Golfdom'S PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

TURFGRASS BREEDING

Innovative Cultivars Arrive Slowly but Surely

By Leah A. Brilman

Turfgrass breeders are always in the process of improving cultivars, yet many of the improvements look minimal to the average consumer. Often the improvements, such as disease resistance, can't be seen by the human eye unless disease is present on a site. However, if the characteristics from one National Turfgrass Evaluation Program (NTEP) trial to the next are closely compared, the improvements are evident.

True innovation may come under a different classification than these gradual improvements, but if you compare Linn perennial ryegrass to the newest cultivars, the differences are outstanding.

Innovations may constitute developing a new species for turfgrass usage, discovering germplasm with unique characteristic in an existing species and integrating this into improved cultivars or applying different selection characteristics to develop unique cultivars. Some of these innovations are available now and others may be available in the next few years.

Improved disease resistance is always an important characteristic. New technologies in genetics enable breeders to not only select for this characteristic but also to potentially determine the genes involved in resistance.

Gray leaf spot has been devastating to perennial ryegrass in the Eastern and transitional zones of the United States. Breeders have developed resistance to this disease by select-

Continued on page 64

PHOTOGRAPH COURTESY: MIKE RICHARDSON

The cold-tolerant bermudagrass variety Yukon is shown in the bottom left corner. Princess 77 is two plots behind it.

IN THIS ISSUE

it's not about
LYING DOWN ON THE JOB

Continued from page 61

ing within existing cultivars and by integrating new germplasm from Europe into existing populations. The new molecular map of perennial ryegrass has identified areas of important genes for resistance, so it is hoped breeders can maintain resistance to this changeable disease, utilizing this knowledge.

In this new European germplasm, other important characteristics have been observed, such as plants with a more spreading growth habit, which may allow development of ryegrasses with a better ability to repair. Molecular maps are also being developed in creeping bentgrass for growth characteristics and dollar spot resistance and in the fine fescues. Resistance genes can be fixed and more easily integrated into varieties with other desirable characteristics.

Hybrids between Texas and Kentucky bluegrass species have been developed and are seeing increasing interest. The hybrids combine the heat and drought tolerance of Texas bluegrass with the turf quality of Kentucky bluegrass. The initial F_1 hybrid, Reveille, is primarily propagated vegetatively due to seed fertility problems but has shown excellent results in the western United States. Other breeders have backcrossed these hybrids to Kentucky bluegrass to improve apomixis and fertility.

Thermal Blue has shown excellent performance in many situations, but as with Kentucky bluegrasses, each cultivar will have strengths and weaknesses. New hybrids will be coming out over the next few years and may push the adaptation range of bluegrasses further south.

Tall fescues with rhizomes have received considerable interest recently. The ability of tall fescues to make some rhizomes has been documented for some time, but it has received increased breeding attention. The Mediterranean-type tall fescues have more extensive rhizomes but are lighter green and lack the turf density of American germplasm that has been cycled for multiple generations under stress in this country.

Improvements on the number and rapidity of rhizome expression in American germplasm are ongoing, with the concentration also including other important turf characteristics, such as disease resistance and turf quality.

Seashore paspalum is being utilized more frequently in many areas of the United States and overseas. Many vegetative cultivars have recently come onto the market, but make sure the one you are going to use has been extensively tested in your region and for your use. The first seeded cultivar, Sea Spray, is available, with more seeded ones in the near future. The seeded types are probably better adapted for home lawns, sports fields and fairways and not for greens.

In many usages, seeded or hybrid bermudagrasses may be as good a choice or better, but seashore paspalums can shine under heavy saline conditions in warmer climates. Farther north you should utilize the cold-tolerant seeded bermudagrasses such as Yukon and Riviera, or vegetative cold-tolerant cultivars.

Another important option for transitional zone areas that want a low maintenance turfgrass, with reduced water requirements are the seeded zoysias such as Zenith and Companion.

Breeders have also been exploring different species of grass for use in turf. Many of these species are first identified after the breeders have found a different species forming high-quality turf under mown or closely grazed conditions. The key is to have these new species evaluated in many environments, under varying management, to see where they might be adapted. If the species still looks promising for at least a portion of the market, it is often necessary to collect a larger pool of germplasm to find the best material. Even after years of development, getting customers to use products that are different than they are accustomed to can be difficult.

Cultivars of tufted hairgrass, *Deschampsia cespitosa*, and prairie junegrass, *Koeleria macrantha*, have both seen some usage. Other species being looked at include crested dogstail and wood bluegrass.

Sometimes we need to re-examine turfgrass species that have been around for some time for improvements or new usages. True colonial bentgrasses, *Agrostis capillaris*, as opposed to Highland bentgrass, which is a dry land bentgrass, *A. castellana*, are being looked at again for home lawns, in particular in the Pacific Northwest. This species uses very little nitrogen and has lower water requirements than many turf species. A trial in Utah, watered at 50 percent ET (evapotranspiration), explored different species for low water usage. In that test, the colonial bentgrass planted as a control had the best color and highest density.

Colonial bentgrasses do not thatch as much as many other turf species and have been used in Europe for many years for lawns.

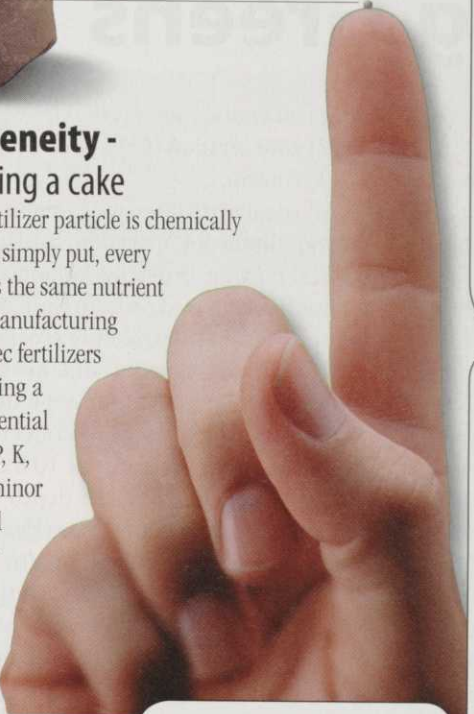
The fine fescues are not just for shade mixtures. The improved cultivars of these low-maintenance species can be used in many areas of the country in full sun as well as shade. The reduced nitrogen and water requirements make them useful for home lawns and golf course roughs. Breeders have significantly improved the heat tolerance of these species and resistance to important diseases, such as leaf spot, red thread and summer patch.

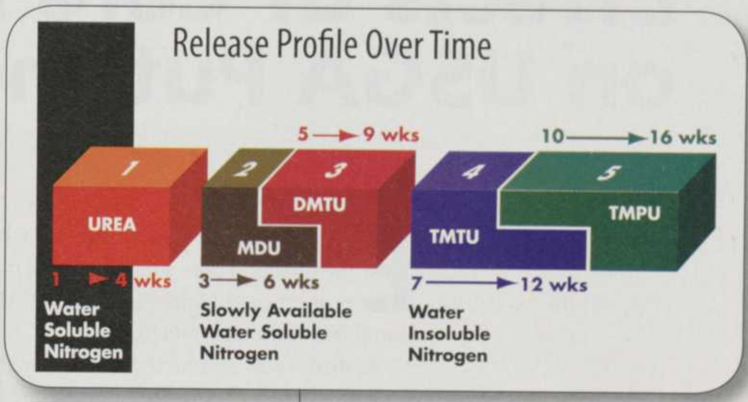
Check the data from your regional turf programs for the NTEP (*www.ntep.org*). The data can be looked at by location, region and management. This will enable you to evaluate important characteristics such as drought tolerance. In other cases it is important to visit the field days at your local university to look at results for yourself.

Leah A. Brilman is the director of research and technical services for Seed Research of Oregon. She has been involved in turfgrass breeding for over 23 years. As the test preparer and coordinator for the Turf Bowl for Golf Course Superintendents Association of America (GCSAA), she will teach a class on alternative turfgrasses. She served as chair of the turfgrass division of the Crop Science Society, president of the Turfgrass Breeders Association (TBA) and representative for the TBA to the NTEP Policy Committee.

Contec® Classic

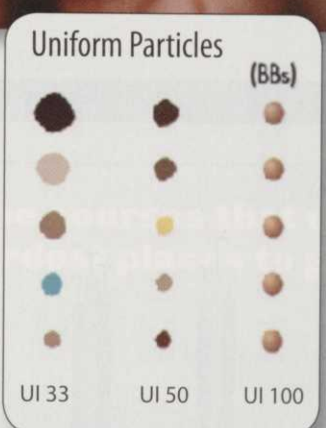
Still the #1 Greens Fertilizer...and here's why:





1. Homogeneity - It's like baking a cake

Every Contec fertilizer particle is chemically homogenous, or simply put, every particle contains the same nutrient formula. Our manufacturing process for Contec fertilizers is similar to baking a cake. All the essential ingredients (N, P, K, secondary and minor elements) are all batched together in the proper ratios. Then the ingredients are mixed together and processed (baked) into chemically uniform (homogenous) particles. The resulting homogenous particles provide the highest level of nutritional performance.



2. Uniform Particles - Why UI?

The Uniformity Index (UI) is the ratio between large and small particles. The higher the UI, or more consistently sized the product particles, the more freely the product will flow, assuring hassle-free spreading, even distribution and more effective performance. Contec products are engineered to have a UI of 40+, one of the highest UI ratings in the industry.

3. Particle Sizing - the right size for the right application

The Size Guide Number (SGN) is the "average particle diameter" of the product expressed in millimeters x 100. With average greens heights being reduced to 1/8" or lower, the smaller the SGN the more efficiently the fertilizer particle will perform. Contec greens fertilizers have an average SGN of 80 (0.80MM), providing superintendents some of the smallest particles in the industry. At 80 SGN, Contec fertilizers provide up to 70 particles per square inch* (PPSI) for maximum coverage and performance.

*depending upon analysis and rate of application

4. Controlled Release Technology - the foundation of Contec products

At the heart of Contec controlled release technology is a unique balance of short, medium and long chain methylene ureas which provide efficient and predictable release of nitrogen over time. By blending the proper proportions of these MU chains together into one homogenous particle Contec greens fertilizers can provide the perfect balance of uniform color response, improved density without surge growth and lasting results, all under a variety of environmental conditions.

5. Product Selection A product for every need

Each region of the country presents a unique set of fertility requirements that can change with the seasons. To meet these demands, we have formulated a variety of Contec fertilizers that will provide a fertility solution to satisfy nearly any need from spring green-up, pre-aerification, transition, summer spoon feeding, seeding and new construction.

Contec® Classic Homogenous Greens Fertilizers

Analysis	SGN	N Source
18-9-18	80	1.4% Amm N, 12.8% WSN, 3.8% WIN
17-3-17	80	3.3% Amm N, 10.8% WSN, 2.9% WIN
19-3-19	80	12.7% WSN, 6.3% WIN
19-2-15	80	12.5% WSN, 6.5% WIN
9-18-18	80	6.3% Amm N, 1.9% WSN, 0.8% WIN
13-2-26	80	8.8% WSN, 4.2% WIN
20-0-10	80	14.9% WSN, 5.1% WIN

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Effects of Core Aeration on USGA Putting Greens

By Peter Sorokovsky

Everyone aerates greens. But just what are the effects of core aeration on soil physical properties of United States Golf Association (USGA) putting greens?

A study was conducted in Surrey, British Columbia, under temperate climate with cool and wet winters and relatively warm summers. Mean annual precipitation was 1,310 millimeters (mm). Three of the regular playing putting greens as well as four practice greens at Northview Golf and Country Club were used in the study.

All greens were constructed using USGA specifications, and turfgrass was a mix of Providence bentgrass (30 percent to 40 percent) and annual bluegrass (60 percent to 70 percent). The experiment was laid out as a randomized, complete block design with three 100-square meter (m) replicates. Treatments included:

(1) no core aeration (NCA);
(2) core aeration (CA); and
(3) control.

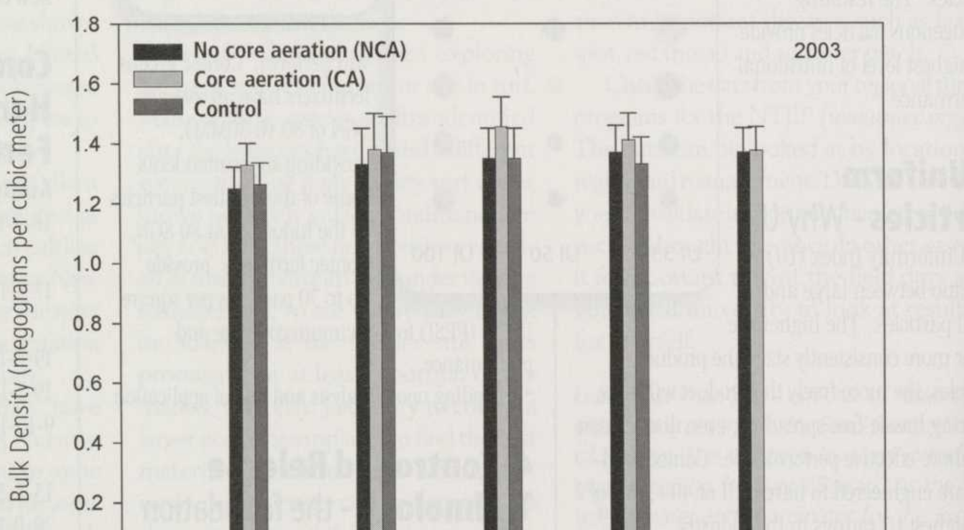
All regular maintenance practices, such as mowing, fertilizing, irrigation, sand topdressing, vertical cutting, brushing, rolling and regular foot traffic, occurred on both the CA and NCA treatments. The control only received fertilizing, irrigation, mowing and no foot traffic through the duration of the experiment.

Core soil samples were collected using a standard cup cutter (diameter 10.8 centimeters cm) at the 0 cm to 17 cm depth (mat layer [approximately 4 cm to 7 cm deep] and the sand layer [approximately 8 cm to 17 cm deep]) for bulk density and water content. Mechanical resistance was measured up to 20 cm in depth, using a Rimik cone penetrometer.

Infiltration rates were measured from steady

Continued on page 68

FIGURE 1



Soil bulk density measured in the mat layer (0 cm to 7.5 cm) under three different management practices in 2003. Error bars represent confidence limits from the MS error anova (n=3). Control for September is absent due to the reconstruction of two of three control putting greens by management

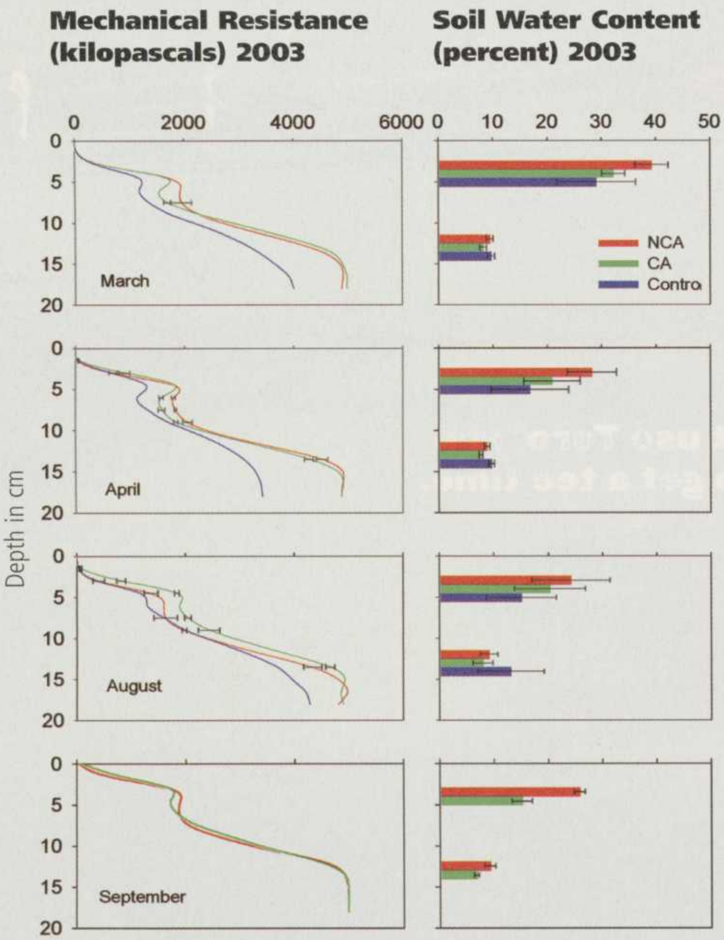
TABLE 1

Average soil bulk density for mat and sand layers:

Bulk Density (megograms per cubic meter)	Sep	Oct	Mar*	Apr*	Jun*	Aug*	Sep*
	Sampling Months for 2002, '03*						
Mat Layer	1.36	1.36	1.28	1.36	1.39	1.37	1.37
Sand Layer	1.56	1.56	1.57	1.57	1.59	1.48	1.64

For August and September 2003 the average soil bulk density is a represented by NCA and CA treatments only.

FIGURE 2



Soil mechanical resistance and water content measured under three different management practices in 2003. Error bars represent confidence limits from the MS error anova (n=3). The control treatment for September is absent due to the reconstruction of two of three control putting greens by management.

Continued from page 66

state using a double-ring infiltrometer (inner ring diameter = 28 cm, outer ring diameter = 56 cm). Percent organic matter was determined by loss on ignition. Sampling and measurements were done before and after three core aeration events on Sept. 28, 2002, and March 30 and Aug. 24, 2003. All core aeration previous to 2004 was done twice a year (spring and fall) at a consistent depth, i.e. from 4 cm to 6 cm.

Soil bulk density measurements of the mat layer revealed no difference in any of the treatments (Figure 1.). However, this was not the case when soil bulk density from the mat was compared to the sand layer.

All sampling times were significantly different to the 0.01 probability level on analysis of variance. This is partly attributable to the development of a compaction pan and almost no organic matter accumulation in the sand layer. From September 2002 to September 2003 the mat layer average soil-bulk density for all treatments was 1.36 megograms (Mg) per cubic meter while for all sand layers it was 1.57 Mg per cubic meter.

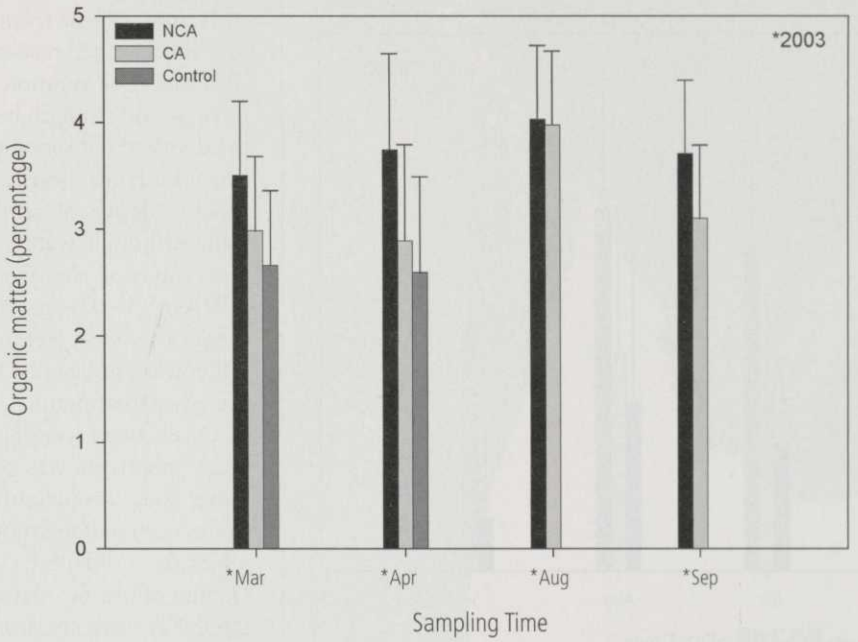
Table 1 shows average soil bulk density of all treatments for each sampling time from the mat and sand layers. This data clearly shows a significant increase in soil bulk density below the depth of core aeration indicating the development of a compaction pan. According to Guertal et al (2002), care should be taken to avoid creation of a compaction pan, caused by aerifying at the same depth for a prolonged period of time.

There was no trend in the data to indicate that treatments differed from one another with respect to soil mechanical resistance (Figure 2).

All the soil mechanical resistance data consistently gave the same pattern form each sampling time with a greater compacted area occurring within the mat layer at about 4.5 cm to 7 cm. Although the graph pattern had not changed throughout the study, the average soil mechanical resistance increased from 1,413 kilopascals (kPa) (March 2002) to 2,055 kPa (May 2004) in the most compacted area of the mat layer (4.5 cm to 6 cm). The mechanical resistance data clearly reveals a pan layer developing and increased soil strength preventing root penetration below 6 cm to 8 cm.

Somewhat surprisingly, there was no difference between treatments when percent organic matter (by mass) was measured after core aeration

FIGURE 3



Percent organic matter (by weight) content measured under three different management practices in 2003. Error bars represent confidence limits from the MS error anova (n=3). The control treatment for August and September is absent due to the reconstruction of two of three control putting greens by management.

practices. The probable reason for this was due to the small-diameter tines that were used (13 mm outside diameter) and the spacing pattern of core holes (50 mm x 65 mm) only impacting 6.4 percent of the total surface area of the putting green. This small percentage of surface area impact could easily fall within sampling error.

Figure 3 shows the percent organic matter content for each treatment. Similar to this study, Murphy et al (1993) found that core aeration on sand-based putting greens (at a 5 percent surface area impact) applied twice a year did not permanently reduce total organic matter content. Smith (1979) reported that organic matter content (in a bermudagrass loamy fine sand putting green) was only reduced when core aeration was increased from twice yearly to monthly over a seven-month study.

Although core aeration under the current level of impact does not, in a single management application, reduce organic matter, it does help to keep organic matter levels under control when combined with sand topdressing.

In March 2002 the percent organic matter was about 2.75 percent, and by the end of the study (May 2004) it was 2.90 percent. According to Carrow (2004), keeping organic matter below 4 percent would reduce the impact of summer bentgrass decline.

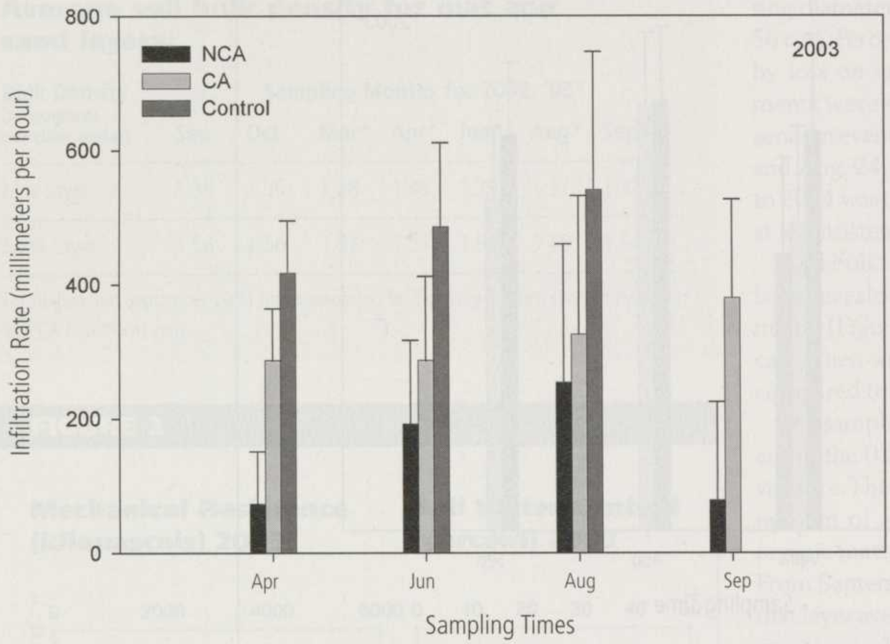
The only soil property that was impacted significantly by core aeration was water infiltration rate. The two sample times (April and September) revealed that CA treatment had greater water infiltration rates than the NCA treatment after core aeration had occurred (Figure 4). Not surprisingly, the greatest infiltration rates were observed on the control plots where little to no traffic occurred.

According to Shreier (2004), high traffic rate would cause a fractionation of the organic matter into smaller size, increasing its surface area and increasing water-holding capacity and decrease infiltration rate. According to McCarty (2001), infiltration rate on USGA-designed putting greens should be no lower than 100 mm per hour for maturing putting greens (over 1 year old). The exception was found for the NCA treatment in April and September, where infiltration rate is below 100 mm per hour.

After core aeration, Carrow (2004) indicated that higher infiltration rates last only five weeks to

Continued on page 70

FIGURE 4



Water infiltration rate measured using a constant-head double-ring infiltrometer under three different management practices in 2003. Error bars represent confidence limits from the MS error anova (n=3). The control treatment for September is absent due to the reconstruction of two of three control putting greens by management.

Continued from page 69

eight weeks before reducing to normal and would need some manner of summer cultivation to keep infiltration high. The most probable reason for seeing higher infiltration rates through the summer on NCA and CA treatments was due to a wetting agent application in mid-May and bimonthly verticutting and topdressing.

Guertal et al (2002) and Murphy et al (1993) state that core aeration in a non-compacted site is damaging to soil structure and should not be used without a clear objective and that core aeration in the non-compacted plots had no effect in reducing bulk density. Similar to those studies, the data recorded from this study indicate that core aeration applied twice annually will not reduce bulk density in a non-compacted sand-based putting green.

It does appear from the soil mechanical resistance data that core aeration will increase soil strength below the depth of core aeration if it is used continuously at a specific depth of application. Although water content was not significantly different between treatments, the NCA treatment was consistently higher than the other treatments.

Qualitatively speaking, the NCA treatment was softer under foot throughout the study. Again, although not significantly different, the amount of organic matter in the NCA was consistently higher, which would increase water-holding capacity and reduce infiltration rates.

Core aeration with 13 mm tines and 25 mm x 25 mm hole spacing could impact a greater amount of surface area (22.3 percent). If properly timed, a single core aeration application per year may be adequate to ensure good drainage through the rootzone mix. Also, reducing the number of aerations and changing depth of application each time may reduce the chance of developing a compaction pan. Careful consideration of what is to be accomplished with core aeration must be considered before application in order to obtain the best results.

Peter Sorokovsky has worked in the golf industry for over 15 years, starting with a summer job to pay his way through the University of British Columbia, where he earned a bachelor's degree in biology. Ten years later, he returned to UBC to pursue a master's in soil science to further his career opportunities.

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