Late Season Nitrogen Fertilization

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It has been pointed out that heavy nitrogen fertilization during the spring and summer is undesirable for cool-season turfgrasses. Nitrogen fertilization has proven beneficial during the late fall (late season) on cool-season turfgrasses (Powell, Blazer and Schmidt). Decreased disease, improved stress tolerance, and increased rhizome and root growth are among several of the claimed advantages to the "late-season" nitrogen fertilization program. The late-season program is based on differences in optimum temperatures that exist between (1) root-rhizome growth versus shoot growth and (2) photosynthesis versus respiration.

Shoot and root growth of cool-season turfgrasses occur most readily in the temperature ranges of 60°-75°F and 50°-65°F, respectively. Root growth of cool-season grasses will continue at soil temperatures close to freezing (Koski, 1983). Shoot growth will cease at higher temperatures than those for root growth. Late-season nitrogen fertilization capitalizes on this differential. Under late-season fertilization, nitrogen applications should be made when vertical shoot growth has stopped, but the turf leaves are still green to produce carbohydrates via photosynthesis. Air temperatures of 45°-50°F are usually necessary for vertical shoot growth stoppage. *It is important to understand that since temperatures will be at a point causing stoppage of topgrowth, roots, rhizomes and stolons will captialize on any applied nitrogen.* The carbohydrate produced will be more efficiently used of root, rhizome and stolon growth during the late fall and winter periods. It is critical that the nitrogen be applied prior to dormancy for maximum efficiency of applied nitrogen. Once the tissue has turned brown, photosynthesis will no longer occur. "Late-season" fertilization is not dormant fertilization.

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During late fall, photosynthesis is higher than respiration for cool-season grasses. With green tissue, photosynthesis will occur readily at low temperatures. This high net photosynthesis during late season leads to maximum carbohydrate production and carbohydrate storage for reserves. The positive carbohydrate balance favors root and rhizome growth over topgrowth since air temperatures are well

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below those considered optimum for shoot growth.

Nitrogen applications during the late season, if timed properly, will extend the greening of the turf later into the fall and winter. Spring green-up will normally occur earlier. The green turf is photosynthetically active, favoring a positive carbohydrate balance. Late-season nitrogen fertilization increases the "green growing" period of the turfgrass plant later into the fall and earlier in the spring. Physiologically, this is a positive agronomic practice.

The most efficient nitrogen fertilizers for use in late-season fertilization programs are those independent of temperature for nitrogen release. Soil temperatures and microbial activity are low at this time of the year, resulting in less efficiency from methylene urea and other temperature–dependent fertilizers. Urea and IBDU slow-release nitrogen are fertilizers that are independent of temperature for nitrogen release and, therefore, make for excellent late-season nitrogen sources. IBDU slow-release nitrogen, having a slow-release characteristic, will not cause surge growth even if misapplied (e.g., too early) in the late-season program.

Nitrogen is a key component of turfgrass fertilization programs. It has an influence on both the morphology and physiology of the turf plant. High quality turf exhibiting acceptable green color and density requires periodic applications of nitrogen. Nitrogen, however, is frequently referred to as the "TNT" of turfgrass fertilization programs. It can be just as detrimental as beneficial if it is mismanaged. Physiologically, the turf manager must maintain a good carbohydrate reserve. Proper timing and rate of application are important in successful long-term programs. Always remember: Greener is not always better. A happy medium must be reached between agronomics and aesthetics. ■

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hours per day in order to control costs. I won't get into manufacturers so as not to offend anyone, but I can say that the most recent purchase which has a sealed centrifugal motor and low friction nozzle seems like the easiest to take care of, the least likely to clog, and the most likely to control algae because extension tubes can easily be added to get closer to the bottom of the pond.

We gave up on chemical controls five years ago and jumped onto the biological bandwagon using Aqua T, Pond Kleen, Wizard, and, more recently, the Bioverse reactor. In an attempt to verify the usefulness of these products, we have discontinued using them and observed regrowth of algae in a known problem pond.

There are grass carp in most every pond, and they do eat algae and are adept at trimming the lake banks when water levels rise during storm events. Grass carp seem to be the largest in lakes that have floating fountains.

More recently, the residents and golfers have allowed buffers of grass and native plants to gradually grow up around portions of some lakes and entirely around others. These buffers should help reduce nutrient inputs from the golf course and homes but may also be a method of reducing our erosion problem. Due to erosion, there is a tremendous amount of suspended silt in some of our ponds which is probably every bit as good as blue dye at filtering light. This is one algae control method we'd be happy to do away with considering the implications to irrigation water quality. For now, these methods are working well in our situation.

Like virtually every other aspect of golf course management, an ounce of prevention is worth a pound of cure. John Cotell of Marine Biochemists believes that creating shade, developing buffer zones, and reducing fertilizer applications, particularly phosphorus, would go a long way toward reducing the need for algae treatments in golf course ponds.

Thanks to the participating experts for sharing their successful ideas and methods. ■