Greenhouse Evaluation of Three Creeping Bentgrass Varieties

By James C. VanHerwynen

As new turfgrass varieties are marketed, questions arise as to their agronomic characteristics, disease susceptibility, and response to management practices. The bentgrass varieties of different geographic origins respond to differences in nutrition, their growth characteristics in general, and their susceptibility to pythium.

The creeping bentgrass varieties grown were Penncross, National, and SR 1020. Penncross represents an older variety with northeast U.S. origin. National and SR 1020 are relatively new varieties. National was developed from plants selected on Canadian golf courses. SR 1020 has its origin in plants from southwestern U.S. golf courses.

The three bentgrasses were grown for a total of 70 days in the greenhouse in pots of a commercial 80:20 sand:peat mix. Bulk lots of the mix were treated with 0, 60, or 120 lb P/A applied as monocalcium phosphate and 0, 100, 200 lb K/A applied as potassium phosphate. The fertilized soil was air-dried for 6 days and samples removed for testing. The mix was then potted, compacted to 1.4 g/cc, moistened to its field capacity of 14.2% and seeded. Nitrogen in the form of a urea solution was then applied at the rates of 0.075, 0.15, or 0.30 lb N/M. The N applications were subsequently repeated bi-weekly.

At 62 days after seeding (DAS), the pots were transferred to a plastic canopy where daytime maximum temperatures ranged from 85 degrees to 95 degrees F and the relative humidity from 65% to 85%. Each pot was then inoculated with a pythium inoculum provided by Dr. Gayle Worf.

Table 1.

Averaged responses of three creeping bentgrass varieties to N, P, and K.

Nutrient and level	Initial emergence rating	Ground cover	Color rating	Clipping weight
		%		mg/pot
N-lb/M/2 wks				
0.075	3.3	54	7.9	90
0.150	2.7	54	8.0	88
0.300	1.4	58	8.2	105
Soil P-lb/A				
40	2.9	52	-	87
101	2.7	49	-	91
164	1.5	55	-	94
Soil K-lb/A				
70	3.8	55	-	90
170	3.2	57	-	95
276	1.4	55	-	94
Duncan's LSD	0.5	6	0.2	10

Results

Observations from the study were first averaged over the data from the bentgrass varieties to see the general effects of the N, P, and K treatments. As indicated in Table 1, increasing the rates of all three nutrients decreased initial plant emergence ratings taken 4 DAS. These adverse nutrient effects lessened day-by-day, disappeared almost completely for N and P by 7 DAS, but remained at the highest K rate. In going from 100 to 200 lb K/A, the final impact was a 36% reduction in bentgrass emergence ratings taken 7 DAS. After 7 days, changes in bentgrass emergence were imperceptible.

The N, P, and K applications had no effects on % groundcover color (Table 1). Color ratings increased slightly with increasing N levels, but even the 0.075 lb N/M applied bi-weekly gave excellent color. Nitrogen was the only nutrient that increased clipping weights.

Many more treatment differences became evident when the performances of the individual creeping bentgrass varieties were examined. Significant differences were found in emergence rates, groundcover, color, root weights, verdure, tissue N, P, and K concentrations and pythium infection. Only clipping weight and tissue %P did not vary among the three bentgrass varieties. (Table 2)

Table 2.

Characteristics of three creeping bentgrass varieties averaged across three levels each of N, P and K.

Chacteristic	Variety			Duncan's LSD
	Penncross	National	SR 1020	
Emergence rating at 7 days	3.0	2.8	3.2	0.2
% Ground cover at 44 days	55	48	59	3
Color rating; 15 and 32 days ave.	7.7	8.1	8.3	0.2
Clipping weight-mg/pot; 34 and 39 days ave.	90	89	89	NS
Root weight-mg/pot; 44 days	528	368	411	145
Verdue-mg/pot; 44 days	401	373	538	81
Tissue analysis				
%N	5.20	5.28	5.45	0.12
%P	0.85	0.84	0.80	0.06
%K	2.31	2.46	2.51	0.07
Pythium infection: % of pot				
2 days	9.2	15.0	5.8	3.9
3 days	51.0	72.1	41.7	12.7
4 days	82.6	91.4	69.3	9.6

Among the 19 sets of observations recorded in this study, there were only four instances of significant fertility x variety interactions. Thus, the general situation was one in which all three creeping bentgrass varieties responded similarly to increasing levels of N, P, and K. The exceptions to this were emergence ratings made at 6 and 7 DAS, % tissue K and the initial infection by pythium.

The fertility x variety interaction in the 6 and 7 DAS emergence ratings arose because only Penncross responded to the highest N rate and only SR 1020 responded to phosphate applications. That response was an increase in emergence at the 60 lb P rate and suppressed emergence at the 120 lb/A P rate. In the case of the interaction in tissue %K, the primary cause was failure of Penncross to show a K response while National and SR 1020 had significantly higher tissue K concentrations at the 100 and 200 lb/A K rates than at the zero rate.

Initial pythium infection levels also displayed a significant fertility x variety interaction. This is of particular interest because it suggests that there were varietal differences in how nutrition predisposes bentgrass to pythium infection. Initial pythium infection in SR 1020 was not affected by N rate while Penncross and National infection levels increased markedly when the N rate went from 0.15 to 0.30 lb N/M bi-weekly. In direct contrast, increasing K levels had no influence on initial pythium infection of Penncross and National but increased the extent of initial infection in SR 1020 by 10%.

Discussion

The adverse effects of fertilization on creeping bentgrass emergence were not expected. Although application rates of 120 lb P/A and 200 lb K/A may seem excessive, these equate to 6.0 lb P_2O_5 and 5.5 lb K_2O/M mixed throughout the 80:20 rootzone mixture. A standard practice is to rake starter fertilizer into the soil just prior to seeding. Assuming this fertilizer is incorporated into the soil to a depth of no more than one inch, then the highest P and K rates used in application of 1.6 lb P_2O_5 and 1.46 lb K_2O/M. This causes one to question whether or not emergence of bentgrass might not be improved by doing one of two things: (1) do not apply starter fertilizer until some time after emergence; or (2) incorporate the starter fertilizer to a greater soil depth.

The bentgrass responses to N, P, and K were considerably less than expected. The N rates were selected on the basis that application of 0.2 lb N/M on a bi-weekly schedule is a common practice. The P rates were based on reports in the literature that soil test P levels up to about 120 lb P/A are required for rapid turfgrass establishment. The maximum K rate elevated soil test K to only 276 lb K/A. This is certainly not an excessive amount from a plant, soil or leaching perspective. All indications from the present study were that 0.075 lb N/M applied bi-weekly, 40 lb soil test P/A and 70 lb soil test K/A were adequate for establishment of the three bentgrass varieties grown. While it is always dangerous to extrapolate greenhouse date to field situations, this study does raise some questions regarding what constitutes adequate N, P, and K rates during the establishment phase of creeping bentgrass.

As for the three creeping bentgrass varieties themselves, SR 1020 certainly merits field testing with the thought that it may be a good alternative to Penncross. Indications from this greenhouse study were that SR 1020 establishes more quickly, has better color, good root development, high verdure to combat invasion by broadleaf weeds and *Poa annua*, and superior resistance to pythium. Furthermore, all of these advantages may be realized at reduced N and K rates. The SR 1020 consistently had higher tissue N and K concentrations at all rates of N and K application. This suggests that SR 1020 may be more efficient than Penncross in terms of nutrient utilization.

Finally, a common assumption is that high N rates increase the susceptibility of bentgrass to pythium. This study indicated that the assumption is a valid one as far as Penncross and National are concerned, but is not true for SR 1020. Increasing the fertilizer N rate 4-fold from 0.075 to 0.30 lb/M bi-weekly did not alter the outstanding ability of SR 1020 to resist pythium. Management-wise, this means that much less attention need be paid to fertilizer N rate as the pythium season approaches when SR 1020 is being grown.

EDITOR'S NOTE: Jim is a May 1991 graduate of the UW-Madison Turf and Grounds Management Program. He is employed as assistant golf course superintendent at the Kenosha Country Club. He spent a year at Blackhawk Country Club in Madison and six years at North Shore Golf Club in Menasha prior to that.