

TURFGRASS TRENDS

■ GLYPHOSATE TOLERANCE

Glyphosate-Tolerant Perennial Ryegrass

By Jonathan Schnore

Would you ever get the notion to spray a rough or fairway that you wanted to keep with glyphosate, the active ingredient in Roundup? For most superintendents, the thought of doing that would be akin to career suicide or at least a final desperate act before seeking employment in another field. But that's exactly what Kevin Hicks, superintendent at the Coeur d'Alene Resort in Coeur d'Alene, Idaho, intends to do.

The Coeur d'Alene resort golf course is located on beautiful Lake Coeur d'Alene and is known for its famous floating green. It was voted 11th best-manicured course in the nation and is the last place you would expect this sort of action from a superintendent.

Two factors came together to create a condition where Hicks' choice was somewhat less than crazy. The first was *Poa annua*, the bane of nearly every golf course. The second was the development of two new perennial ryegrass varieties that tolerate glyphosate herbicide.

Hicks began testing these new glyphosate-tolerant perennial ryegrasses on his course in 2010. He first planted them in a small test nursery in an area that was slated for renovation, just in case it failed.

"*Poa* is a survivor," says Hicks about his recent experience with glyphosate-tolerant perennial ryegrass. "I saw them as another tool for a multipronged attack." Hicks had been watching the development years ago of glyphosate-resistant creeping bentgrass and thought the perennial ryegrasses were different and would fit better into his overall plan for the course.

Glyphosate "resistance" is in fact very different from glyphosate "tolerance." Glyphosate-resistant plants are created by inserting foreign genes along with a promoter that turns the gene on overdrive into the plant of interest. The resulting plant is known as a GMO, or genetically modified organism. It usually involves regulation and testing by USDA/APHIS to prevent foreign genes from accidentally being released into the wild.

Glyphosate "tolerance" results from a natural mutation enhanced through breeding and does not involve the use of plant biotechnology. The USDA does not regulate naturally occurring mutations, mainly because there is no foreign DNA inserted into the plant. Another difference between the two is that tolerant plants can still be killed by applying high rates of glyphosate; resistant plants cannot.

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Hicks planted a trial to see if his mixed stand could be converted to glyphosate-tolerant cultivars with minimal disruption and minimal Poa return.

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Glyphosate-tolerant perennial ryegrasses fit into the plan at the Coeur d'Alene Resort. The owner wants to switch from a creeping bentgrass/*Poa annua*-mixed rough to a predominantly perennial ryegrass stand. The challenge for Hicks was to not only convince his owner, but also himself, that the application could be made without killing the supposedly tolerant perennial ryegrass.

To accomplish that, Hicks planted a trial in order to test if his mixed stand could be converted to the glyphosate-tolerant cultivars JS501 and Replay with minimal disruption to play and minimal *Poa annua* return. Dr. Christian Baldwin, research scientist at Jacklin Seed, was involved in the project to help lay out the treatments in a scientifically sound manner.

Renovation trial

Debris was removed from the experimental area, which was scalped and verticut. There were five programs of spraying and seeding (Table 1). They ranged from spraying glyphosate 5 days before seeding, 3 weeks after the initial seeding, and a combination of the two. Glyphosate-tolerant perennial ryegrass was seeded at 10 lbs. per 1,000ft² on

June 23 or June 23 and July 14. Glyphosate rates applied to all seeding and timing combinations were 0, 4, 8 or 16 fluid oz. per acre of the 4.17 lb. per gal. glyphosate formulation.

Perennial ryegrass injury and coverage was recorded weekly beginning two weeks after the initial seeding until August 23rd. The experimental area was maintained like the rest of the rough on the golf course.

Results

The results showed Hicks the information he needed to move forward with the renovation plan.

- The application of glyphosate 5 days before seeding yielded only 20 percent perennial ryegrass cover on August 23rd.

- The glyphosate application 3 weeks after initial seeding at the 8 and 16 oz. / acre rates yielded 70 percent perennial ryegrass on August 23rd.

- The glyphosate application made 5 days before seeding and again 3 weeks after initial seeding also yielded 70 percent perennial ryegrass cover on August 23rd.

- Regardless of the glyphosate application rate and timing, no injury to the glyphosate-tolerant perennial ryegrass varieties was noted.

These data showed that the most important glyphosate application was the one made 3 weeks after seeding. Even though the plots were scalped and verticut, there was enough *Poa annua* seed in the soil to germinate and grow 3 weeks after the initial glyphosate application. The glyphosate application 3 weeks after initial seeding was safe on the perennial ryegrass because the plants were in the 2-leaf stage. Seeding interval did not have an effect on the amount of perennial ryegrass in the plots.

At the conclusion of the trial, around Labor Day, the best plots had 70 percent perennial ryegrass and 30 percent *Poa annua* cover. Hicks then decided to see if he could take the stand to *Poa annua*-free with a repeat application of glyphosate. Hicks and Baldwin picked several plots and made an application of glyphosate at the 8 oz. per acre rate around mid-September. The plots went into winter nearly *Poa annua*-free.

With his confidence bolstered, Hicks decided to test a 1-acre area in the 18th rough. The area was the same creeping bentgrass/*Poa annua* mix and was seeded in early September with Replay using a Turfco TriWave at 2 lbs./1,000 sq. ft. in each of two passes, and then broadcast seeded at 4 lbs./1,000 sq. ft. in each of two passes for a total of 12 lbs. seed per 1,000 sq. ft.

TABLE 1: PROGRAM EVALUATION

Five programs of glyphosate application and seeding were evaluated at the Coeur d'Alene Resort to renovate the existing *Poa annua*/creeping bentgrass rough

Program	Glyphosate application (0, 4, 8, or 16fl oz./A)		Seeding date (10 lbs./1000ft ²)	
	June 18th	July 14th	June 23rd	July 14th
1	NO	YES	YES	YES
2	YES	YES	YES	YES
3	YES	NO	YES	YES
4	NO	YES	YES	NO
5	YES	NO	YES	NO

The site is currently coming out of winter and looks beautiful. The area was not treated with glyphosate prior to winter; however, the first glyphosate application is slated for early June 2012.

The origins of glyphosate tolerance in perennial ryegrass dates back to a turf trial that was sprayed out with glyphosate in

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An aerial view of Coeur d'Alene Resort.

TABLE 2: MANAGEMENT CHECKLIST

Dos and don'ts when managing glyphosate-tolerant perennial ryegrass.	
DO	DON'T
Allow for a border to minimize spray drift onto sensitive species.	During establishment, do not apply glyphosate when perennial ryegrass is between the 3rd and 4th leaf stage.
Minimize traffic after a glyphosate application until the foliage has dried.	Do not apply glyphosate at rates exceeding 0.26 lb. acid equivalent per acre.
Remove dew the following morning to minimize glyphosate tracking to sensitive species.	Do not apply glyphosate when the four-week forecast is for daily low air temperatures below 50 degrees F.
Consult the label of the selected glyphosate product used to obtain information regarding user safety recommendations, environmental hazards, personal protective equipment, storage and disposal.	Do not tank mix glyphosate with a plant growth regulator.
	Do not apply glyphosate when mowing heights are below 0.5 inch.
	Do not reapply glyphosate within 4 weeks after a previous glyphosate application.

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Maryland in 1999. One plot was not killed by the normal application of glyphosate, so plants were plugged and brought to Post Falls, Idaho, for breeding. Several cycles of recurrent selection for glyphosate tolerance and turf quality led to the development of JS501 and Replay. Before release they underwent DNA fingerprinting that showed a single mutation that led to glyphosate tolerance.

An earlier release, 'Aurora Gold,' bred by Crystal Rose-Fricker, was a conventionally bred hard fescue that has shown tolerance to glyphosate. Likewise, the Scotts Company has recently been granted approval by USDA/APHIS for the release of its GMO Roundup Ready Kentucky bluegrass.

Dr. Baldwin spent three years developing a management program for use of glyphosate-tolerant perennial ryegrass. Since they still can be injured by high doses of glyphosate, the program includes "watch-outs" for

these varieties (Table 2).

"This grass is not a magic bullet," Baldwin says of the program he helped develop for JS501 and Replay. Instead, he envisions them as part of a comprehensive IPM program to help manage *Poa annua*. He reasons that when one approach is the only tool, it has the potential to create problems or resistant types of *Poa annua* over time.

Baldwin believes that the use of glyphosate-tolerant grasses, cultural practices, pre-emergent herbicides and other chemistries, can give the golf course superintendent another tool to control *Poa annua*.

This was one of several tests conducted with glyphosate-tolerant perennial ryegrasses on golf courses.

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