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Azinger's and Wilson's democratic presentation of Valhalla.

Though Azinger had been contemplating the concept since being named captain, it is still unlikely that such a bold move would have been attempted had Davis not set a dramatic precedent with his totally un-USGA-like setup of Torrey Pines' South Course. While some shrugged off the epic week in San Diego to Tiger or the dreary Masters finish where Trevor Immelman survived a car-wreck finish in cruel weather, the U.S. Open allowed most players and media to make a connection between course setup and fun golf.

Davis, manning his third U.S. Open as the person in charge of the competition, watched tapes of the 2007 event at Oakmont Country Club and determined the rough was too penal. A memo went out to future Open venues warning that it was time to put less emphasis on the density of rough, with Torrey Pines serving as the testing ground. While bizarre weather spurred on the growth of kikuyugrass to the dismay of everyone involved, Woodward and his team took a run-down muni and managed to get Torrey Pines as firm and meticulous for which Davis could have hoped.

The metamorphosis turned the U.S. Open spotlight away from course conditioning questions to the unique setup touches envisioned by Davis to emphasize a supreme mental examination over an excessively physical one. But it was Davis' decision to alternate tees and turn the grueling 14th hole into a driveable par 4 on Sunday that earned raves and had golfers across the country glued to their televisions.

Airing in prime time on the East Coast, Sunday's telecast drew an 8.5 rating, up 21 percent from the previous year. More importantly, non-golfers tuned in for the final thrilling hour and set Internet viewing records for the following day's playoff, where Woods edged Mediate on the 19th hole.

In a magical transformation, the U.S. Open became the most complete and interesting Major championship. More importantly, by maintaining the difficulty and test of skill that is the Open's trademark, the USGA gave golf professionals and superintendents an example for the ages. They proved that a golf course could be set up with just an ounce of creativity and vision to test players without embarrassing them.

But even more significant, that remarkable week at Torrey Pines inspired new admiration for the people and courses that make up the sport. The combination of thrilling play, heart-stopping heroics and an inspired course setup reminded the world why golf matters. ■

TOP Assistants

Greg D'Antonio was born to run ... a golf course, that is

Editor's note: If you'd like to nominate someone for the feature, please send an e-mail to Larry Aylward at laylward@questex.com.

Growing up, Greg D'Antonio was always helping his dad with yard work. It was a sign of things to come. When he was 12, he began doing yard work and lawn care for his neighbors to earn some cash.

D'Antonio, assistant superintendent at Chester Valley Golf Club in Malvern, Pa., was 16 when he got his first job working for his uncle at White Manor Country Club in Malvern. The superintendent bug had bitten.

D'Antonio enrolled at Penn State University and studied turfgrass science. Fast-forward and D'Antonio just completed his 10th summer working on a golf course. He has been as assistant superintendent for about 4.5 years.

We caught up with D'Antonio recently to talk about the profession he loves.

What's your favorite part of the job?

My favorite thing about the job is that no two days are ever the same. Each day presents new challenges and demands, and new ways to solve problems and overcome obstacles. Obviously, weather is a big determining factor in that. I also enjoy trying to motivate a team of people to work together for one common goal. No matter how good a superintendent or assistant is, he needs good people around him to succeed.

Who has been the biggest influence on your career and why?

I would not be where I am without the help of all three superintendents for whom I worked: Don Brown, Matt Shaffer and my current boss, Dave Visocan. All have had long, successful careers and all have taught me a great deal about how to achieve success in this industry. Dave has definitely been the biggest influence on me. From the day he hired me as a naive 21-yearold, he has been willing to teach me, listen to my ideas and allow me to make decisions as if I was in his position. He has taught me too many things to list. I feel that he has prepared me to be a successful superintendent some day.

What's your favorite product or piece of equipment and why?

I tend to be a little rough on equipment, so anything durable would be a start. Living in the Philadelphia area, where summers are usually tough, you cannot survive without a sprayer. The Toro 5700D sprayer allows us to spray tees, fairways and rough very quickly and has gotten us through some tough summer weather patterns. It's amazing how expectations have been raised everywhere to require more spraying. When I graduated less than five years ago, we only sprayed greens, tees and fairways at Chester Valley. Now we have added rough, green banks, bunker banks, tee banks and even native areas. I'm sure many courses are in the same boat and a good sprayer allows us to get it done quickly as time and minimizing disruption to the golfers are important.

If you could change something about the industry right now, what would you change?

I guess I would love it if golfers did not compare courses as much as they do. There are so many things that vary course to course, and I really believe no two courses can play and look the same.

Describe yourself in one word.

Determined.

What is your favorite hobby and why?

I enjoy the outdoors, staying active and playing and watching sports. Having been born and raised in the Philadelphia area, I root for all four major sports teams and am a huge Penn State football fan.

What's your favorite vacation spot?

Anywhere there is a beach and water.

What's your favorite golf course besides your own?

The East Course at Merion Golf Club. Obviously, I'm a little biased having interned there five years ago. I also have a lot of sweat equity invested there. There is no place like it from the bunkers to the wicker baskets atop the flagsticks. I'm excited for the U.S. Open to be held there in 2013.

If a movie were made about your life, what famous actor would play you?

Since I'm an assistant superintendent, I know about chinch bugs and manganese and I have a five-year plan, I would say Bill Murray. I'm still working on my own grass variety, and we don't have any gophers right now.

It's your last day on Earth. What do you do?

Sleep in. I rarely get to do it. ■

PHOTO COURTESY: GREG D'ANTONIO

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TURFGRASS TRENDS

CREEPING BENTGRASS DENSITY

Nitrogen Affects the Summer Density of Creeping Bentgrass

By Adam C. Moeller and Cale A. Bigelow

Creeping bentgrass (*Agrostis stolonifera* var. *palustris* Huds. Farw.) is the preferred turfgrass species for golf greens (Beard, 2002). Creeping bentgrass is a cool-season grass that forms an extremely dense, fine-textured, persistent turf that tolerates close (less than 0.125 inches), frequent mowing. During summer months, however, shoot density (SD) often declines, resulting in poor stand quality. Various cultural practices, such as mowing height, fertilization regime, topdressing and vertical mowing, can have an influence on SD. Golf course superintendents utilize several management practices to maintain turf vigor during the summer. One practice is light, frequent, nitrogen (N) fertilization. However, annual N rates vary widely.

Recently, high shoot density (HSD) bentgrasses bred to provide superior appearance and stress tolerance compared to the industry standard (Penncross) have been widely planted (Beard et al., 2001; Landry and Schlossberg, 2001). The effect of variable N rates on these cultivars and their seasonal changes in SD is unclear.

Tale of two fertilities

A field study was conducted at the W.H. Daniel Turfgrass Research and Diagnostic Center at Purdue University, West Lafayette, Ind., from 2006 to 2007 on a sand-based research green built to United States Golf Association (USGA) specifications. Three creeping bentgrass cultivars — A-4, L-93 and Penncross — were evaluated because of their commonality on golf greens and noted differences in SD.

The study site was maintained to emulate moderate golf course putting green conditions with modern cutting heights and cultural practices.

Two fertility regimes designated as "low" and "high" (2.3 pounds versus 4 pounds of N per 1,000 square feet annually) were used to assess the varying range of N applied to mature putting greens annually. Granular N was applied in the spring and fall to promote recovery from hollow-tine core cultivation (mid-April and mid-September) and to store carbohydrates in late fall (early November). Spoon feeding N was performed during the summer months (mid-May through September) with roughly half of the total N applied as a liquid.

Seasonal SD was measured by removing two intact cores per plot with a soil probe and counting individual shoots, which were then averaged and used for data analysis. Four SD measurements were taken in 2006 (June, July, August and October) and six times in 2007 (May through October).

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Seasonal density changes

Seasonal SD counts ranged from 760 to 2,160 shoots dm^2 (per square decimeter) throughout the study (Figure 1). The temporal changes in SD followed the cool-season growth pattern with the highest values measured during spring and autumn and a decline during the summer months. Among cultivars, A-4 generally possessed the highest SD (1,400 to 2,160 shoots dm^2) compared to Penncross (760 to 1,470 shoots dm^2) which had the least, while L-93 was intermediate (1,230 to 1,780 shoots dm^2). While each cultivar experienced reduced SD during the summer, the magnitude of the decline varied with cultivar and to a lesser extent N regime. The spring density of Penncross in both years was on average 37 percent less than A-4 at 4 lbs N/1,000 ft^2 yr^{-1} (square feet per year). By comparison, summer density of Penncross averaged over both years was 44 percent less than A-4 under 4 lbs N/1,000 ft^2 yr^{-1}. The higher SD of L-93 and A-4 is consistent with reports that have demonstrated the enhanced ability of HSD cultivars to provide superior turf conditions during the summer when compared to Penncross and many other earlier bentgrass generations (Landry and Schlossberg, 2001).

The SD values for HSD cultivars in this study were generally similar to some previously reported values (Ervin et al., 2000; Bruneau et al., 200) but lower than others (Beard et al., 2001; Sifers et al., 2001; Jordan et al., 2003). Sweeney et al. (2001) reported similar shoots dm^2 . They did not, however, report significant density reductions and in some instances measured an increase in SD from spring through summer. Some possible reasons for our lower values may be the slightly higher cutting height and the more intensive/abrasive light frequent sand topdressing program employed to reflect contemporary management practices.

In general, annual N regime did not significantly affect SD (Figure 1). In August of each year, however, when overall SD was lowest, the high N regime resulted in significantly more shoots than low N plots when averaged across cultivars, 1,170 versus 1,330 and 1,220 versus 1,310 shoots dm^2 for the low and high N regimes in the 2006 and 2007 study years, respectively. For example, SD reductions for A-4, L-93 and Penncross from June to August of each year averaged 23 percent, 23 percent and 37 percent at 2.3 lbs N/1,000 ft^2 yr^{-1}, respectively. By comparison, at the 4 lbs N/1,000 ft^2 yr^{-1} N rate, reductions were 17 percent, 15 percent and 23 percent, respectively.

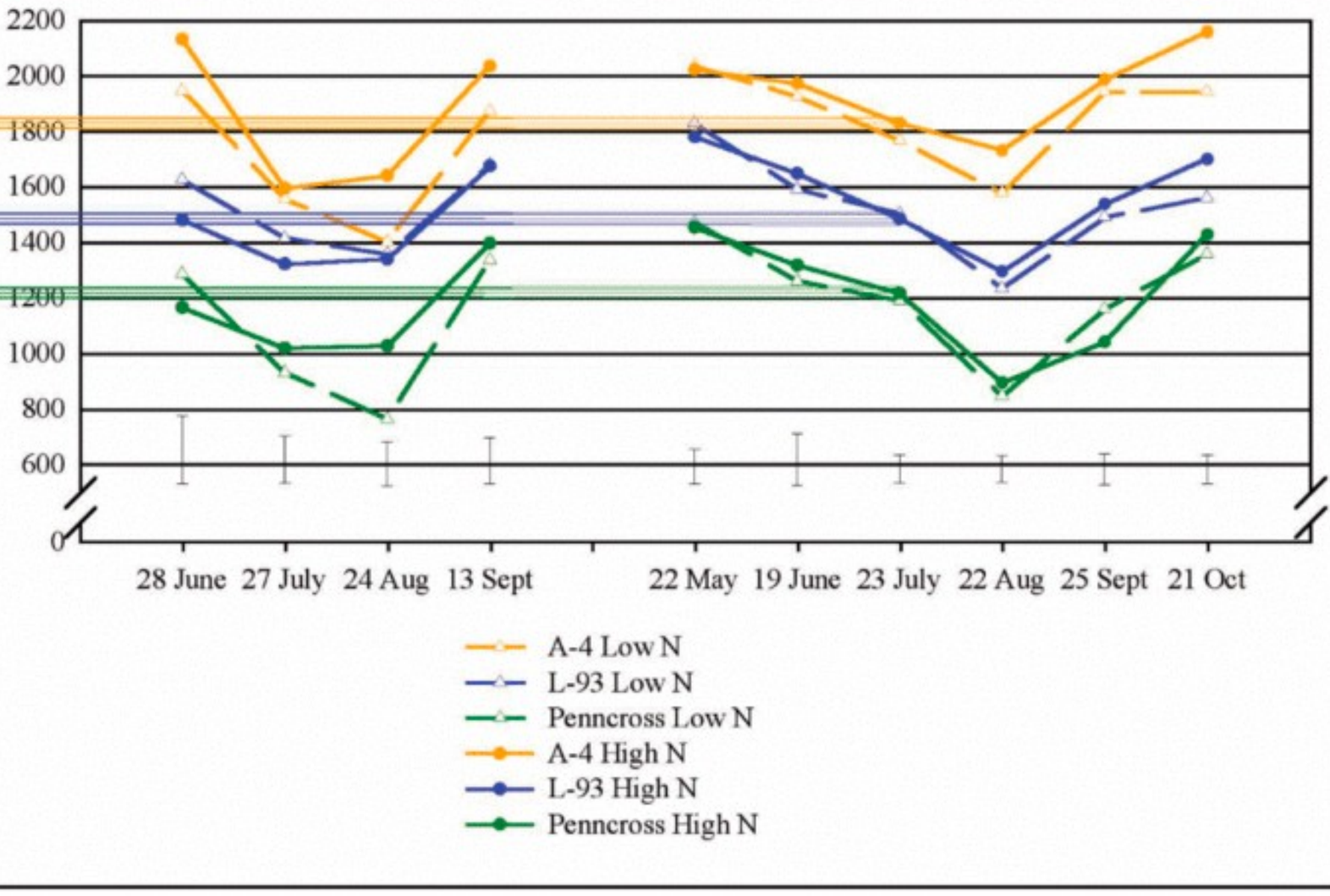
Summary and recommendations

As superintendents continue to strive to produce smooth, firm, consistent, putting green conditions, it is clear that several important factors affect bentgrass appearance and overall health. Of utmost importance is cultivar selection and N fertility level, particularly with respect to summer performance. The HSD cultivars are more reliable than Penncross because they maintain a dense turf canopy even with SD losses during the summer. Consider the following: When Penncross was most dense, during May or June, its SD was nearly equivalent to A-4 and L-93 at their lowest SD.

In response to golfers' desires for fast green speeds, many superintendents are applying low annual N, often < 2.5 lbs N/1,000 ft^2 yr^{-1}. This management approach is risky, and may compromise bentgrass health, especially on heavily trafficked greens grown in poor growing environments. These ultra-low N regimes result in malnourished turf, which is more prone to environmental stress, pest damage and *Poa annua* invasion. An alternative approach might be to apply 3 lbs to 4 lbs N/1,000 ft^2 yr^{-1} and manipulate other inputs such as applying plant growth regulators and using lightweight rollers to achieve a desired green speed.

In this field study, increasing the annual N level from 2.3 to 4 lbs N/1,000 square feet per hear had little effect on the overall seasonal SD of each cultivar. The exception, however, occurred in August when a beneficial response of the higher N level for SD was observed for both Penncross and A-4. Additionally, although increased N did not significantly enhance SD, it dramatically improved bentgrass visual appearance (data not shown). These data support the recommendation that moderate summer N (0.4 to 0.5 lbs N/1,000

FIGURE 1



Seasonal shoot density was measured by removing two intact cores per plot with a soil probe and counting individual shoots.

square feet per month) should be applied to minimize stand loss and ensure rapid recovery at the onset of favorable growing weather.

Due to the increased SD and organic matter accumulation associated with HSD cultivars, many golf course managers are on an aggressive sand topdressing program to maintain a firm, smooth surface. This normally involves the light application of sand topdressing every seven days to 10 days throughout the growing season. Although not directly evaluated in this study, we suggest that care should be exercised when attempting this management strategy for older bentgrass cultivars like Penncross, especially when maintained using a low N fertility program. Sand topdressing is a mechanically abrasive practice and may cause deleterious effects and, if improperly timed, further reduce Penncross SD and negatively affect overall putting green quality.

Where the densest, most aesthetically pleasing and persistent putting greens are desired, modern bentgrass cultivars should be planted and ample annual N should be applied. In the cool-humid region this will be about 3 to 4 lbs N/1,000 square feet per year for mature sand-based putting greens. In addition, a large proportion of the annual N should be supplied during the summer months using light, frequent liquid applications in order to promote recovery during the heavy-use seasons.

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California Bulrush Improves Wetland Water Quality

By Herry S. Utomo and Ida Wenefrida

As the social demand for a cleaner and better environment grows, more ecological engineering that incorporates phytoremediating plants will be integrated in the architecture and design of better quality human settlements and other social and sport facilities. Blended into the designed landscape, these plants will add aesthetic values of the design while providing a natural way to remove various pollutants and waste.

California bulrush (*Schoenoplectus californicus*), also known as giant bulrush, can facilitate removal of some toxic metals from both municipal and industrial pollutants. In wetland construction and reconversion of degraded marshes, this plant helps improve water quality.

California bulrush is a perennial graminoid plant commonly found in marshes, swamps, seeps, lake, washes, floodplains, along lake and stream margins and in wet meadows. It spreads primarily by vegetative propagation, producing new stems from an extensive system of underground rhizomes and, to a limited extent, through seed dispersal. It can grow in relatively deep water of 36 inches or more to produce extensive colonies. When established in conjunction with shorelines, California bulrush provides an effective buffer that dissipates wave energy, reduces shoreline scouring, and traps suspended sediments and other solids. Dense stands of California bulrush are efficient users of available nutrients, producing significant amounts of organic matter. The cumulative effects of organic matter production, sediment trapping and erosion control not only provide shoreline protection, but also accelerate sediment accumulation and near-shore building.

In addition, this plant has been known to provide a favorable habitat for wildlife, including some endangered species.

Removing pollutants from water

In recent years, ecological engineering has been increasingly used to address a broad range of issues, including to better design and architecture of human settlements, to treat pollutants and hazardous waste, to conduct ecological restoration and remediation, and to protect fundamental food production. Constructed wetlands, common around golf courses, are a part of ecological engineering to address a variety of purposes, from restoring degrading wetlands to serving specific functions: buffering valuable aquatic

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TABLE 1

Performance of California bulrush breeding line LA268 and Restorer in multi-year trials

Trait	Mean[1]	
	LA268	Restorer
Rate of spread (m^2/yr)[†]	7.52[a]	5.17[b]
Plant height (cm)[†]	182.8[a]	164.7[b]
Stem diameter (mm)[†]	13.14[a]	12.40[a]
Stem count[††]	81.7[a]	43.3[b]
Stem count[†]	1538[a]	1332[b]
Number of panicles[†]	738[a]	712[a]
Panicle weight[†]	636.5[a]	467[b]
Salinity tolerance	Moderate	Moderate

[1]Values in the same row followed by the same letters are not significantly different (P<0.05)
[†]Freshwater plots (3 blocks, 4 replications; 2 year data)
[††]Brackish marsh (3 blocks, 4 replications; 2 year data)