Take Advantage of *Poa annua* Winterkill: Increase Bentgrass on Putting Greens

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This past winter was especially harsh for turf on many putting greens in Wisconsin due the long period of ice cover followed by late winter freeze-thaw episodes. *Poa annua* was especially susceptible due to its lesser tolerance for ice and freezing compared to creeping bentgrass. For those greens that had mixed *Poa annua*/creeping bentgrass populations, this spring and summer offer a good opportunity to enhance the population of bentgrass.

Encourage spread of existing creeping bentgrass

Creeping bentgrass is a stoloniferous grass, capable of producing lateral above-ground stems (stolons) that grow along the surface. Nodes, seen or felt as bumps on the stolon, are areas capable of producing new cells which can form into either root or shoots. Botanists call these areas meristems: in plant terms, they are analogous to human stem cells. The stolons of creeping bentgrass are indeterminate, meaning they can produce multiple nodes (and thereby plants) from a single stolon. Conversely, rhizomes of Kentucky bluegrass are determinate, meaning one plant per rhizome.

Golf course superintendents rarely see stolons on established putting greens. The tremendous density of the turf prevents the need for grass plants to produce stolons. Noticeable stolon growth usually only happens when a void develops in the turf due to a turf-killing disease or environmental stress such as winterkill. Creeping bentgrass stolons are capable of growing 12 inches or more in a year in our region. Given the multiple nodes on each stolon, plus the fact that an individual mother plant can produce multiple stolons, the opportunity to colonize adjacent voids is tremendous.

Stolons are produced in greatest quantity when a) nearby plant competition is reduced, b) climate is good (e.g.,temperature), c) adequate irrigation, fertility and mowing regimes are provided. Stolon growth is enhanced at higher mowing heights but can still be sufficient at greens height. Nitrogen inputs on putting greens have decreased in the past 20 years: adding a little N to a N-starved bentgrass can be a great way to stimulate stolon production. One of the best ways to encourage stolon growth is to verticut the existing turf: severing existing plants stimulates hormonal production that causes development of new stolons, and severing existing stolons releases meristem activity from surrounding plant tissues so new plants can develop. Encouraging stolon growth by filling voids will rarely be sufficient by itself: most approaches will also require interseeding.

Interseeding

Interseeding is sometimes erroneously called overseeding. Overseeding is when cool-season grass seed is applied to a dormant warm-season turf in the South and is a temporary measure to produce a green, growing turf. Interseeding is the introduction of new seed into an existing, growing turf. Previous work has shown that interseeding creeping bentgrass into well established putting greens is relatively ineffective. The high density of existing turf outcompetes the seedlings for space, moisture, and nutrients. However, voids left by winter-killed *P. annua* will allow repopulation by

creeping bentgrass if proper management steps are taken. Seed germination and establishment requires seed-to-soil contact. Interseeding can be done by raking seed into the soil, broadcasting following an aeration or verticutting followed by topdressing and dragging, or by slit-seeding.

In Wisconsin, lawn seeding is conventionally recommended during later summer or early autumn (Stier, 2000). Unfortunately the same time period also favors germination of *P. annua* on closely mown turf. Research conducted at Rutgers University in the past several years has shown mid-summer seedings of creeping bentgrass putting greens result in less *P. annua* than either spring or late summer/autumn seedings (J. Murphy, pers. communication). Summer seeding of putting greens works because greens typically now have automatic irrigation and fungicides can be applied to control seedling diseases such as Pythium blight. Seed rate is variable, but 1 lb/1000 ft^2 is usually sufficient. Depending on the variety, one pound of seed will contain between approximately 6 to 8 million seeds. Most of the seeds of course will die before producing a mature plant.

Selection of bentgrass varieties

Several high quality creeping bentgrass cultivars for greens have been released in the past 15 years. The A and G series, bred using plants selected from old 'Penncross' greens at Augusta National in Georgia, received the most attention. Others like 'L-93' offer similar performance with less reputation for excessive thatch development. The 1998 National Turfgrass Evaluation Program (NTEP) putting green test ran from 1998 to 2002. Twenty-nine cultivars of creeping and velvet bentgrass were planted in 20 states on either native soil or sand-based root zones and evaluated for turf quality, disease severity, and other characteristics from 1999 to 2002. Table 1 lists the varieties and their company sponsors. In Wisconsin, the trial was seeded 31 August 1998 using 1 lb seed/1000 ft^2. The root zone was a silt loam with a pH of 7.8. Greens were mowed daily at 0.156 inches, todressed at 3 week intervals, and aerated once each April/May. Irrigation was supplied three times weekly to provide 70% ET and prevent moisture stress.

Snow mold damage, genetic color and spring greenup were evaluated during spring. Density estimates were collected seasonally, and quality ratings collected monthly. Quality was rated visually on a 1 to 9 scale, with 1 equal to dead turf or bare soil, 9 equal to dense, uniform, disease-free turf with moderate to dark green color. A rating of 6 was considered acceptable for a high quality golf

Table 1. Entries and sponsor list for the 1998 NTEP Bentgrass Putting Green Trial.

Name	Species	Sponsor
Backspin	creeping	Turf Merchants, Inc.
Bavaria	velvet	Turf Merchants, Inc.
ABT-CRB-1	creeping	AgriBioTech, Inc.
Crenshaw	creeping	AgriBioTech, Inc.
L-93	creeping	Standard entry
Century	creeping	AgriBioTech, Inc.
Imperial	creeping	AgriBioTech, Inc.
ISI Ap-5	creeping	International Seeds, Inc.
BAR CB 8US3	creeping	Barenbrug Research
Bengal (BAR AS 8FUS2)	creeping	Barenbrug Research
Vesper (Pick MVB)	velvet	Pickseed West, Inc.
Pick CB 13-94	creeping	Pickseed West, Inc.
Syn 96-1	creeping	Texas A&M University
Syn 96-2	creeping	Pickseed West, Inc.
Syn 96-3	creeping	Texas A&M University
SRX 1BPAA	creeping	Seed Research of Oregon, Inc.
Brighton (SRX 1120)	creeping	Seed Research of Oregon, Inc.
SR 1119	creeping	Seed Research of Oregon, Inc.
Providence	creeping	Seed Research of Oregon, Inc.
SRX 1NJH	creeping	Seed Research of Oregon, Inc.
SR 7200	velvet	Seed Research of Oregon, Inc.
PST-A2E	creeping	Pure-Seed Testing, Inc.
Pennlinks	creeping	Tee-2-Green Corp.
Penncross	creeping	Standard entry
Penn G-1	creeping	Tee-2-Green Corp.
Penn G-6	creeping	Tee-2-Green Corp.
Penn A-1	creeping	Tee-2-Green Corp.
Penn A-2	creeping	Tee-2-Green Corp.
Penn A-4	creeping	Tee-2-Green Corp.

course. Disease ratings included snow mold, take-all patch, and dollar spot.

Turf quality during the growing season is summarized in Table 2. Fig. 1 shows dollar spot disease in June and July. In June several cultivars expressed good initial disease resistance, but resistance decreased as conditions became more favorable to the disease. Fungicides were applied to the half the plot to prevent disease; data are only shown for those plots which did not receive routine fungicide applications and for commercially-available varieties.

Additional data are available free of charge at www.ntep.org. In addition to seeing the rest of our Wisconsin data, viewers can see data from other states and other conditions, including sand-based putting greens. Remember that data from other states may not reflect the type of turf quality you may expect in Wisconsin due to different climates and pest or disease pressures.

Table 2. Turf quality of commercially available creeping and velvet bentgrasses as part of the 1998-2002 NTEP putting green trial on a silt loam soil at the O.J. Noer Turfgrass Research and Educational Facility, Verona, WI, during 2001. A rating of 9 is considered ideal turf, a rating of 6 is considered acceptable turf quality. Values within a column followed by the same letter were not statistically different at P (0.05. Data adapted from www.ntep.org.

Cultivar	May	June	July	August	September
L-93	6.0 a	5.0 a	5.0 a	5.3 bc	5.3 abc
A-2	5.3 a	4.7 a	4.0 abc	6.3 ab	6.0 ab
G-1	4.3 a	5.0 a	4.0 abc	7.0 a	6.3 a
Vesper (Pick MVB)	5.0 a	5.0 a	4.0 abc	5.7 bc	6.0 ab
A-1	4.3 a	4.3 a	4.3 ab	6.3 ab	5.7 abc
Bengal (BAR AS 8FUS2)	4.7 a	4.0 a	3.7 abcd	6.0 ab	5.7 abc
Brighton (SRX 1120)	5.3 a	4.7 a	2.7 cdef	6.0 ab	5.7 abc
Pennlinks	4.7 a	4.3 a	4.3 ab	5.7 bc	5.3 abc
SR 1119	5.0 a	4.7 a	3.3 bcde	5.7 bc	5.3 abc
G-6	5.0 a	5.0 a	3.0 bcdef	6.0 ab	5.3 abc
Penncross	4.3 a	4.0 a	4.0 abc	6.0 ab	5.0 abc
SR 7200	5.0 a	4.7 a	5.0 a	4.0 d	4.7 bc
A-4	4.3 a	4.0 a	3.0 bcdef	6.3 ab	6.0 ab
Backspin	4.3 a	4.3 a	2.7 cdef	5.3 bc	5.0 abc
Imperial	4.3 a	3.7 a	2.3 def	5.7 bc	5.0 abc
Crenshaw	4.0 a	3.7 a	2.0 ef	5.7 bc	5.0 abc
Providence	4.7 a	4.7 a	2.0 ef	4.7 cd	5.0 abc
Century	4.3 a	3.3 a	1.7 f	5.3 bc	4.7 bc
Bavaria	3.3 a	3.3 a	3.7 abcd	2.7 e	3.3 c

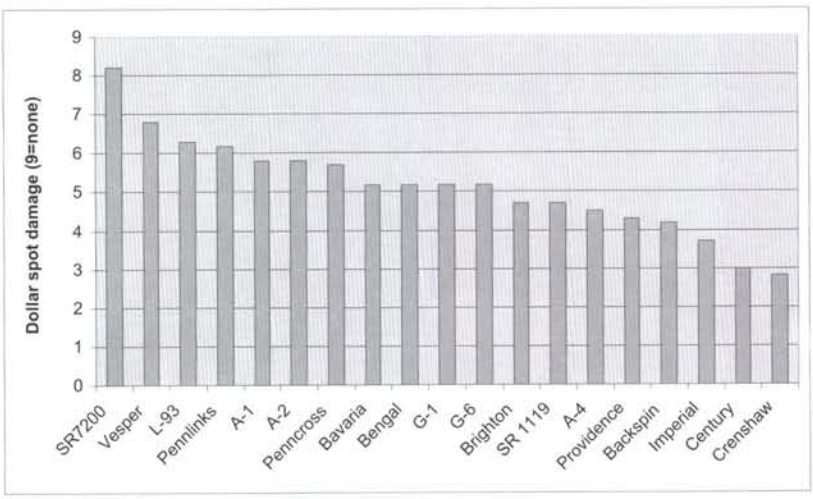

Fig. 1. Dollar spot severity of commercially available creeping and velvet bentgrasses as part of the 1998-2002 NTEP putting green trial on a silt loam soil at the O.J. Noer Turfgrass Research and Educational Facility, Verona, WI, during June-July, 2001. A rating of 9 is no disease, a rating of 6 is considered acceptable. The Least Signficant Difference for statistical comparison between cultivars was 1.3. Data adapted from www.ntep.org.

Golf play and green recovery

Due to the difficulty of experimenting with controlled levels play while re-establishing partially-killed greens, no data are available to indicate how long an active green will take to recover from winterkill. Stolons can grow and fill voids during low to moderate levels of play—high levels of play (e.g., >20,000 rounds/yr) may discourage extensive stolon growth. Some seed will be able to germinate and develop into plants with some play, but again, success decreases as play increases. Success can be increased if seed is primed before application (see *The Grass Roots*, Vol 27, Stier, 1998).

Creeping bentgrass seed germinates best between 59-86°F (Beard, 2002). Germination will occur at lower temperatures, particularly above 40°F, but will take longer. Temperature is the most important reason germination time can take between 6-10 days. Some varieties may germinate faster than others, though data are too limited to be useful and in any case the differences will be trivial for practical consideraton in terms of getting a putting green ready for play.

Ultimately the decision to close or not close a putting green to allow recovery depends on the people involved in the decision-making process. Questions that need to be answered include 1) Can a temporary green be established in the fairway, 2) What will be the revenue loss, short and long-term, due to closing of the regular greens, 3) How bad is the green? Putting greens with more than 30% turf loss will usually need to be closed

for at least one month of good growing (and golfing) conditions, longer the worse the damage is. If a green is closed and interseeded on May 30, soil temperatures are optimal and germination can occur by June 5. Under ideal conditions, new leaf production can be expected at roughly 6 day intervals. If a plant normally has 5 leaves, plants will be up to leaf capacity by July 5. Plants will still be young and relatively weak and may not be ready for play until at least August. Since it takes about 65 days for cool-season grasses to become physiologically mature, beginning play in August will still likely result in a slow decline of turf growth and quality, though in many cases the diminished play and good growing conditions in September and October will be sufficient to allow the grass to recover and reach maturity before winter. Beginning play in July just 30 days after seeding may result in areas of dead turf again before the end of the season: this is not a reflection on turf management skills, just a biological limitation of turf growth and wear tolerance.

Putting greens with less than 30% damage may or may not need to be closed depending on how much poor turf the golfers will accept and the length of time for which they will accept poor turf. A green with 15-30% damage may end up looking and playing poorly the entire growing season if play is high and the weather conditions less than ideal for turf growth.

Conclusion

Research on lawn type turf at Purdue University in the late 1990's indicated early spring overseedings, even before soil temperature was optimal for germination, resulted in better turf density than waiting until optimal soil temperatures. Unpublished research during the last three years in a simulated athletic field situation at Cornell University shows interseeding at 2-4 week intervals even under traffic produces a better turf than less frequent interseeding. The bottom line for recovering winter-damaged putting greens: Verticut and/or core aerate, overseed and topdress as soon as possible in the spring. Follow up as needed during the summer. In Wisconsin, one of the most consistently best varieties for putting greens on silt loam soil has been L-93, though many other varieties may perform similarly or even better.

REFERENCES

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Stier, J.C. 1998. Pump up that seed: priming and pregermination. *The Grass Roots* 27(3):31, 33, 34-35.