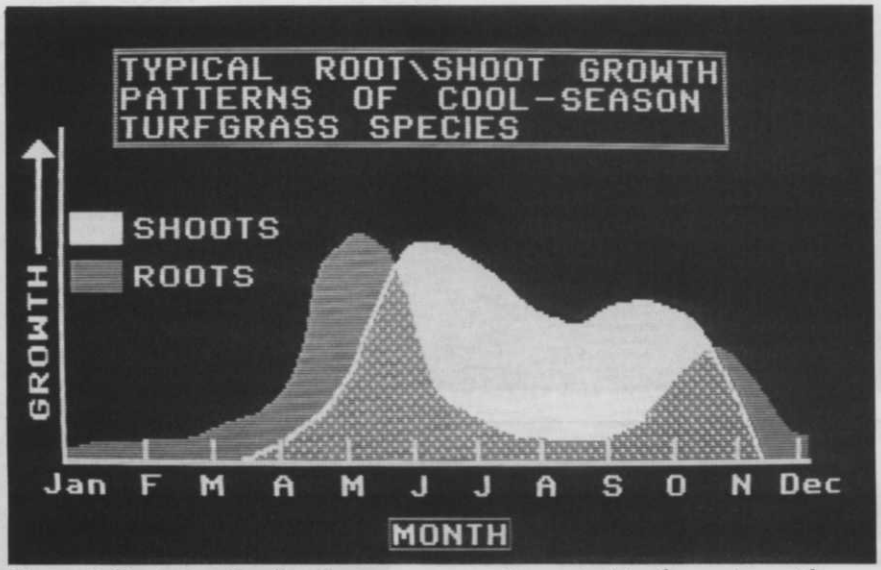

Figure 2. Root growth of cool-season grasses is greatest in the spring with a significant root growth surge again in the fall.

Timing of nitrogen applications is critical to a healthy turf with maximum stress tolerance. Heavy nitrogen fertilization during the spring and early summer is undesirable for cool-season turfgrasses. Environmental conditions are favorable for a rapid topgrowth surge at the expense of root growth. Lush, succulent growth is also produced from heavy nitrogen in the spring. This takes the turfgrass into the summer in a soft growth condition and more vulnerable to disease, heat and drought.

To avoid these latter disadvantages, late-season fertilization has been adopted for cool-season grasses. Late-season fertilization means application of nitrogen during that period of the year (late fall) that will favor root growth over shoot growth, and favor a positive carbohydrate balance in the turfgrass plant.

Cool-season turf shoot and root growth occur most readily in temperatures of 60 to 75 and 50 to 65 degrees Fahrenheit, respectively. Research at Ohio State University has shown that root growth of cool-season grasses will continue at soil temperatures close to freezing. Shoot growth will slow and eventually cease long before soil temperatures drop low enough to stop root growth. Roots can be actively growing while shoots above are brown and dormant. Late-season fertilization capitalizes on this differential in optimum temperatures and minimum temperatures for growth of shoots versus roots.

For the "late-season" concept to work successfully, turf must be green when the late-season nitrogen application is made.

On cool-season grasses, a late summer/early fall nitrogen application will ensure that the turf remains green before the late-season application.

Ideally, the late-season nitrogen application should be made when vertical shoot growth has stopped, but the turf is still green to produce carbohydrates via photosynthesis.

Air temperatures of 45 to 50 degrees Fahrenheit are usually necessary to ensure vertical shoot growth stoppage of cool-season grasses. Since temperatures will be at a point that stops roots, cool-season grass rhizomes and stolons will capitalize on any applied nitrogen and carbohydrate produced. The carbohydrate produced by the green turf will be more efficiently used for root, rhizome and stolon growth during the late fall, winter and spring.

Research at Ohio State University has shown a significant increase in both root growth rates and root numbers (Figures 3 and 4) from late-season nitrogen fertilization. A more positive carbohydrate balance also was provided from late-season fertilization compared to a spring/summer fertilization.

Nitrogen applications during the late season, if timed properly, will extend greening later into the fall and winter. Spring green-up will usually occur earlier.

In general, the turf's "greening period" from late-season fertilization can be extended four to eight weeks during late fall and early spring. This is a sound practice both agronomically and aesthetically.

Typically, spring color of late-season fertilized turf remains quite good until late May or early June. Then the effects of nitrogen applied the previous fall begin to wear off. Spring appli-

Poor fertilizer performance? It might be ammonia volitilization

Nitrogen loss from ammonia volatilization can result in poor fertilizer performance, according to David Kissel, researcher at Kansas State University.

Kissel says that as in leaching, losses of nitrogen by ammonia volatilization can make it necessary to re-apply fertilizer to restore the lawn to its original green color and vigorous growth.

Ammonia volatilization occurs when nitrogen is converted to a gas and released into the air. This nitrogen removal bypasses the turf and deprives a lawn of needed nutrition. Of the 16 elements needed for healthy turf development, nitrogen is by far the most important.

"Ammonia volatilization can take place when urea and urea-containing fertilizers are present on turfgrass surfaces, in the thatch layer, or very near the soil surface," he says. Non-urea fertilizers are also susceptible to nitrogen losses from ammonia volatilization, but only when applied to the surface of alkaline soils.

Along with heavy thatch, a lack of rainfall or irrigation will increase the chances for nitrogen loss from ammonia volatilization because movement of applied fertilizer into the soil will be reduced. Kissel says that substantial losses can be avoided if irrigation or rainfall occurs within a few hours after fertilizer application.

If irrigation is not possible, and conditions are favorable for loss, he recommended using non-urea nitrogen or slow-release fertilizer, such as sulfur-coated urea or some of the new products, like N-Sure nitrogen solution, in combination with the regular nitrogen source.

Kissel addressed the ammonia volatilization problem at the Kansas Turfgrass Foundation meeting in Wichita, Kan. □