BY SCOTT MCELROY, PH.D.

Out in the cold

Additives may be the answer to improving herbicide performance

Herbicides have numerous hurdles to overcome to be effective.

First, they must be applied in a correct manner according to label recommendations – and with the correct additives.

Next, herbicides have to be applied in a timely manner when the target weed is most susceptible.

Then, after herbicides contact the leaf surface, they must remain there for absorption to occur or move at the desirable rate through the soil to be absorbed by the roots. Low humidity, dry conditions or rain soon after an application can decrease weed control by decreasing the absorption of the herbicide. Once absorbed, the herbicide must translocate or move to the active site within the plant and potentially move throughout the entire plant. Plants under certain environmental stress can have decreased functionality in the vascular system, thus decreasing translocation.

Lastly, an herbicide must remain in its active form within the plant until the weed is controlled. Throughout time, the herbicide can be degraded or metabolized within the plant, thus deactivating it.

With the obstacles herbicides must overcome, it's a marvel they work at all.

ERRATIC WEATHER IS THE NORM

The weather has become something more than just a conversation starter. With global warming, El Niño and the threat of superhurricanes,

Nontreated clumpy perennial ryegrass.

Clumpy perennial ryegrass treated with Revolver alone.

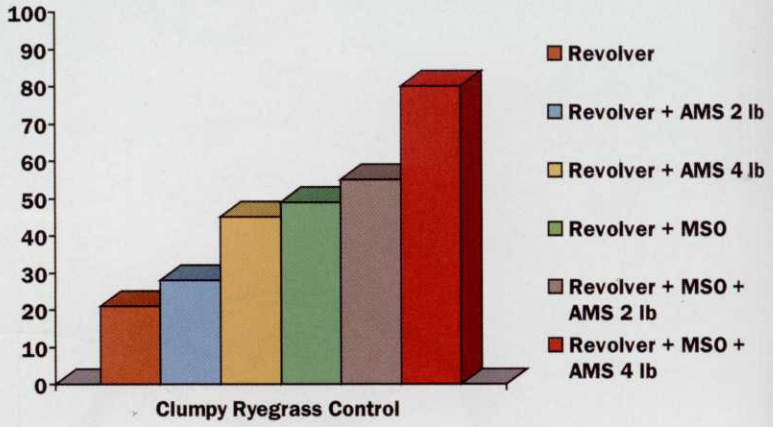
Clumpy perennial ryegrass treated with Revolver plus 2 pounds of ammonium sulfate per acre.

weather influences everything, even public policy. So, we shouldn't be surprised by the effect erratic weather is having on golf course management, particularly weed control.

Consider this: In 1970, the average temperature in Illinois in January was 18.2 F. In 2006, it was 37.9 F, according to the NOAA Satellite and Information Service. This isn't an example of global warming. It's an example of how temperatures can fluctuate throughout time, and from year to year.

These temperature fluctuations confound our ability to predict things such as turfgrass dormancy, weed germination, disease occurrence and insect activity. To combat this, it's often beneficial to implement management practices that are more robust under abnormal environmental conditions.

Table 1. Percent control of clumpy perennial ryegrass applied with Revolver herbicide and several additives. Final ratings were taken after 69 days.



EFFECTS OF LOW TEMPERATURE

Herbicide efficacy can vary with differing environmental conditions. Sulfonylurea herbicides, such as foramsulfuron (Revolver herbicide) can be negatively affected by low temperature conditions. When this herbicide is applied at temperatures consistently less than 55 F to 60 F, weeds such as clumpy perennial ryegrass (*Lolium perenne*) and clumpy tall

Clumpy perennial ryegrass treated with Revolver plus 4 pounds of ammonium sulfate plus 1 percent methylated seed oil.

Clumpy perennial ryegrass treated with Revolver plus 4 pounds of ammonium sulfate per acre.

Clumpy perennial ryegrass treated with Revolver plus 1 percent volume to volume methylated seed oil.

fescue (*Schedonorus phoenix*) aren't completely controlled. Both species can become chlorotic when treated with Revolver under low temperature conditions, but after three to four weeks, injury subsides and weeds recover. Unexpected low temperature swings in the spring or fall could potentially induce decreased activity in sulfonylurea herbicides.

It's not completely understood why the effectiveness of sulfonylurea herbicides is less under relative cold weather conditions. The most popular theory focuses on the metabolism of the herbicide. During these periods of relative cold temperatures, plants are growing more slowly. Sulfonylurea herbicides are effective because they block production of essential amino acids. Because the plant is growing slowly under low-temperature conditions, the plant doesn't need essential amino acids. The plant is in a state of hibernation for lack of a better term.

Under normal conditions, the plant would be growing and would starve to death as it continues to grow. As the plant stagnates in growth, other metabolic processes slowly degrade, or metabolize, the herbicide to a less active form.

Other theories exist concerning the decrease in control. A decrease of absorption of the herbicide or movement of the herbicide through the plant also could potentially occur during these conditions. A similar sulfonylurea herbicide, nicosulfuron, has been reported to be absorbed

more by quackgrass (*Elytrigia repens*) and moves throughout the plants more under higher temperatures (Bruce et al., 1996).

OVERCOMING LOW TEMPERATURE

Recent research at the University of Tennessee identified potential additives to overcome the decreased control that occurs when Revolver is applied during low-temperature conditions. Research was conducted to evaluate the use of ammonium sulfate and methylated seed oil to improve control of clumpy perennial ryegrass.

Revolver was applied at 0.4 fluid ounces per 1,000 square feet with and without additives. Additive treatments tank-mixed with Revolver included 2 and 4 pounds of ammonium sulfate per acre, 1 percent volume to volume methylated seed oil, 2 pounds ammonium sulfate plus 1 percent methylated seed oil, and 4 pounds ammonium sulfate plus 1 percent methylated seed oil. Treatments were applied Feb. 23, 2006, in Knoxville, Tenn. Final ratings were taken 69 days after treatment on May 3.

Clumpy ryegrass control with Revolver applied with no additives was 20 percent at the final rating. All additives except ammonium sulfate at 2 pounds per acre provided a statisically higher level of clumpy ryegrass control over Revolver applied alone (Table 1). The additives ammonium sulfate at 4 pounds per acre, methylated seed oil, or ammonium sulfate at 2 pounds per acre plus methylated seed oil increased clumpy ryegrass control to 45 to 55 percent. The greatest increase in clumpy ryegrass control was observed with ammonium sulfate at 4 pounds per acre plus methylated seed oil, which increased control to 80 percent.

Others have reported similar results with enhancement of certain herbicides with additives. Absorption, translocation and accumulation of nicosulfuron are known to increase when treatments are made with ammonium sulfate or petroleum oil adjuvants (Bruce et al., 1996). Similar results have been reported with glyphosate (Roundup) when applied with crop oil or organosilicone surfactants (Collins and Helling, 2002).

A WORD OF CAUTION

Additives that aid an herbicide to overcome adverse environmental conditions aren't the same as additives that enhance the performance of a herbicide under normal conditions. Many additives claim to increase the efficacy of some herbicides to the point where one could reduce the rate of the herbicide. Research cited here doesn't support the decrease of an herbicide rate with the addition of any additive. Rather, this research potentially supports the use of additives that enhance absorption or translocation of an herbicide, or decrease the metabolism of an herbicide within the plant when applications are made under negative environmental conditions.

FINAL THOUGHTS

In the area of golf course management, environmental conditions influence everything a superintendent does. Applying herbicides and other pesticides is no different. While ammonium sulfate and methylated seed oil can help Revolver improve effectiveness in low temperature conditions, one should be cautious of egregious product claims to enhance products beyond the claims of the manufacturer. And in all cases, avoid making applications of any postemergent herbicide when temperatures are below 40 F. GCI

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IMPACT ON THE BUSINESS

The early bird

A fall preemergent herbicide application saves time in preparation for a busy spring

By John Walsh

Like most golf course superintendents, Tom Breiner is busy in the spring. Because he has a lot on his plate during that time of year, Breiner spreads out certain tasks. One of those is a preemergent herbicide application.

Instead of applying Barricade (prodiamine) in the spring, Breiner applies the product in the fall, specifically late November.

"That will give us season-long control for the following year," says the golf course superintendent of the private, 54-hole Fiddler's Elbow in Bedminster, N.J. "Applying Barricade in the fall takes pressure off of us in late April when we're busy with other things."

Breiner applies the herbicide in a granular form combined with fertilizer at a rate of 0.75 pounds of active ingredient per acre. If he were to apply the herbicide in the spring, the rate would be less – 0.55 pounds of active ingredient per acre.

"It's not that much more costly to apply it in the fall," he says.

Breiner says he can apply Barricade in fall because the herbicide breaks down by microbial activity, and in cold weather, there's little to no microbial activity. The herbicide isn't mobile, and it doesn't leach; rather, it binds to clay colloids in the soil.

"I've been doing this successfully since 1994," he says.

Barricade also has a desired effect on *Poa annua*, but that's not why Breiner uses it.

Breiner spends about $425,000 a year on inputs (fertilizer, pesticides and lime). Herbicides are the least costly in that group at less than $30,000. He applies preemergent herbicides on tees, fairways and the rough but applies postemergent herbicides only on the rough.

Eighteen years ago, Breiner worked with a consultant to improve the soil in the fairways. At the time, he was using dicamba to control white clover. But over time, with the use of lime, fertility and a soil-balancing program, the need for a postemergent herbicide in the fairways ceased.

"Just dandelions will pop up here and there," he says. "At most, we'll hit weeds in the fairways with an herbicide in a spray can."

The pressure for crabgrass is strong at Fiddler's Elbow, Breiner says, adding that if he misses a spot treatment or neglects to apply a preemergent, crabgrass will appear. In addition to crabgrass, Breiner controls many broadleaf weeds, including white clover, dandelions and oxalis.

On the 90 acres of creeping bentgrass fairways, Breiner has been rotating Barricade and Drive (quinclorac) every other year.

"Barricade is very strong, and there is a concern about high amounts of it in the soil, but I haven't seen problems," he says. "I'm just being precautionary."

Drive has a 45-day residual postemergent effect. It also controls white clover. Breiner also uses Gallery (isoxaben), a preemergent for broadleaf weeds, regularly in weed-prone areas.

Breiner uses various products, such as 2,4-D, dicamba and triclopyr, for postemergent applications. He uses amine formulations of postemergent herbicides from early to late fall and then switches to ester formulations of the same product because amine formulations need warmer soil temperatures to work, and ester formulations are less temperature dependent.

Yellow nutsedge is a problem weed for Breiner. He has been using SedgeHammer (halosulfron methyl) and recently observed good results using Dismiss (sulfentrazone).

Additionally, Breiner plans to test various herbicides. For example, he'll work with Dimension (dithiopyr) – the only herbicide he knows much about for use on greens – on two greens that aren't in play where crabgrass is emerging. He's also experimenting with Quicksilver (carfentrazone), a fast-acting product with a low use rate that can be used in conjunction with a Trimec (2,4-D) formulation.

Breiner also plans to test Tenacity (mesotrione), which removes undesirable bentgrass out of bluegrass rough. **GCI**