA for 12 years. Gealy has been a member of the board of directors for the Weed Science Society of America since 2006.

REFERENCES


