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-

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it’s not about
LYING DOWN ON THE JOB
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ing within existing cultivars and by inte-
grating 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 change-
able 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 Ken-
tucky bluegrass species have been devel-
oped and are seeing increasing interest.
The hybrids combine the heat and
drought tolerance of Texas bluegrass
with the turf quality of Kentucky blue-
grass. The initial F₁ hybrid, Revelle, 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 breed-
ing attention. The Mediterranean-type
tall fescues have more extensive rhi-
zomes 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 Amer-
ican germplasm are ongoing, with the
concentration also including other
important turf characteristics, such as dis-
ease resistance and turf quality.

Seashore paspalum is being utilized
more frequently in many areas of the
United States and overseas. Many vegeta-
tive cultivars have recently come onto the
market, but make sure the one you are
go ing 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 Riv-
iera, or vegetative cold-tolerant cultivars.

Another important option for transitional
zone areas that want a low mainte-
nance 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
mowed 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 develop-
ment, getting customers to use products
that are different than they are accus-
tomed 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 dogtail
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 bent-
grass, which is a dry land bentgrass,
A. castellana, are being looked at again
for home lawns, in particular in the Pacif-
Northwest. This species uses very lit-
tle nitrogen and has lower water require-
ments than many turf species. A trial in
Utah, watered at 50 percent ET (evapo-
transpiration), explored different species
for low water usage. In that test, the colo-
nial bentgrass planted as a control had
the best color and highest density.

Colonial bentgrasses do not match
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 resis-
tance 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 turf-
grass 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.
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-aeration, transition, summer spoon feeding, seeding and new construction.

Contec Classic Homogenous Greens Fertilizers

<table>
<thead>
<tr>
<th>Analysis</th>
<th>SGN</th>
<th>N Source</th>
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<tbody>
<tr>
<td>18-9-18</td>
<td>80</td>
<td>1.4% Amm N, 12.8% WSN, 3.8% WIN</td>
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<tr>
<td>17-5-17</td>
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<td>3.3% Amm N, 10.8% WSN, 2.9% WIN</td>
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<tr>
<td>19-3-19</td>
<td>80</td>
<td>12.7% WSN, 6.3% WIN</td>
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<td>19-2-15</td>
<td>80</td>
<td>12.5% WSN, 6.5% WIN</td>
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<tr>
<td>9-18-18</td>
<td>80</td>
<td>6.3% Amm N, 19% WSN, 0.8% WIN</td>
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<td>13-2-16</td>
<td>80</td>
<td>8.8% WSN, 4.2% WIN</td>
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<tr>
<td>20-0-10</td>
<td>80</td>
<td>14.9% WSN, 5.1% WIN</td>
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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

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Funny how the courses that use Toro® are always the hardest places to get a tee time.

From the first tee to the last green, Toro® helps keep your course in top form. And when a course plays as good as it looks, golfers have a way of coming back week after week after week.
TABLE 1

Average soil bulk density for mat and sand layers:

<table>
<thead>
<tr>
<th>Bulk Density (megograms per cubic meter)</th>
<th>Sampling Months for 2002, '03*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mat Layer</td>
<td>Sep  1.36</td>
</tr>
<tr>
<td>Sand Layer</td>
<td>1.56</td>
</tr>
</tbody>
</table>

For August and September 2003 the average soil bulk density is 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.

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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
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 per-
cent 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 aer-
ation on sand-based putting greens (at a 5 per-
cent surface area impact) applied twice a year
did not permanently reduce total organic mat-
ter content. Smith (1979) reported that organic-
ic matter content (in a bermudagrass loamy fine
sand putting green) was only reduced when
core aeration was increased from twice yearly
monthly over a seven-month study.

Although core aeration under the current
level of impact does not, in a single manage-
ment 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. Accord-
ing 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 infiltra-
tion rate. The two sample times (April and Sep-
tember) revealed that CA treatment had
greater water infiltration rates than the NCA
treatment after core aeration had occurred (Fig-
ure 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 mat-
ter into smaller size, increasing its surface area
and increasing water-holding capacity and
decrease infiltration rate. According to McCar-
ty (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
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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 aeration 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.

**REFERENCES**


Guertal, B. and Han, D., "Does aeration solve compaction problems?" Turf Trends, February 2002.