RESEARCH

Effects of nitrogen and mowing height on TifEagle grow-in

Lower mowing heights can adversely affect TifEagle grow-in, and more is not always better when it comes to nitrogen.

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TifEagle, a dense, fine-textured bermudagrass (*Cynodon* species), has established itself as one of the ultradwarf bermudagrasses of choice for use on putting greens in the southeastern United States. Vegetatively propagated, TifEagle has more shoots per unit area and shorter and narrower leaves than Tifdwarf (2), the most commonly used bermudagrass for putting greens in the South.

The objective of this research project was to evaluate the impact of nitrogen rate and mowing height on the shoot density and color of TifEagle hybrid bermudagrass managed as a putting green during the grow-in period.

Methods

The study was conducted twice. On June 23, 2003, and June 17, 2004, TifEagle was sprigged on a native soil (loamy sand) putting green at 10 Georgia bushels per 1,000 square feet (0.01 cubic meter of sprigs/square meter) by hand-spreading the sprigs, lightly disking and covering the sprigs with topdressing sand.

Nitrogen rates and mowing heights

Experimental treatments consisted of five nitrogen rates (1/16, 1/8, 1/4, 1/2 or 1 pound nitrogen/1,000 square feet/week [0.3, 0.6, 1.2, 2.4 or 4.8 grams nitrogen/square meter/week]) and three mowing heights (1/8, 5/32 and 3/16 inch [3.2, 3.9 or 4.8 millimeters]) (Figure 1). There were four replications of each treatment.

Photo by W. Bryce

Figure 1. TifEagle establishment plots (from front to back) were mowed at 1/8 inch (first row from left to right in the front of the photo), 5/32 inch (middle row) and 3/16 inch (back row). Nitrogen rate treatments are evident from front to back, with the thinnest turf receiving lower rates of nitrogen.

Beginning two weeks after sprigging, the nitrogen-rate treatments were applied to designated plots using a drop-type Gandy fertilizer spreader. The nitrogen source was urea (46-0-0). Mowing-height treatments started three weeks after sprigging, with plots mowed six days a week using a walk-behind greens mower. Additional topdressing was applied to the entire test area approximately monthly. Irrigation was applied as needed to supply 1 inch (2.54 centimeters) of water per week. Additional fertilizers (phosphorus and potassium) and lime were applied at the end of each yearly experiment to correct any deficiencies, as recommended by a soil test.

Data collection

We collected data about weekly. Turf

color, weekly percentage of grow-in (collected by the line-transect method), shoot density, weight of harvested stolons and rhizomes and inorganic soil nitrogen (nitrate-nitrogen and ammonium-nitrogen). The line-transect method is a simple system to quantify the grow-in rate of turf. In our case, four strings with 25 marks each were stretched across the length of each plot. The strings were placed at the same locations each week. If a piece of green tissue touched a mark, it was counted as a "grow-in hit," and the number of hits from the 100 marks was totaled as percent grow-in.

Once grow-in was close to 100%, shoot density was determined twice a month. Shoot density was determined by removing three cores, each 2 inches (5.08 centimeters) in diameter, per plot and hand-counting all the shoots in each plug. The weight of harvested stolons and rhizomes was determined each fall by removing an additional three cores, removing all roots and leaf tissue from the rhizomes and stolons and drying the harvested material in an oven. Soil inorganic nitrogen (nitrate-nitrogen and ammonium-nitrogen) was also determined in the fall by extracting 6-inch-deep soil samples with 2-molar potassium chloride and analyzing the extracted solution.

Results

Grow-in

In both years, grow-in of TifEagle was affected only by nitrogen rate and not by mowing height or by the interaction of mowing height and nitrogen rate. Over both years, grow-in was quickest at nitrogen rates ranging from ½ to ¾ pound nitrogen/1,000 square feet/week (2.4 to 3.6 grams/square meter/week), indicating that the highest nitrogen rate of 1 pound/1,000 square feet/week (4.8 grams/square meter/week) was not needed for effective establishment.

Figure 2 shows grow-in for a typical collection date six weeks after sprigging (1 month of nitrogen-rate and three weeks of mowing-height treatments had been applied by this date). Figure 3 shows TifEagle grow-in over the weeks in which the line-transect data were collected. Grow-in is shown at the two highest rates of nitrogen application, because those rates bracket the optimal nitrogen rate for grow-in, as mentioned above. In this soil type (loamy sand), grow-in was achieved as quickly with nitrogen applied at ½ pound as it was at the highest nitrogen rate. More than 90% coverage was obtained between four and six weeks after sprigging. Agronomically, therefore, the highest rate of nitrogen would not be needed to ensure rapid coverage of the sprigged bermudagrass.

Shoot density

Only nitrogen rate affected shoot density, in both years of the study. On average, shoot density was maximized at rates between ⅔ and ⅘ pound nitrogen/1,000 square feet/week (3.3-4.3 grams /square meter /week), rates similar to those that maximized TifEagle grow-in. Although shoot density was maximized at higher nitrogen rates, it may have occurred at the expense of rhizome and stolon weights, which often decreased at higher rates of nitrogen (see below). Shoot densities collected during this study were typically 20 to 30 shoots/square inch (3.3 to 4.7 shoots/square centimeter), similar to shoot densities collected in other TifEagle research (3).

Stolon/rhizome dry weight

In 2003, when turf was mowed at 5/32 inch (3.9 millimeters), the dry weight of rhizomes and stolons increased as the nitrogen rate increased until the nitrogen rate reached ½-¾ pound/1,000 square feet/week (2.4-3.7 grams/square meter) (Figure 3). When the mowing height was higher, at 3/16 inch (4.8 millimeters), the dry weight of stolons and rhizomes increased until the nitrogen rate reached above ¾ pound/1,000 square feet (3.6 grams/square meter) (Figure 4). In comparison, at the lowest mowing height of ⅛ inch (3.2 millimeters), the dry weight of stolons and rhizomes was greatest when the nitrogen rate was lower — ⅓ pound/1,000 square feet/week (1.6 grams/square meter/week) — and the weight of the stolons and rhizomes decreased as additional nitrogen was applied (Figure 3). In 2004, the dry

TIFEAGLE AT 6 WEEKS

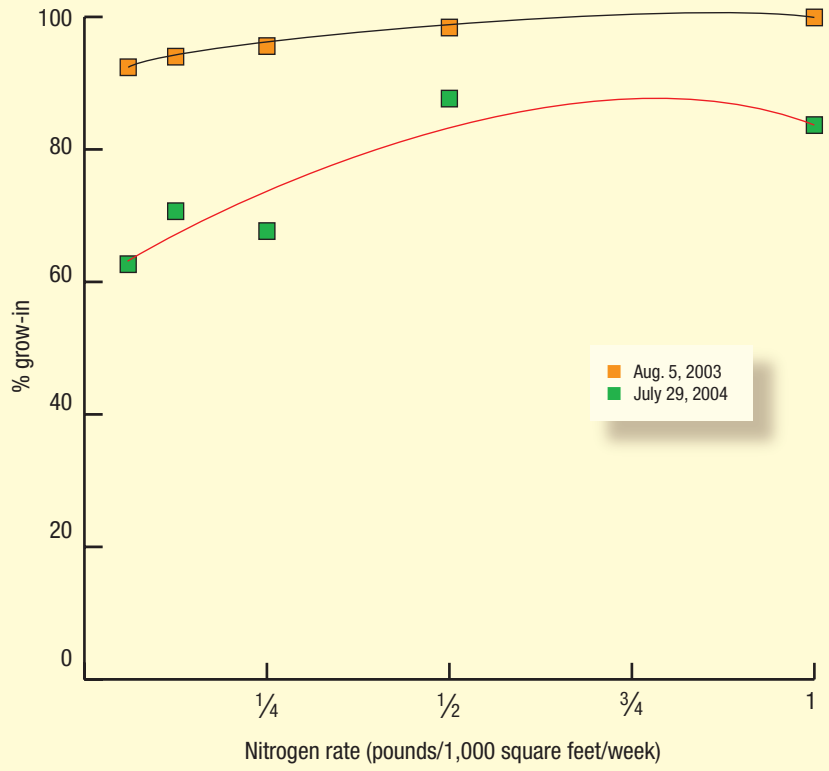
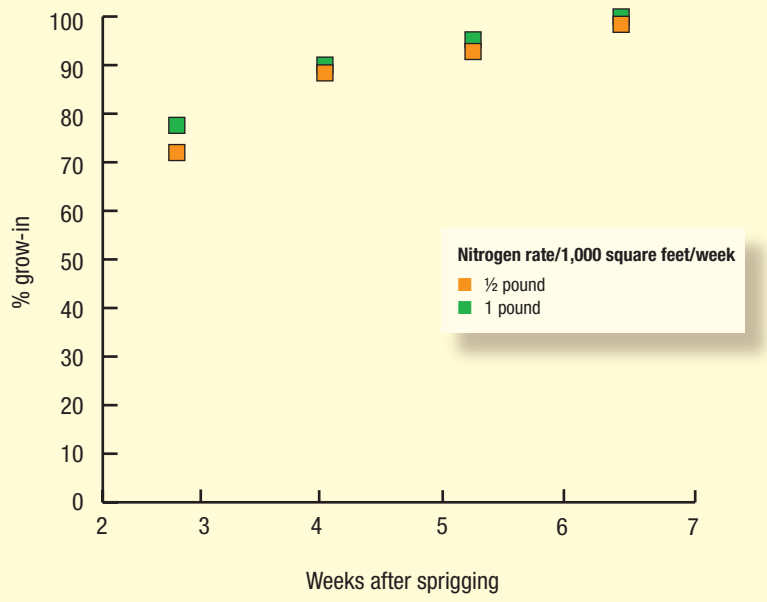


Figure 2. Percent grow-in of TifEagle bermudagrass as affected by nitrogen rate, six weeks after sprigging in 2003 and 2004.

TIFEAGLE, 2003



TIFEAGLE, 2004

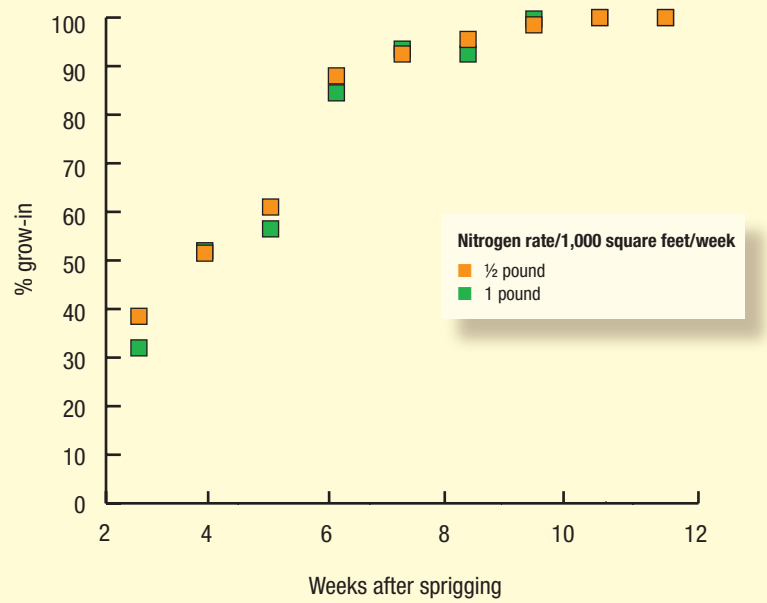


Figure 3. Percent grow-in of TifEagle bermudagrass over time, as affected by nitrogen rate in 2003 and 2004.

weight of rhizomes and stolons was affected only by nitrogen rate, and the weight of the rhizomes and stolons was maximized at a nitrogen rate of ¾ pound/1,000 square feet/week (3.7 grams/square meter/week).

Turf color and spring green-up

The color of the turf during each year's experiment was affected by both mowing height and nitrogen rate. Although mowing height often did not affect grow-in, shoot density or the weight of rhizomes and stolons, it did affect the color of the turf because turf mowed at the lowest height (⅛ inch [3.2 millimeters]) often had a lower color score than (was not as green as) turf mowed at 5/32 and 3/16 inch (3.9 and 4.8 millimeters). The greenness of the turf usually increased as the rate of nitrogen application increased, with turf color maximized at nitrogen rates between ⅔ and 1 pound nitrogen/1,000 square feet/week (3.3 and 4.8 grams/square meter/week).

Spring green-up of the plots was affected only by nitrogen rate and not by mowing height or the interaction of the two treatments. In every year, spring green-up was quicker and the turf was darker green in plots that had received the highest rates of nitrogen in the previous year. This green-up was not a function of spring residual ammonium-nitrogen or nitrate-nitrogen, as the previous year's nitrogen rate treatments did not significantly affect spring soil ammonium-nitrogen or nitrate-nitrogen concentrations. In March 2004, average soil ammonium-nitrogen was 5.8 pounds/acre (2.9 micrograms/gram) and average soil nitrate-nitrogen was 2.2 pounds/acre (1.1 micrograms/gram). In March 2005, average soil ammonium-nitrogen was 1.8 pounds/acre (0.9 micrograms/gram) and average soil nitrate-nitrogen was 6.2 pounds/acre (3.1 micrograms/gram).

Soil nitrate-nitrogen and pH

As mentioned above, there were few differences in soil extractable ammonium-nitrogen and nitrate-nitrogen as a result of nitrogen rate or mowing height in the spring (post-test) samplings. In the fall samplings, however, nitrogen rate almost always affected soil ammonium-nitrogen and nitrate-nitrogen content. Of potentially greatest concern would be soil nitrate, with its possible link to reductions in soil groundwater quality. Maximum soil nitrate-nitrogen was measured in

plots receiving the highest rate of nitrogen, but even at the highest nitrogen rates, residual levels were not especially high.

In Alabama, soil nitrate tests are not well-calibrated, as they are not used for fertilizer recommendations. As a general scale, however, soil nitrate levels of 40-60 pounds/acre (20-30 micrograms/gram) have been measured in crop production systems. In this study, the highest levels of soil nitrate-nitrogen ranged from 4.0 to 6.0 pounds/acre (2.0-3.0 micrograms/gram) in the September 2003 and 2004 samplings. The lowest levels of soil nitrate-nitrogen (around 1.4 pounds/acre) occurred at nitrogen application rates of around ½ pound nitrogen/1,000 square feet/week (2.4 grams nitrogen/square meter/week). This indicates that much of the nitrogen applied at lower rates was being used by the growing turfgrass plants. It has been shown that inorganic nitrogen is rapidly used by growing turf (4), and in some cases depleted within two to four days, primarily by biological immobilization (1).

THE RESEARCH says . . .

- **In this study,** TifEagle was grown in on a native-soil putting green at five different nitrogen rates and three different mowing heights.
- **In 2004 and 2005,** grow-in, shoot density and spring green-up were affected only by nitrogen rate. Turf color and stolon and rhizome dry weight were affected by both nitrogen rate and mowing height. Spring green-up was faster and turf color was darker in plots that had received the most nitrogen in the previous year.
- **The highest rate** of nitrogen rarely resulted in optimal grow-in, shoot density or dry weight of rhizomes and stolons.

The highest fertilization rate (1 pound nitrogen/1,000 square feet/week [4.8 grams/square meter/week]) almost never resulted in optimal grow-in, shoot density or dry weight of rhizomes and stolons. Thus, even if applying nitrogen at 1 pound/1,000 square feet/week did not appear to pose a great environmental threat, it certainly was not a wise agronomic rate. In general, an application rate of ½ to ¾ pound nitrogen/1,000 square feet/week (2.4-3.6 grams/square meter/week) supplied sufficient nitrogen for grow-in, shoot establishment and color, without negatively affecting stolon and rhizome weight or leaving excessive residual soil inorganic nitrogen.

RHIZOME AND STOLON WEIGHT

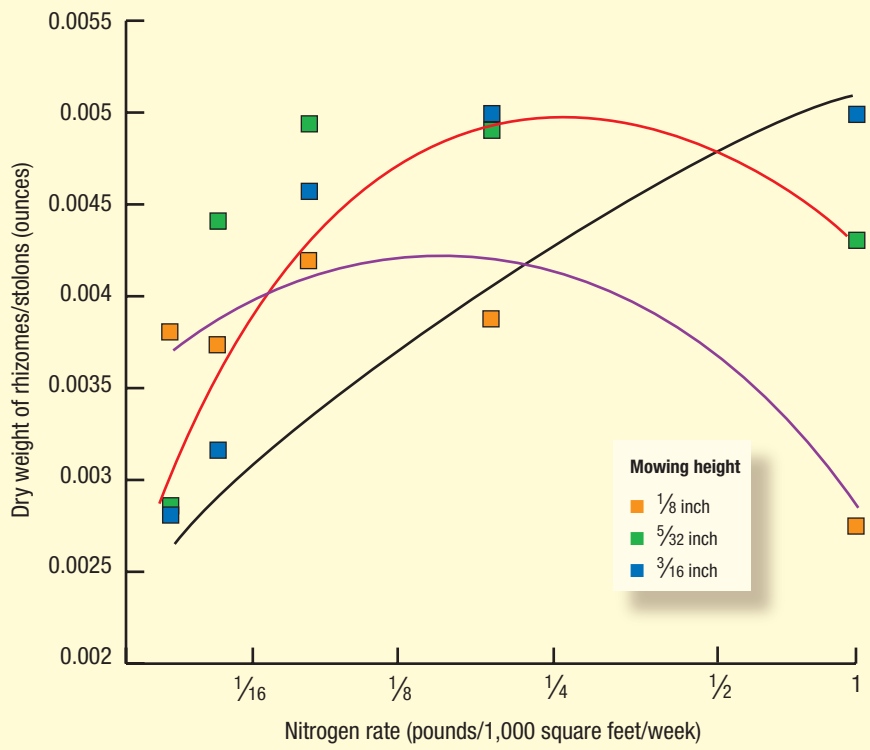


Figure 4. Dry weight of rhizomes and stolons from TifEagle bermudagrass as affected by mowing height in 2003.

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Additional reading

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