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TURFGRASS TRENDS

AMENDMENT RESEARCH

IN THIS ISSUE

Rootzone Amendments in Sand-Based Poa Sod Evaluated, Compared

By David Green II

Annual bluegrass (*Poa annua*) is an extremely adaptive grass species, used for closely mowed greens in cool climates (Cook, 1996). In areas where cloud or fog cover limit light intensity, annual bluegrass is naturally selected because of its increased photosynthetic rate over other grass species used on greens (Vargas, 1996).

Unfortunately, limited seed supplies and lack of readily available sod are problems when the annual bluegrass turf must be replaced. Currently, most golf courses maintain a nursery green to replace damaged turf, but when this material is lacking or exhausted, generally other grass species must be used.

Pre-grown sod is an alternative propagation method many turfgrass managers prefer, since propagating from seed can take several weeks to produce a useable turf sward. Most commercial sod is grown on native clay loam soils and the final sod product contains a 1/2 inch to 1 inch of the soil media attached to the roots (Davis and Pratt, 1982). Unfortunately, when applied on a USGA sand-based golf green, this clay loam creates an interface layer with the sand-based media that disrupts water, nutrient and oxygen movement in the rootzone.

Sand media alone has a very low cation exchange capacity, with poor nutrient and water retention. Therefore, a soil amendment is required to provide nutrient and water-holding capacity.

Sod grown on plastic is an alternative technique to alleviate this interface problem (Renaud and Turgeon, 1975). And washed sod or sod grown in similar sand-based media are alternatives that have been developed for sand-based golf greens.

A sand-based media is preferred for high-maintenance turf because it resists compaction, drains quickly and maintains good aeration properties (Bigelow *et al*, 2000). However, sand media alone has very low cation exchange capacity, with poor nutrient and water retention. Therefore, a soil amendment is required to provide nutrient and water-holding capacity. The amendment often used is an organic material such as sphagnum peat moss. Organic material does an excellent job of enhancing soil structure by improving aggregation and can be an excellent substrate for microbial growth. In addition to the structural benefits, most organic matter can hold several times its weight in water and has moderate nutrient-holding capacities (Bigelow *et al*, 2000).

Several inorganic materials are also used for amending sand media to improve nutrient and water-holding capacity (Bigelow *et al*, 2000). These materials are derived from

Continued on page 58

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FIGURE 1

Evaluation of annual bluegrass sod production techniques in San Luis Obispo, Calif.

Continued from page 57

large, naturally occurring mineral deposits. Some of the more commonly used products include calcined clay, expanded shale, diatomaceous earth and zeolite.

Calcined clay or porous ceramics have been heat-treated at temperatures between 1,000 degrees Fahrenheit (F) and 1,800 degrees F to increase their structural integrity (Bigelow et al, 2000). These materials have an extremely high water- and nutrient-holding capacity. However, the small pore sizes in these materials often hold moisture too tightly for plant availability. Zeolite is a relatively new amendment for turfgrass rootzones. This material has a three-dimensional rigid crystalline structure with tremendous water- and nutrient-holding capacity, yet water and nutrients are generally readily available to the plant (Shaw and Andrews, 2001).

Studies have shown that sand-based systems amended with zeolite improve germination rate, root and shoot growth, and turf quality on a creeping bentgrass green as compared to unamended sand (Ferguson et al, 1986).

Although studies have examined the influence of various soil amendments on the growth of turfgrass, research has not thoroughly examined the influence of these materials in a sod production system. The objective of this research was to define the optimal annual bluegrass sod production technique as influenced by soil amendment, propagule type and fertility rate.

Material and methods

Three studies to evaluate optimal annual bluegrass sod production techniques were conducted at California Polytechnic State University, San Luis Obispo, Calif., between 2001 and 2004.

Studies conducted between April and June 2001 examined the effects of soil media amendments, nitrogen rate and propagule type on annual bluegrass sod production. A fine-textured G-50 sand measuring 0.1 millimeters (mm) to 0.25 mm was obtained from a local source. Sphagnum peat moss was selected as the organic amendment. Profile calcined clay (Robison Fertilizer, Anaheim, Calif.) and ZeoPro GB-30 zeolite (ZeoponiX Inc., Louisville, Colo.) were selected for inorganic amendments. Sand was mixed with organic and/or inorganic amendments to create three soil medias — 20 percent sphagnum peat moss, 80 percent fine-textured sand; 20 percent Profile, 80 percent fine-textured sand; and 20 percent ZeoPro GB-30, 80 percent fine-textured sand. The final soil media used was 100 percent fine-textured sand.

A 25-foot by 60-foot, 4-milliliter (ml) polyethylene plastic was anchored to the ground, and 5-foot by 5-foot plots were established on the plastic with 1-inch by 2-inch fir-board dividers (Figure 1). Plastic was punctured with a pitchfork to allow for water drainage. Soil media were mixed on site and then evenly distributed to a 1-inch depth. Plots were then propagated with either seed (1 pound Peter-

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FIGURE 2

Mean percent density visual estimates as influenced by soil amendment on Aug. 17, 2004. Bars represent standard deviation at $P < 0.05$.

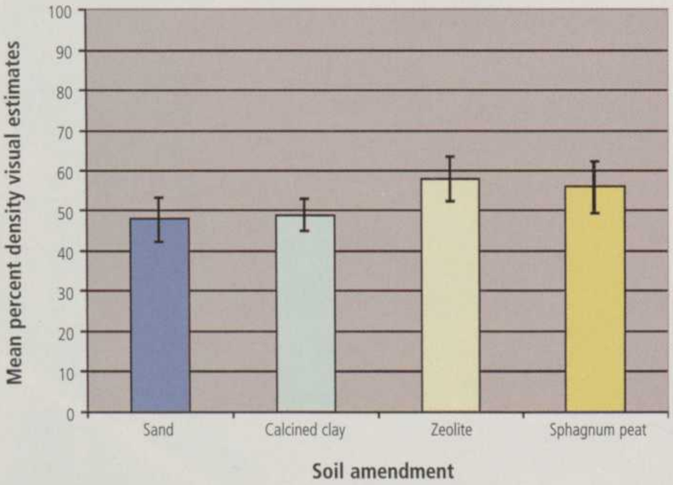
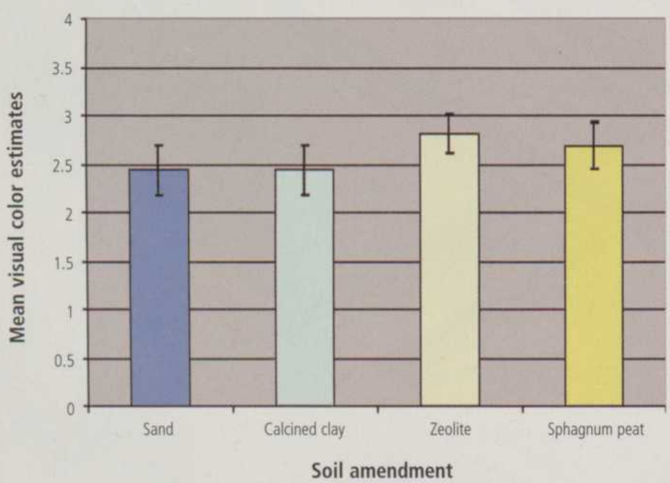


FIGURE 3

Mean visual color estimates as influenced by soil amendment on Aug. 17, 2004. Bars represent standard deviation at $P < 0.05$.



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son's creeping bluegrass seed per 1,000 square feet), plugs (0.75 cubic feet of 1/4-inch annual bluegrass plugs freshly cored from local golf green per 1,000 square feet) or a seed/plug combination (half propagule rates). Following propagation, plots were lightly tamped and irrigated for three minutes, five times a day. The sod plots were mowed at 1 inch, starting approximately four weeks after propagation. Heritage fungicide (Syngenta Professional Products) was applied on a preventative basis to control crown and basal rot anthracnose (*Colletotrichum graminicola*).

Ten days after propagation, each plot was divided into four equal 2 1/2-foot by 2 1/2-foot sections for application of the nitrogen treatments. Each 6 1/4-square foot section received one of four nitrogen rates (0.25, 0.50, 0.75 or 1 pound per 1,000 square feet) applied using a handheld shaker on a monthly basis using Greens King Ultra 18–4–10 (N-P_2O5-K_2O). The final experimental design was a 3-foot by 4-foot factorial with nested nitrogen effects in a randomized complete block design with four blocks.

Between May and August 2004 a third study was conducted. Experimental procedure was similar to the protocol listed above with the exception that only soil amendment and nitrogen rate were evaluated. The plug/seed combination previously described was used for propagation. The experimental design for the third study was a 4-foot by 4-foot factorial randomized complete block design with four blocks.

All study plots were evaluated weekly for percent density and color. Percent density was visually assessed using a 0 to 9 scale where 0 = 0 percent, 1 = 1-11 percent, 2 = 12-22 percent, 3 = 23-33 percent, 4 = 34-44 percent, 5 = 45-55 percent, 6 = 56-66 percent, 7 = 67-77 percent, 8 = 78-88 percent, 9 = 89-100 percent coverage of the plot. Turfgrass color was visually assessed using a 0 to 4 scale, where 0 = sundown yellow, representing necrotic turf, 1 = electric radiance (bright yellow), representing chlorotic turf, 2 = fresh zest (light green), 3 = Irish delight (medium green) and 4 = green knoll (dark green), representing vigorous, healthy annual bluegrass turf. General linear model and least significant difference mean separation techniques (SAS Institute Inc., Cary, N.C.) were used to determine significant treatment differences among treatments.

Results

Soil amendment, nitrogen rate and propagule treatments all showed a significant ($P > 0.05$) effect on sod density and color in these studies. Propagule by nitrogen rate and soil amendment by nitrogen rate interactions were significant ($P > 0.05$) in 2001. Soil amendment by nitrogen rate was not significant and propagule effect was not evaluated in 2004.

Plug propagules consistently provided the quickest establishment with twice the density (70 percent to 90 percent) as compared to seed

Continued on page 62

Continued from page 60

(25 percent o 45 percent) after eight weeks in 2001. The plug/seed combination had the greatest increase in average density (43.3 percent) over 15 weeks.

A significant ($P > 0.05$) soil amendment effect was observed during the first 10 weeks of production in 2001 and after the 10th week in 2004. ZeoPro GB-30 and sphagnum peat provided significantly ($P > 0.05$) greater mean density (30 percent to 65 percent and 30 percent to 55 percent, respectively) and color (medium green) after 12 weeks as compared to Profile or unamended sand (30 percent to 50 percent and 25 percent to 50 percent mean density, respectively; light green color)(Figures 2 and 3).

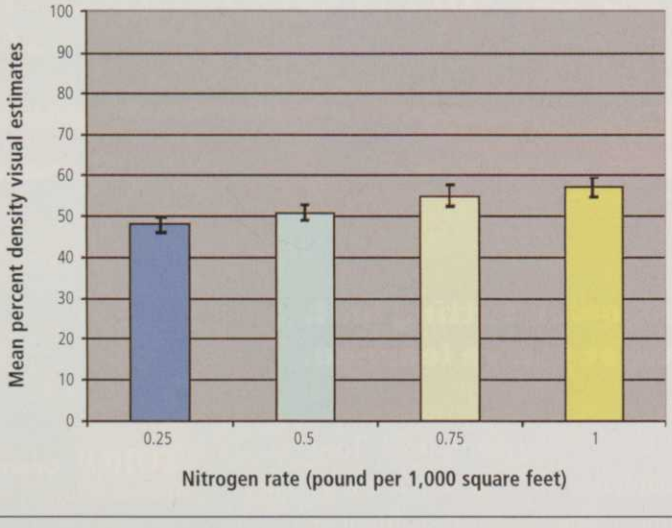
The only exception to these results was that Profile provided greater mean density than sphagnum peat in one of the 2001 studies.

Nitrogen rate significantly ($P > 0.05$) influenced both turfgrass density and color, either directly or by interacting with propagule and soil amendment treatments. In two of the studies, the 0.75 pound and 1 pound per 1,000-square-feet application rates provided higher mean density (53 percent to 72 percent and 58 percent to 75 percent, respectively) and darker green color than the 0.25 pounds per 1,000 square feet application rate (41 percent to 52 percent mean density) (Figure 4). Higher nitrogen rates did not significantly influence sod production in one 2001 study. However, nitrogen rate was observed to interact with the propagule and soil amendment treatments to provide improved sod density and color. ZeoPro GB 30 and sphagnum peat amendments were found to have a greater response in both density and color to higher nitrogen rates as compared to Profile or sand alone in 2001 (Figure 5).

Also, the plug/seed propagule treatment had the least response to increased nitrogen rates (Figure 6).

FIGURE 4

Mean percent density visual estimates as influenced by application rates of nitrogen on July 8, 2004. Bars represent standard deviation at $P < 0.05$.



Conclusion

Results were not always consistent between studies due to climatic differences that increased variability in annual bluegrass growth and crown and basal rot pressure. Plugs were found to provide the quickest establishment and best sod quality overall of the three propagation techniques studied. At the 0.75 cubic foot rate, plugs provide 25 percent to 35 percent turfgrass density at the initiation of the propagation procedure. The seed and seed/plug combination failed to equal the turfgrass density of the plugs until 12 weeks to 14 weeks into production.

ZeoPro GB-30-amended sand provided the darkest green color and quickest establishment in all studies. The sphagnum peat amendment also provided acceptable sod quality with a slightly lower density and lighter green color. Profile-amended sand did not significantly ($P > 0.05$) improve turfgrass density or color as compared to the pure sand.

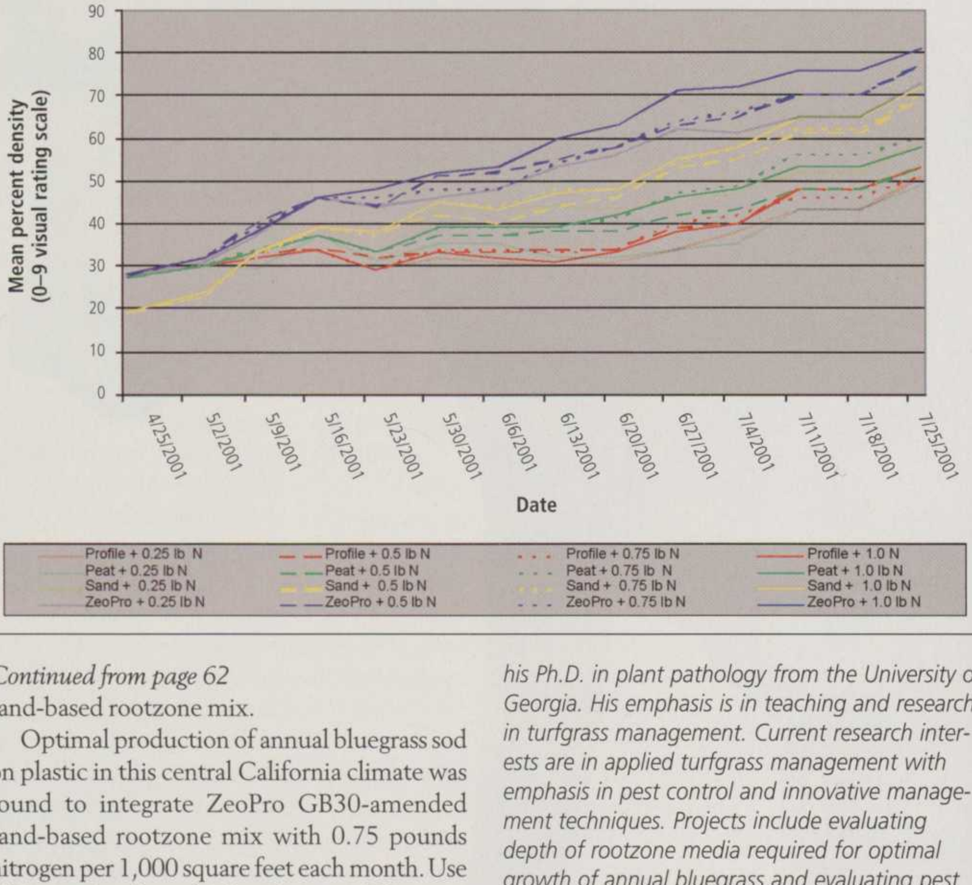
It is difficult to explain why the Profile amendment did not improve establishment rate or sod quality since this does not agree with previous research (Bigelow *et al*, 2000). Some possible explanations could be variation in the amount of amendment added and climatic differences between studies.

The optimal nitrogen application rate in the production of annual bluegrass sod for this central Californian climate was 0.75 pounds per 1,000 square feet per month. Increasing nitrogen above this rate did not significantly improve establishment rate or color, which agrees with previous research (Frank, 2000; Furguson et al, 1986; Turgeon, 1999; Vargas, 1996). Results suggest that ZeoPro GB-30-amended sands have a lower nitrogen rate requirement than other amendments. Further research is necessary to define the optimal rate of nitrogen when ZeoPro GB30 is used in a

Continued on page 64

FIGURE 5

Mean percent density visual estimates as influenced by the interaction between soil amendment and application rates during 2001.



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sand-based rootzone mix.

Optimal production of annual bluegrass sod on plastic in this central California climate was found to integrate ZeoPro GB30-amended sand-based rootzone mix with 0.75 pounds nitrogen per 1,000 square feet each month. Use of 0.75 cubic feet of 1/4-inch annual bluegrass plugs provided the quickest establishment rate; however, these propagules were infested with weed seed, which decreased sod quality.

David Green II is an assistant professor at California Polytechnic State University. He received his Ph.D. in plant pathology from the University of Georgia. His emphasis is in teaching and research in turfgrass management. Current research interests are in applied turfgrass management with emphasis in pest control and innovative management techniques. Projects include evaluating depth of rootzone media required for optimal growth of annual bluegrass and evaluating pest control techniques in turf. M. Facciuto, Sacramento, Calif.; M. Deuel, Sunset Hills Country Club, Thousand Oaks, Calif.; and R. Cenell, Coeur d'Alene Golf Course, Coeur d'Alene, Idaho, participated in this research as part of their senior project, completed to fulfill partial requirement of a bachelor of science degree.

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