Turfgrass Competition: It's A Jungle Out There!

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BOB SCHULTZ just seeded three new fairways with a mixture of Kentucky bluegrass and perennial ryegrass. His green committee had requested a 50:50 mix of the two grasses on these fairways, so Bob put 50 pounds of bluegrass seed and 50 pounds of ryegrass seed into the spreader. But now that the grass is up and growing, there is hardly a shoot of bluegrass to be found. What happened to the bluegrass?

Across town, Greg Wallace is engaged in his fourth attempt to overseed his *Poa annua* fairways with a more desirable grass. Greg had tried several bentgrasses in the past, but every time he overseeded he ended up with more *Poa* than before he started. This time, Greg is trying an improved perennial ryegrass variety. As time passes, he sees *Poa* in his fairways give way to the ryegrass. Why did the ryegrass work when other grasses wouldn't?

Last year Ed Barrett decided to renovate his No. 1 fairway, which was heavily infested with *Poa*. He killed off the turf with glyphosate, grooved it with a vertical mower, and seeded it to a blend of Kentucky bluegrasses. This year the *Poa* is back — not as plentiful as before, but increasing in strength each month.

Bob, Greg, and Ed share a common problem: They're having trouble establishing the grass they want because of unseen problems with grass competition. Competition among grasses may seem a bit abstract. We're all familiar with how people compete: one person runs faster, jumps higher, or shoots a lower golf score than another. In the business world, they say, "It's a jungle out there!" But how do plants compete? And what can we do to swing the competition in our favor?

ALL LIVING BEINGS require three basic things in order to survive: food to eat, air to breath, and a means of getting rid of waste products. Grass plants are no exception. Plants get their food from sunlight, carbon dioxide, water, and soil minerals. A plant that can get more sunlight, moisture, or nutrients than its neighbors is said to be highly competitive. Certain grass species are more competitive than others. These differences among species are most pronounced during seedling development.

Waste products can also be limiting factors to grass growth. Thatch is a waste product that can accumulate and affect the health of the turf. Some plants also excrete invisible chemical wastes. For example, perennial dropseedgrass, a Southern turf weed, gives off certain chemicals that can stunt the growth of bermudagrass and buffalograss. This phenomenon of natural herbicides is called allelopathy.

But first, let's deal with some of the physical aspects of competition.

Figure 1. When seeded side by side, perennial ryegrass is dominant, Poa annua *is a close second, and the Kentucky bluegrass is a distant third.*

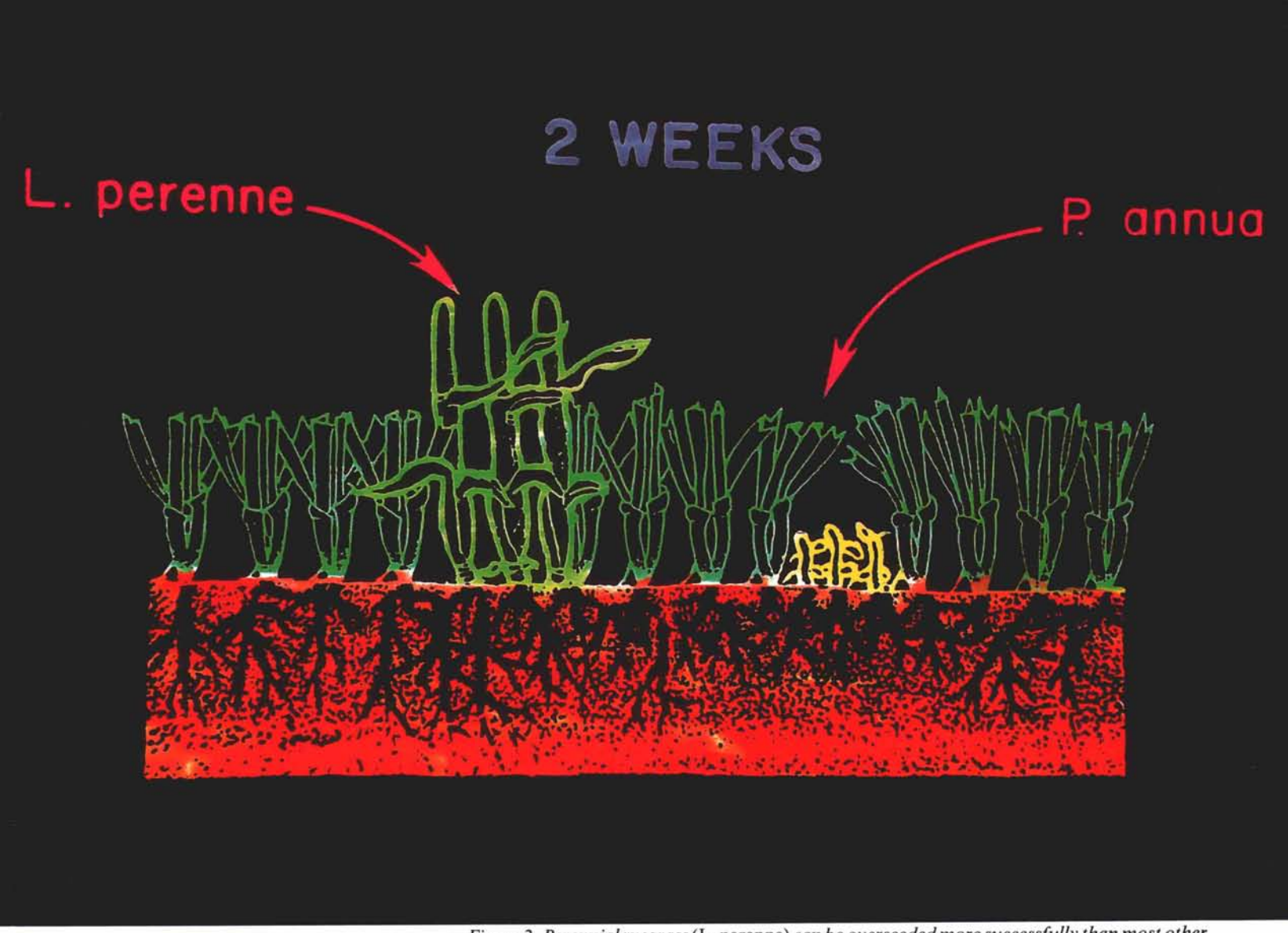

Figure 2. Perennial ryegrass (L. perenne) *can be overseeded more successfully than most other grasses. On several occasions, ryegrass seedlings were seen protruding above the leaves of the sod.* Poa annua *seedlings were tiny, yet some remained alive for several weeks.*

KENTUCKY BLUEGRASS, perennial ryegrass, and *Poa* have quite different seed sizes. Ryegrass has relatively large seeds — about 280,000 seeds per pound — whereas Kentucky bluegrass and *Poa* have much smaller seeds — 1-2 million seeds per pound. Remember, the larger the seed, the fewer number of seeds per pound. A mixture of one pound of bluegrass with one pound of ryegrass would contain roughly 15 percent ryegrass, by actual seed numbers.

Large seeds contain large amounts of stored energy. Ryegrass, with its large seeds, is a demon in the seedbed. When ryegrass, Kentucky bluegrass, and *Poa* are planted side-by-side at the same time, the ryegrass is the clear winner *(Figure 1). Poa,* however, is not far behind. *Poa's* seedling vigor is not due to its seed size, which is actually quite small, but to a high rate of seedling growth. Two British scientists once surveyed 123 species of plants and weeds and found that *Poa annua* had the highest seedling growth rate of them all. Ryegrass gets ahead of *Poa* though, because of a slightly faster start.

Ryegrass, bluegrass, and *Poa* also differ in the field survival of their seed. Field survival is an estimate of the percentage of seed germination under field growing conditions. *Poa* and ryegrass have a field survival value of about 75 percent; Kentucky bluegrass averages only 45 percent.

OVERSEEDING is truly the acid test for any grass species. An actively growing sod hardly presents an ideal environment for a young plant. Compared to the stout, hardy plants of established turf, seedlings possess a meager root system and a tiny amount of foliage. It's no wonder that many overseeding attempts are unsuccessful.

We studied the competition involved in overseeding by punching aerifier-style holes in established turf, filling the holes with soil, and planting seeds on top. We tested three different sods and three species of seeds, representing ryegrass, bluegrass, and *Poa.* Surprisingly, the same number of seedlings emerged in the sod as in a fallow seedbed nearby. The difference appeared several days later. As time passed, the sod-sown grasses began to wither and die. By six weeks, only 25 percent of the original bluegrass and *Poa* seedlings remained alive. Perennial ryegrass was the exception. More than 60 percent of the ryegrass seedlings were still actively growing after six weeks.

On several occasions, we saw blades of the young ryegrass plants protruding ¾-inch above the foliage of the sod *(Figure 2)*. Evidently the ryegrass was able to break through the dark umbrella of neighboring leaves to bask in the energy-rich sunlight. This probably made the difference between life and death for the ryegrass.

We followed the life of the *Poa* seedlings until the sod had enveloped them. It's uncertain how long these remaining *Poa* plants survived. Perhaps they were maintaining a minimal existence, waiting for an opportunity, such as a divot or a management mistake, to continue their development.

DO PLANTS CONTROL each other with toxic chemicals? Hundreds of research experiments show that all plants contain toxic chemicals in varying amounts, and some plants, through excretion or death and decay, release these toxins into the environment. The next question is whether turfgrasses fit into the toxic category.

To test this idea, we germinated *Poa* seeds on a damp paper blotter. Then, we interspersed seeds of Kentucky bluegrass along with the *Poa* seedlings. Germination and growth of the bluegrass was reduced by having had *Poa* in close proximity.

We took this test one step further. We germinated and grew *Poa* on a blotter, dried out the blotter, scraped off the *Poa* and then germinated bluegrass on it. Again, the bluegrass was stunted — this time, the bluegrass was affected by chemicals that were indirectly transferred by way of the blotter. The same type of situation could occur in the field. Thatch could conceivably act as a blotter, holding toxins in place until they are absorbed by other plants.

Finally, we took this idea to the field *(Figure 4)*. We built a large underground framework, lined it with plastic, and filled it with sand. We then established grasses so that water would flow through the rootzone of one species, downhill to the rootzone of another, carrying with it any toxic chemicals. We monitored the growth of these grasses over a two-year period. The results were subtle, yet significant. Kentucky bluegrass plots that received fluids from *Poa* had slightly less ground coverage during establishment, fewer large shoots, and decreased thatch development. All combinations of the three species were examined. When it was exposed to the fluids from Kentucky bluegrass, ryegrass experienced increases in rust, red thread, and Pythium blight diseases. And *Poa* had reduced root tissue weight and spring greening when it was exposed to ryegrass fluids.

BOB SCHULTZ, Greg Wallace, and Ed Barrett all had trouble with grass competition problems. Bob's ryegrass-bluegrass planting would have yielded a balanced mixture if he'd adjusted for the competitive nature of ryegrass seedlings. A mix containing 75 to 95 percent bluegrass (5 to 25 percent ryegrass), by weight, is needed to produce a 50:50 mixture of these two grasses.

Greg's overseeding attempts were unsuccessful until he tried ryegrass. Perennial ryegrass is one of the few grasses with seedlings that are vigorous enough to take on established plants. Generally, the larger the seed, the easier it is to overseed. When overseeding with a small-seeded species, such as bentgrass, to give the new grass plants a chance to take hold, try to weaken or kill the existing vegetation before planting.

Ed Barrett had a problem with *Poa annua* moving back into his new bluegrass stand. *Poa* seed is usually quite plentiful in most golf-course soils, and when that *Poa* germinates, it can outgrow Kentucky bluegrass. It's also possible that plant toxins may be giving *Poa* the edge it needs to win.

What can be done to counteract *Poa's* poison? Well, that's the subject of our research project.

Figure 3. On the left are Poa annua *seedlings grown on a blotter where Kentucky bluegrass once grew. On the right is* Poa *growing where other* Poa *had been. The plants on the right were spindly and almost without roots, evidently stunted by toxins released from the earlier seedlings.*

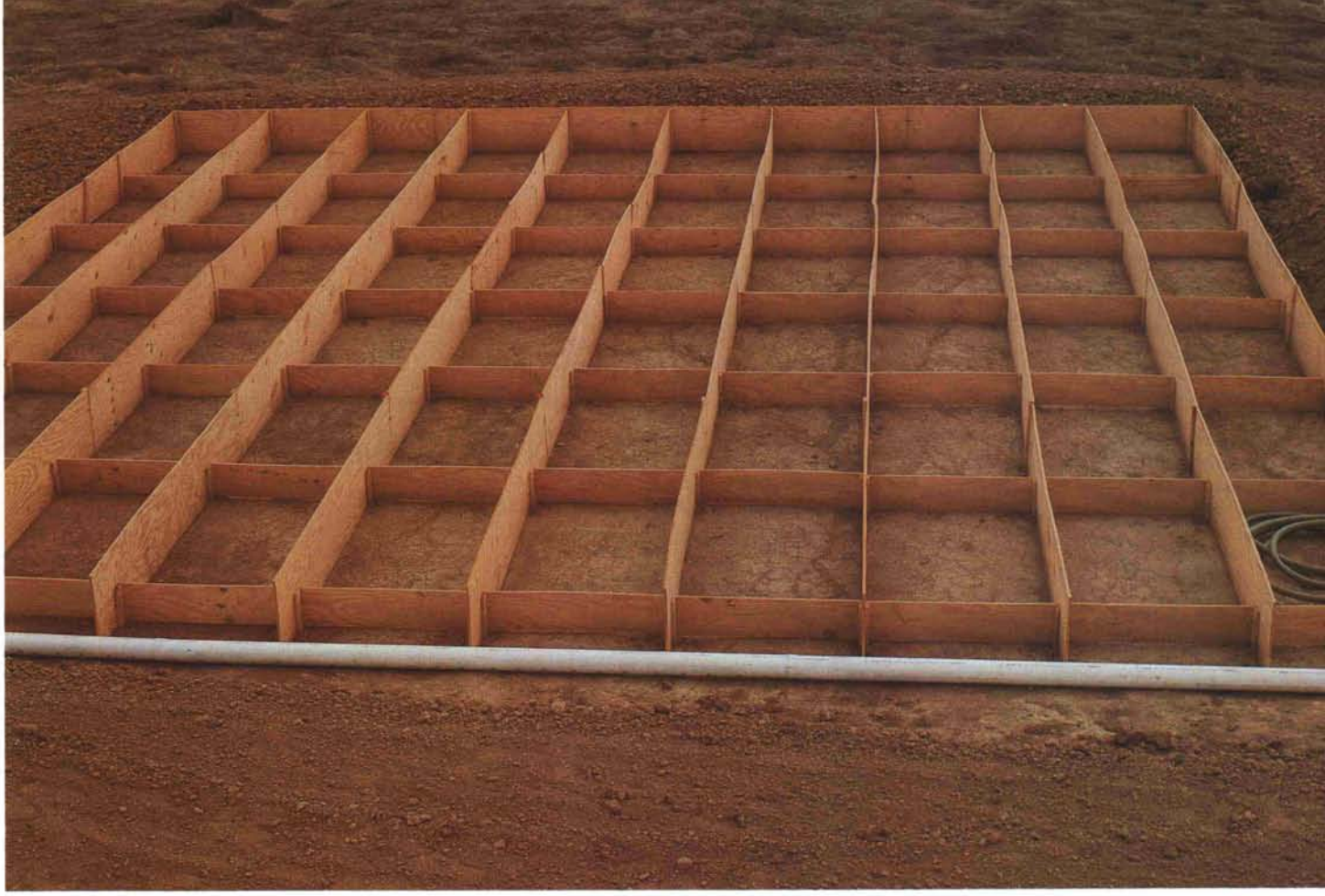

Figure 4. Construction of an outdoor system for testing turfgrass for allelopathy (plant toxins). The underground wooden framework was covered with plastic, filled with sand, and planted to Kentucky bluegrass, perennial ryegrass, and Poa annua, *with the resulting grass cover.*