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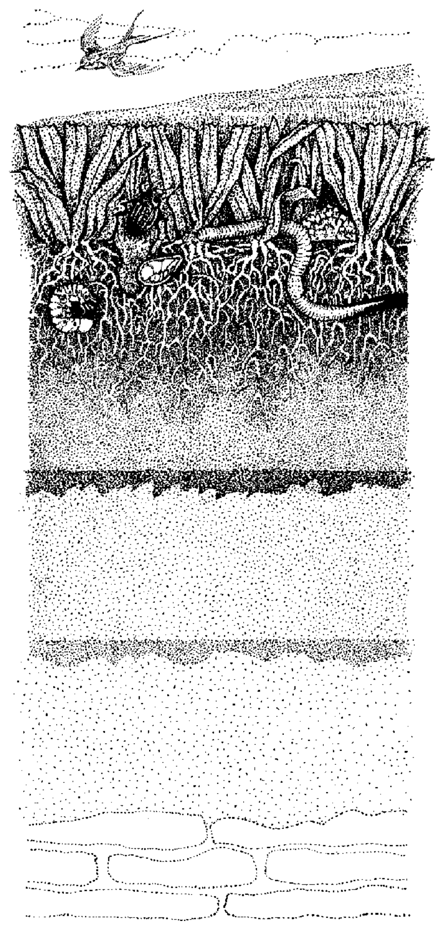

Establishing and Trafficking New Bentgrass Putting Greens

Golf turf managers are pressured from the golfing community to reduce the establishment time of playing surfaces. To this end, accelerated grow-in procedures are implemented that eventually permit play on surfaces that are less than prepared to receive traffic. Research hassuggested that accelerated grow-in procedures and premature traffic results in a turfgrass stand that is more prone to damage from pests, in particular, diseases.

New cultivars of creeping bentgrass are available and mark a significant improvement in visual quality, growth habit and ability to tolerate close mowing. The ability to lower cutting heights is critical for golf turf managers who are required to provide ball roll distances consistently greater than 10 feet.

The goal of our research at Cornell University is to determine optimum putting green establishment programs that lead to a more stress tolerant, disease resistant stand of turf, less reliant on pesticides. ■

More specifically, our objectives are to evaluate newly released creeping bentgrass cultivars established under various procedures; evaluate microbial seed treatment on seedling survival and suppression of seedling disease; and assess the impact of establishment procedures and traffic on the incidence of foliar and root diseases in the mature turfgrass stand.

Putting Green Establishment Procedures

A 20,000 square foot experimental golf green was constructed at the Cornell Turfgrass Research and Education Center in Ithaca, NY in 1997. The green was constructed to conform to California specifications. Unamended sand (pH

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Figure 1

Light, frequent topdressing is vital during grow-in to manage the surface accumulation of organic matter.

The high shoot density of the new cultivars, SR1119, L-93 and Penn G-1 acts as a "sieve" to topdressing particles greater than 0.25 mm.

7.8) was placed above subsurface drainage, in direct contact with the native subsoil. Drain lines were cut into subsoilon 10-foot centers This system is widely used when economics prohibit the incorporation of organic matter into the rootzone. Interestingly, a preliminary microbial screening of the sand rootzone indicated a plethora of activity often thought to be nonexistent under these situations.

Planting

Plots were established on July 29, 1997 (year 1) and repeated in a separate area on the green on May 13, 1998 (year 2) with four commercially available bentgrass cultivars (Penncross, L-93, SR 1119, Penn G-1) at four or five seed rates (0.25, 0.5, 1, 2, 4 lb. PLS/M) and treated with a fungicide (Mefenoxam), one of two or three microbial inoculants (*Azospirillum brasilienses, Enterobacter cloacae, Pseudomonas aureifaciens*), or untreated. Data were collected in the first 12 weeks for seedling survival, visual cover, tillering and growth habit.

Grow-in Management

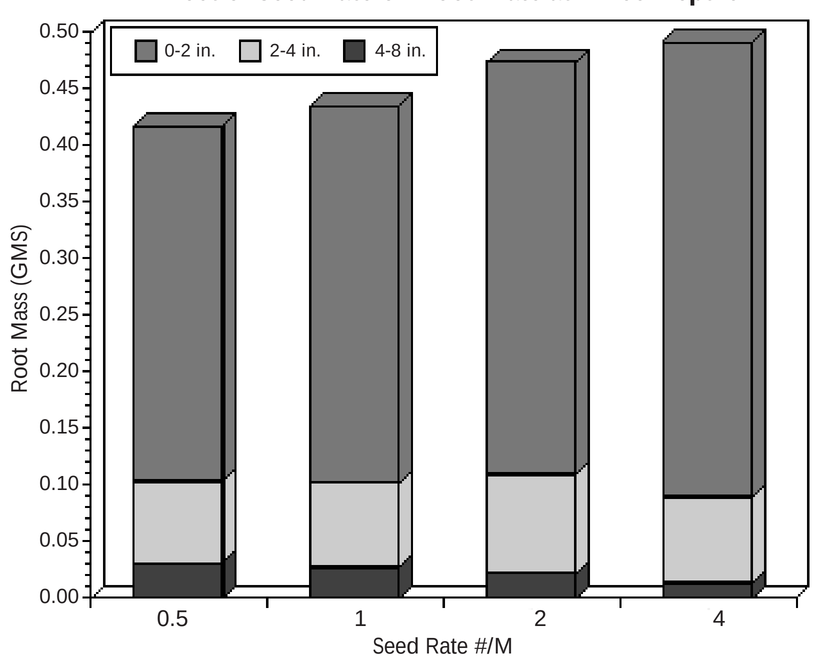
Grow-in fertility of the plots established in 1997 amounted to 6.5 lb. of actual nitrogen (N) per 1000 square feet, 3.5 lb. of phosphorus (P) and 5.5 lb. of potassium (K). Fertilizer applications were made as turf color and growth indicated. It was noted that high seed rate plots required substantially more N from a color perspective then the plots seeded at the recommended rate. Once established, in 1998 the plots were foliar fed with 0.125 lb. of N weekly supplied as urea and potassium nitrate. Irrigation was used to keep the sand surface moist during the establishment phase of the study (a formidable challenge with straight sand greens). Irrigation water maintained a pH of 8.2 throughout the growing season.

In year two, the mature plots were put under championship management conditions in cooperation with David Hicks, Golf Course Superintendent of Cornell's Robert Trent Jones Golf Course and were opened for simulated play on May 31, 1998. During the season, cutting heights were reduced from 0.156" to 0.125" and finally down to 0.095" for two weeks in August.

Cutting height reductions were performed in conjunction with an aggressive sand topdressing program that was implemented every three weeks (see Figure 1). In fact, topdressing commenced prior to mowing as a means of managing the organic matter accumulation associated with seedling bentgrass. The high shoot

Figure 2

Effect of Seed Rate on Root Mass at Three Depths



density of the new cultivars, SR1119, L-93 and Penn G-1 acts as a "sieve" to topdressing particles greater than 0.25 mm. Attempts were made to apply dry sand, brush the material and then follow with irrigation. Mowing practices were suspended for the day following topdressing and still, a significant amount of material remained on the surface.

The traffic simulated approximately 25 to 30,000 rounds of golf per year, typically what is expected on the average daily fee course in upstate NY. In addition, rooting was investigated by sampling the untreated and fungicide seed treatment plots with a Noer Profiler (1.25" x 4" x 12"), sectioned at 0-2", 2-4" and 4 to 8" depths. The roots were washed free of sand and oven dried. Ball roll data were collected using a modified stimpmeter.

Results of Second Year Plots

Pest Issues

As a result of the mild winter experienced in 1997-8, there was a low incidence of pink and gray snow mold on the experimental area. This was surprising as previous research has indicated that seed rate can have a significant impact on susceptibility to snow mold. It appeared that three of the four cultivars used in the study exhibit a significant amount of tolerance to snow mold. Although, where snow mold was observed, recovery was slow.

Throughout the second year of the experiment, diseases, insect damage, algae, and drought stress symptoms were observed on the plots. Some stress appeared to be related to the traffic, however, except for turfgrass quality ratings (see Table 1) there were not significant differences associated with the traffic treatment. Also, except for the initial seed treatment fungicide, no pesticides have been applied to the plot area.

Rooting

Plots established in 1997, at seed rates greater than 2 lb. per 1000 square feet (2x the recommended rate) exhibited more severe wilting com-

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Figure 3

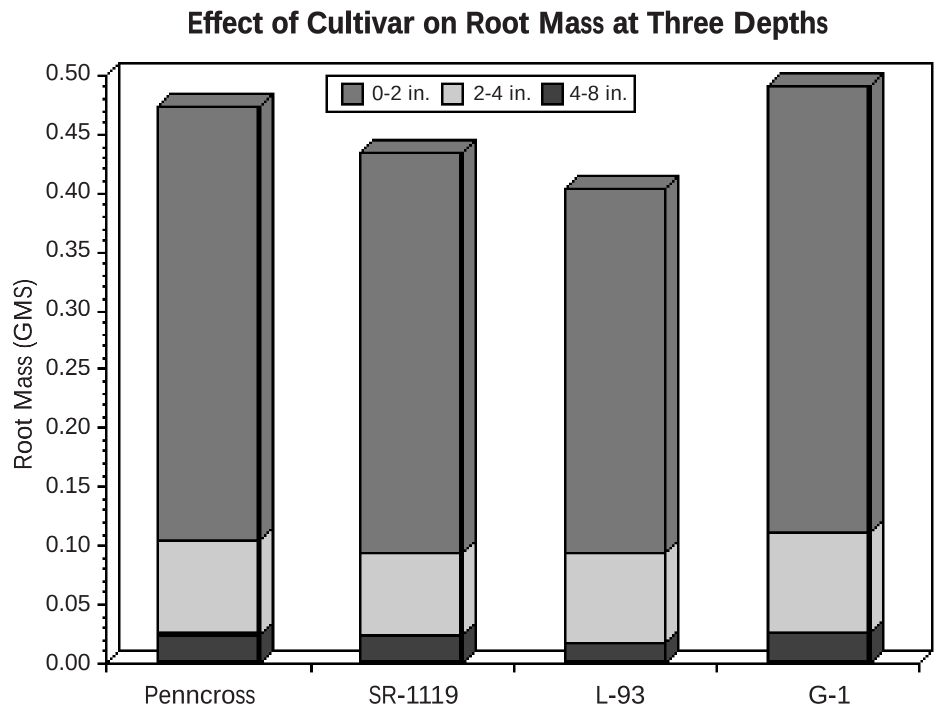

Figure 4

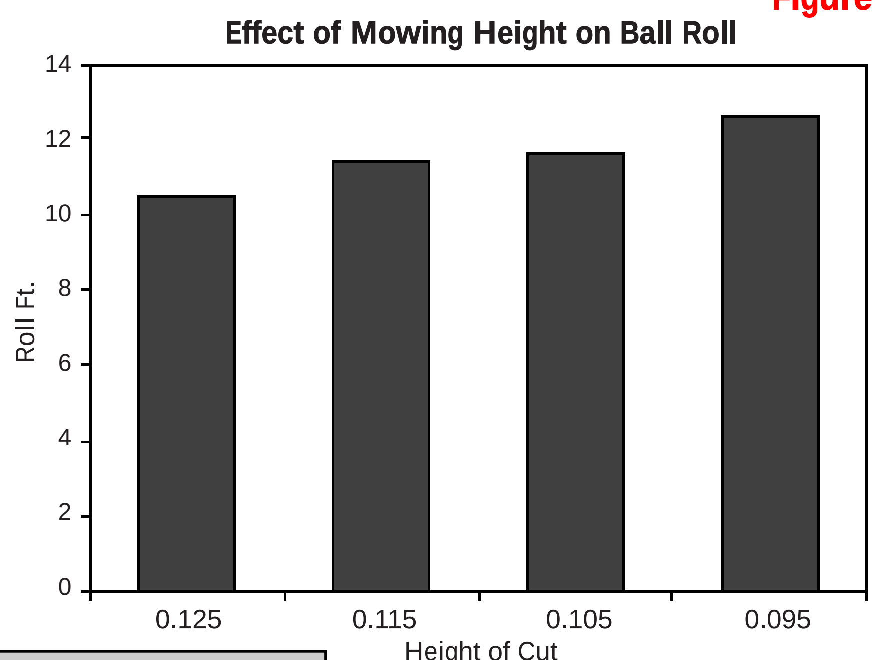

Table 1. Influence of cultivar, cutting height and traffic on turfgrass quality.

	Cutting Height 0.125"		Cutting Height 0.095"	
Cultivar	No Traffic	Traffic	No Traffic	Traffic
Penncross	6.2	5.0	4.1	2.5
SR1119	7.2	5.9	6.6	5.3
L-93	7.6	6.3	7.4	5.8
Penn G-1	7.5	6.6	7.7	6.0
lsd (0.05)	0.8	1.0	0.7	0.6

Quality ratings from 1 to 9, where 1=dead turf, 6=acceptable, 9=best.

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pared to recommended seed rates. Root sampling indicated that as seed rate increased, the amount of surface rooting increased with a concomitant reduction of rooting below the 4" depth (see Figure 2). There was a significant cultivar effect for rooting. The "high shoot density, upright growth habit" of Penn G-1 resulted in the greatest amount of surface rooting (see Figure 3).

A substantial amount of below-ground competition was evident at the high seed rates. This effect was noted when fertility was reduced and plants became chlorotic. It appears that there is a greater need for additional resources to sustain high plant populations that result from high seed rates. In addition, the excessive accumulation of organic matter at the surface could pose serious long term consequences, especially if not addressed with a judicious topdressing program.

Cutting Height

Cutting height had a significant impact on ball roll distance (Figure 4). Results indicate that up to 3.5 feet can be gained in ball roll distance by reducing cutting height from 0.125 to 0.095. Yet, it is important to note, except for Penn G-1, no other cultivars were able to maintain acceptable quality at the close cutting height under traffic treatments. Furthermore, as cutting heights were lowered to 0.125" and below, many plots exhibited significant reductions in surface density. Plots established at the recommended seed rate or below exhibited a 25 to 50% greater incidence of algae as compared to high seed rate plots, especially for the more prostrate growth habit cultivar, Penncross. As cutting heights were increased above 0.125" in early fall, algae was not evident. In addition, there was a surprising increase in the incidence of take-all patch (*Gaumenomyces* spp.) associated with the low seed rate plots.

Results from First Year Plots (established 1998)

Seedling Growth

Consistent with data from 1998, visual observations indicated that the higher seed rate plots exhibited more rapid germination independent of cultivar and seed treatment. This includes the seedling survival assessment which for the second year indicated a substantial difference in the percentage survival based on the pure live seed count, again independent of cultivar and seed treatment. This response is consistent with previously observed results from a golf course fairway study with different bentgrass cultivars. The efficiency of the increased seed rate approach is extremely low when viewed in this light, regardless of the fungicide or microbial inoculant.

However, unlike plots established in 1997, the 1998 plots demonstrated visual symptoms of *Pythium* spp. Plots with seed rates greater than 1 lb. per 1000 square feet had a 50% higher incidence as compared to the 0.5 and 0.25 lb. rate. In addition, the microbial seed treatments reduced *Pythium* to a level similar to the fungicide treatment at the 4 lb. (4x) seed rate.

Visual cover ratings recorded at six weeks after establishment when averaged across culti-

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These smaller plants are less likely to produce stolons that are necessary for traffic tolerance and recuperative ability following surface disruption.

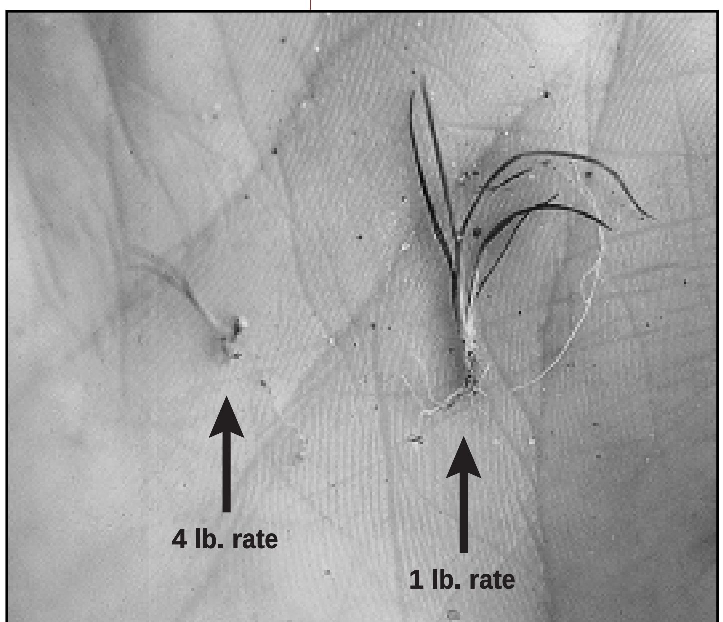

Figure 5

Individual plants established on the same date at different rates. The 4 lb. rate plot is 100% dense while the 1 lb. rate plot is about 80%. Which would you rather open for play?

established for the next time period. Training and professional development opportunities can be identified to help meet the new expectations.

At this point we are back at performance expectations and the process continues.

Sally and George

We now return to Sally and George. Sally's supervisor was telling her she was doing fine but she's still frustrated by the lack of a clear understanding of her performance level. If she had a "great boss" using this performance management process, she would be clear on her expectations and her progress relative to those expectation would clearly provide information on how well she was performing. George's supervisor is telling him to not worry about how his work contributes to the business and just keep up his good work. If George had a "great boss' using our process, the performance expectations would be derived from and clearly tied to the goals and the mission of the business or organization.

Robert A. Milligan
Cornell University Turfgrass Team

The recent trend in golf turf management to accelerate establishment systems appears to be substantially flawed. The manager and golfer are lured by rapid development of surface density, yet, upon close observation there is a collection of small, weak plants that, based on our data persist into the second year.

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vars and seed treatments were not significantly different in response to seed rate. This was consistent with results from 1997. Furthermore, the increased plant density associated with the high seed rates results in plants with one half the number of tillers as compared to recommended rates. These smaller plants are less likely to produce stolons that are necessary for traffic tolerance and recuperative ability following surface disruption (Figure 5).

Implications

The most significant, but easily overlooked implication of this two year research project, is the low disease incidence in response to the most severe management and traffic stress. The cultivars selected, lest Penncross, represent significant improvements in disease tolerance and demonstrate the importance of the genetic component of IPM, i.e. selecting pest resistant species and cultivars. In addition, the excellent growing environment established at the research center (proper root zone selection, site placement for maximum air movement and light penetration, precise cultural management) demonstrates the importance of these factors to the maintenance of healthy plants, more able to tolerate pest infestations.

The recent trend in golf turf management to accelerate establishment systems appears to be substantially flawed. The manager and golfer are lured by rapid development of surface density, yet, upon close observation there is a collection of small, weak plants that, based on our data persist into the second year. This was most obvious in the significant below-ground competition evident in the root sampling data. High seed rate plots produce a higher proportion of roots at the surface to exploit resources. This surface rooting will require a higher frequency of resource applications (fertilizer and water) as well as organic matter accumulation that could result in decreased infiltration. Previous research has shown that reduced infiltration as a result of surface organic matter accumulation will create an anaerobic layer that will further restrict rooting and create an ideal disease environment.

As a result of this research, we have identified possible disease tolerance of certain creeping bentgrass cultivars (genetic component of IPM); the role of seed rate in reducing disease incidence; and the reduced need for fungicides in the seed bed when utilizing recommended seed rates. The consequences of high seed rates persist into the second year, especially evident in the rooting response, where greater surface rooting is likely to result in reduced stress tolerance.

Frank S. Rossi, Arthur Schaub and Eric B. Nelson
Cornell University Turfgrass Team

Short Cutts

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The Executive Director of the New York State Turfgrass Association is Elizabeth (Beth) Seme. Academic Liaisons are Dominic Morales of SUNY Delhi, Bob Emmons of SUNY Cobleskill and Frank Rossi of Cornell University. Mr. Horst Pogge serves on the New York Greengrass Board. If you have any questions about NYSTA activities, programs or interest in serving on the Board, contact Tony Peca at (716) 343-2828 or Beth at (800) 873-8873.

Advanced Short Courses Draw Rave Reviews

The Cornell Turfgrass Program embarked on a new direction for the 1999 Short Course schedule. As you may have read in previous issues of *CUTT* and from conferences around the state, we did not conduct the two-week Turfgrass Management Course. Rather, we introduced a new series of Advanced Short Courses to address specific needs of Sports Turf managers and Golf Course Superintendents. These course were held over the first two weeks of January on the Cornell University campus.