Restoring Greens After Winterkill: There's Always Hope!

By Dr. John Stier, *Department of Horticulture, University of Wisconsin-Madison*

The winter of 2007-08 was not nearly as hard on putting greens as the winter of 2004-05, but many courses still suffered significant damage. In some cases the damage was confined to specific biotypes of Poa annua: one plant, or patch, would die while another right next to it survived fine. In both winters fairly similar situations occurred but minor differences resulted in much less kill this year than in 2004-05. In 2005, a January thaw was accompanied by one and one-half days of rain over frozen ground which immediately turned to ice that stayed until mid-March. In 2008, the January thaw occurred, but the ground had usually never frozen and there was less rain, so ice sheeting was much less than in 2005. Consequently only the weakest biotypes of P. annua died. Additionally, many courses may have had less P. annua in 2008 than in 2005 because the 2005 winterkill removed so much P. annua.

In any case damage was still sometimes sufficiently severe that putting greens coming into the playing season this past month had unacceptable quality. Superintendents had several options: 1) do nothing, and hope that bentgrass would spread into the killed patches or that *P. annua* would quickly germinate and fill in, 2) Verticut or aerate with the intention of cutting bentgrass plants and stimulate stolon development, 3) hand-seed killed areas, 4) slit-seed affected areas on greens, or 5) place living bentgrass plugs cut from a nursery into the worst patches. No single option was best for all situations; instead, the best course of action often depended on the severity of the problems and the resources at hand (primarily labor and equipment).

Some of our politicians might have chosen hope over other options. Many superintendents, however, felt compelled to do something to improve the situation (I'm sure hope was still in their minds as well). As I was looking at a course and discussing the situation with the superintendent this spring, it occurred to me that we don't really know how well verticutting truly stimulates bentgrass spread on putting greens. The hypothesis is that severing stolons from the mother plant encourages them to develop new plants. Stolons that remain attached to the mother plant can still develop new plants but perhaps not at the same rate as unattached stolons. In Kentucky bluegrass, suppression of bud development appears to be controlled by hormones within the tiller (Nyahoza, 1974) and perhaps by the mother plant. The suppression of stolon development by mother plants would likely be a survival mechanism: suppression of buds closest to the mother plant decreases competition between mother and daughter plants while buds appearing further away from the mother plant on the same stolon would be less likely to compete for space and resources and consequently not be suppressed by the mother plant.

We do know tremendous variation exists in stolon development, both number and length, depending on the variety of creeping bentgrass (Kik et al., 1990; Cattani, 1999). Dr. McCarty's group in South Carolina has shown that verticutting and aeration reduce organic matter development in bentgrass putting greens compared to topdressing without cultivation (McCarty et al., 2005; McCarty et al., 2007), but stolon development *per se* was not measured. We also neglected to measure stolon development *per se* during our investigation into thatch and organic

matter development of the A and G series bentgrasses (Stier and Hollman, 2003). I have seen tremendous stolon growth of bentgrasses, sometimes approaching 12 inches growth per year, but this has been in tall cut turf or in open areas at fairway and greens height. I rarely have seen much in the way of stolons in dense putting green turf: I suspect competition between plants inhibits stolon development. Clearly one of us professors needs to look into verticutting and stolon development on greens.

Seeding is a time-honored way to increase turf density. While introducing seed into dense turf rarely allows the introduced seed to develop into new plants (Kendrick and Danneberger, 2002), germination can occur in 5 to 10 days in the absence of competition from other plants. While he realized intraseeding into an existing bentgrass turf provided little chance for new seedlings to develop, the superintendent I was visiting this spring asked me if it was possible to build up a creeping bentgrass seed bank that would be able to compete against the native *P. annua* seed bank. Interesting idea: Dr. Brian Horgan (Minnesota) and Dr. Frank Rossi (Cornell) have both shown constant intraseeding into sports turf areas helps keep decent turf on the fields. However, it's not clear if their work was really building a seed bank or providing a constant source of new seed to germinate in bare areas.

Building a seed bank with creeping bentgrass so it can outcompete *P. annua* may be tough. In one study of a golf green, *P. annua* seed numbers in the soil fluctuated from 2,788 seeds per square foot in the autumn/winter to over 19,500 seeds per square foot in the spring (Lush, 1988). Bentgrass seed numbers were just under 300 per square foot. My graduate Mark Garrison is investigating the potential of turfgrasses to be invasive: so far he's found that only about 40% of creeping bentgrass seeds survive in the soil for 12 months. We don't have *P. annua* in our trial, but in a different study about 40% of *P. annua* seeds germinated in late spring after being stored under controlled conditions from the previous fall (Williams, 1983), so there may or may not be much difference between survival rates. Part of the problem with the Williams (1993) study was that germination was used to determine survivability, while in our work we also use the tetrazolium test to distinguish between dormant seeds and those that are really dead. A head-to-head comparison of survivability between the two species would be needed. Whoever does this work will need to use numerous varieties/ecotypes from several environments.

Assuming one did want to interseed, the next question would be which variety or varieties to use? The National Turfgrass Evaluation Program trials probably provide about the best information available. Our most recent trial was planted in late summer 2003. While some varieties have succumbed to environmental stresses over time, others have improved while some have stayed relatively constant. Table 1 shows the relative establishment rate averaged over locations in seven states. Penncross had among the best establishment rate, yet many superintendents are planting newer varieties because they have superior turf quality (Table 1). Varieties that had among the quickest establishment rates and were in the top group for quality three years after planting were Shark, Authority, CY-2, 007, and Mackenzie. CY-2 and Declaration have significantly better quality in Wisconsin than all but Tyee, Shark, 007, Authority and 13-M when grown on a silt loam and mowed at 0.125 inch height (data not shown), but only C-2, Shark, 007,

Table 1. Creeping bentgrass establishment rates and 2006 annual turf quality from the 2003 National Turfgrass Evaluation Program for putting green trials.

Variety	Establishement rate (% cover)[1]	Annual average quality[2]
Tyee	69.2	6.9
CY-2	73.5	6.9
Shark	77.2	6.8
Declaration	71.1	6.7
007	72.9	6.7
Mackenzie	72.8	6.7
Authority	75.3	6.6
Penn A-1	75.5	6.5
Independence	74.5	6.5
Memorial	75.6	6.4
LS-44	73.0	6.4
13-M	71.6	6.4
Bengal	75.7	6.2
Benchmark DSR	65.1	6.2
IS-AP 9	72.1	6.2
Kingpin	70.0	6.2
Alpha	71.4	6.1
T-1	76.9	6.1
Pennlinks II	73.9	5.7
Penncross	77.0	5.1
LSD	6.3	0.3

[1] Average value of percent ground cover during establishment from seven states.
[2] Average turf quality when grown on native soil from 10 states, three years after planting.

Mackenzie and Authority were in the top group for establishment rate. However, data from establishment rates in the late summer may not correlate to establishment rates during the cooler temperatures of spring. In any case almost all varieties were relatively close to the fastest-establishing variety, so deciding the best cultivar may depend more on other characteristics such as quality or color than establishment rate.

Ultimately the best method for restoring greens from winterkill damage rests with the equipment and labor (i.e., budgets) at hand along with the need to quickly restore a high quality putting surface. Some clubs are more relaxed than others. If all else fails, there's always hope!

References

Cattani, D.J. 1999. Early plant development in 'Emerald' and 'UM67-10' creeping bentgrass. Crop Sci. 39:754-762.

Kendrick, D.L., and T.K. Danneberger. 2002. Lack of competitive success of an intraseeded creeping bentgrass cultivar into an established putting green. Crop Sci. 42:1615-1620.

Kik, C., J. Van Andel, W. Van Delden, W. Joenje, and R. Bulsma. 1990. Colonization and differentiation in the clonal perennial Agrostis stolonifera. J. Ecol. 78:949-961.

Lush, W.M. 1988. Biology of *Poa annua* in a temperate zone golf putting green (*Agrostis stolonifera/Poa annua*) II. The seed bank. J. Appl. Ecol. 25(3):989-997.

McCarty, L.B., M.F. Gregg, J.E. Toler, J.J. Camberato, and H.S. Hill. 2005. Minimizing thatch and mat development in a newly seeded creeping bentgrass golf green. Crop Sci. 45:1529-1535.

Nyahoza, F. 1974. Some aspects of the physiology of the rhizomes of *Poa pratensis* L. Weed Res. 14(5):329-336.

Stier, J.C., and A.B. Hollman. 2003. Cultivation and topdressing requirements for thatch management in A,G bentgrasses (*Agrostis stolonifera* L.) and creeping bluegrass (*Poa annua* var. *reptans* Hausskn). HortScience 38:1227-1231.

Williams, E.D. 1983. Germinability and enforced dormancy in seeds of species of indigenous grassland. Ann. Appl. Biol. 102(3):557-566.