Nitrogen fertility and the new bentgrasses

Differing rates of nitrogen application can vary root and shoot quality of the latest cultivars.

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KEY POINTS

- Crenshaw and L93 creeping bentgrasses exhibited significantly better root growth and shoot quality than Penncross in this study.
- An 8-pound annual nitrogen rate provided the highest shoot quality in newly established Crenshaw without significandy sacrificing root growth.
- L93 had the best shoot quality with the 12-pound nitrogen rate, but maximum root growth occurred with 8 pounds.

With the release of new bentgrass *(Agrostis palustris)* cultivars in recent years, many superintendents are seeking management practices that will unleash these grasses' full genetic potential. How different are the new cultivars from the industry standard, Penncross, in terms of nitrogen fertility requirements? Do the aggressive growth habits and greater heat tolerance of these new cultivars (2,3) require changes in nitrogen fertility? Because nitrogen fertilization plays an important role in performance of both roots and shoots, it's important to establish guidelines.

In a study in the University of Georgia's rhizotron (an underground root observation laboratory in Athens), the root and shoot responses of Crenshaw, L93 and Penncross creeping bentgrass were monitored under three nitrogen fertility programs (4, 8 or 12 pounds per 1,000 square feet per year).

Methods

The rhizotron comprises 24 individual root observation chambers. The facility allows aboveground plant growth to occur under actual field conditions while the root systems are monitored along a glass observation panel. Each chamber is 39 inches (1 meter) square by about 7/4 feet (2 meters) deep and can be filled with a variety of soil types.

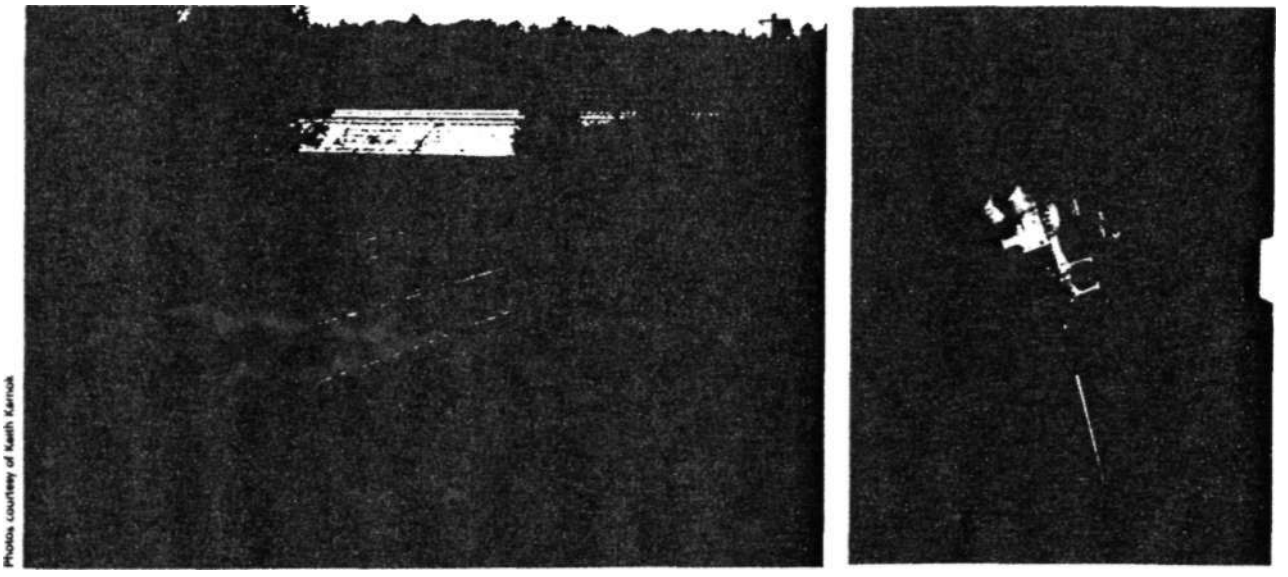
In this study, each chamber held a USGA Green Section-recommended 12-inch root-zone mix of 85 percent quartz sand and 15 percent peat moss. In March 1997, sod of each cultivar was installed atop the chambers. Fertility treatments totaling 4, 8 and 12 pounds of nitrogen per 1,000 square feet per year were applied every 14 days in a complete nutrient solution for *the* duration of the study. The plots were mowed at 5/32 inch daily, and curative fungicide treatments were applied when necessary.

Root observations occurred every 14 days beginning April 12, 1997, and ending in September 1998. Root growth was monitored in two ways: "Total root length" is a measure of all roots below the 0.8-inch depth and including "deep root length," which is a measure of roots extending only beyond 7.5 inches. Shoot-quality ratings were taken monthly.

Results and discussion

Crenshaw

At the 4- and 8-pound rates, Crenshaw had greater total root length, deep root length and shoot quality than Penncross. Likewise, at the 4-pound



Creeping bentgrass grows on the University of Georgia rhizotron Oeft). A microscope (right) allows detailed observation of root growth in the rhizotron's belowground chamber.

rate, Crenshaw showed greater deep root length and shoot quality than L93. Crenshaw's overall root growth (total root length and deep root length) was superior at the 4- and 8-pound rates compared with the 12-pound rate. On the other hand, shoot-quality ratings at the 8- and 12-pound nitrogen rates were equal and superior to that observed at the 4-pound nitrogen rate.

L93

At the 4-pound rate, overall root growth (total root length and deep root length) of L93 did not differ from that of Penncross. At the 8-pound nitrogen rate, however, L93 showed superior total root length and deep root length compared with Penncross. At every nitrogen rate, L93 shoot quality was superior to Penncross's. Total root length, deep root length and shoot quality did not differ between L93 and Crenshaw at the 8-pound or 12-pound nitrogen rate. The overall best root growth for L93 occurred at the 8-pound rate, and its best shoot quality occurred at the 12-pound rate.

Penncross

In general, total root length, deep root length and shoot quality of Penncross were inferior to those of Crenshaw and L93 at all nitrogen fertility rates. Somewhat surprisingly, both Crenshaw and L93 out-performed Penncross, even at the lower nitrogen fertility rates.

Conclusions

This study shows that Crenshaw and L93 have significantly improved the root growth and shoot quality of creeping bentgrass. It should be noted, however, that root growth — both total root length and deep root length for all cultivars — tended to be higher at the lowest nitrogen rate, whereas shoot quality was highest at the highest nitrogen rate. This response to nitrogen fertilization by creeping bentgrass as well as other turfgrasses has been well substantiated over the years (1,4).

However, L93 appeared to deviate from this response to nitrogen by producing significandy greater deep root

length at the 8-pound rate than at either the 4- or 12-pound rates. Therefore, it would appear that the 8-pound rate for L93 would provide maximum rooting while maintaining very good shoot quality.

In general, Crenshaw and L93 performed similarly in terms of root growth and shoot quality, particularly at the 8- and 12-pound nitrogen rates. Crenshaw, however, outperformed L93 in terms of deep root length and shoot quality at the 4-pound nitrogen rate. Overall, the results of this study suggest that the 8-pound nitrogen rate for Crenshaw provides the highest shoot quality without significantly sacrificing root growth.

Because these data are from a 19-month study using a new USGA-recommended root-zone mix, the observations may or may not be evident in older mixes where soil organic matter has increased and various cultural and environmental factors exert influence. Nevertheless, this information provides general guidelines for a nitrogen fertility program for Crenshaw and L93 creeping bentgrasses in newly established greens. |

Acknowledgments

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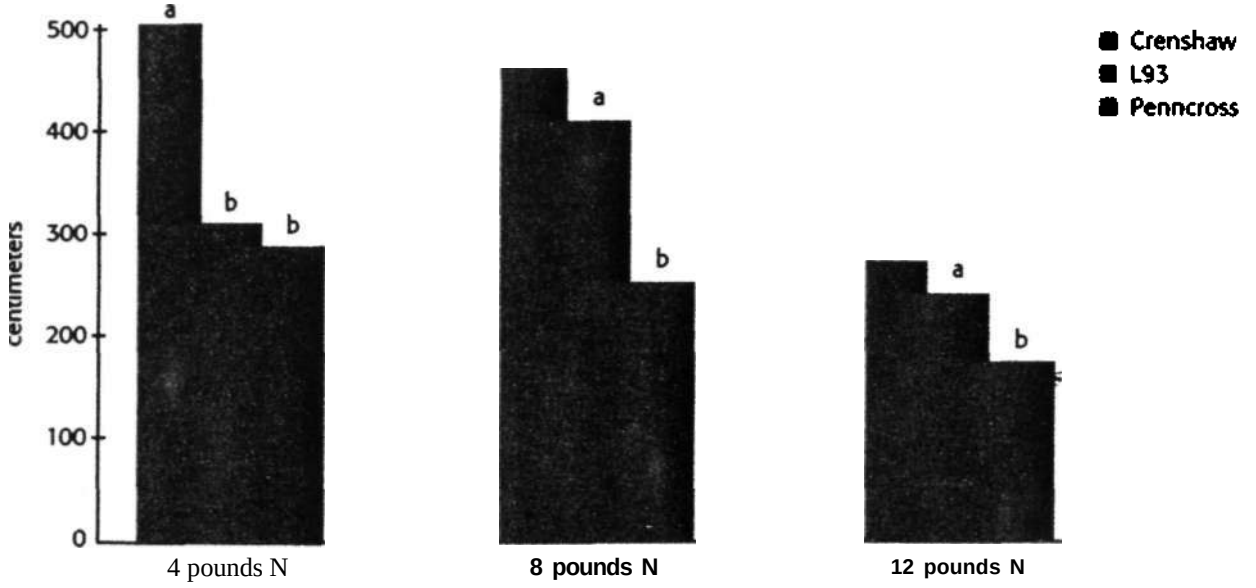
Deep roots



At various nitrogen rates, Crenshaw and L93 consistently produced greater root lengths in deep soil than Pennaoss. The data are total centimeters of roots that had penetrated deeper than 18.5 centimeters as observed in a rhizotron monitoring chamber. Differences are not statistically significant between bars with the same letter within each annual nitrogen rate.