WHEN IS NITROGEN DETRIMENTAL TO TURF?

Fertilization studies on bentgrass. *G. V. Johnson and W. R. Kneebone. 1972. Proceedings, 1972 Arizona Turfgrass Conference. pp. 13-21. (from the Department of Soils, Water, and Engineering and the Department of Agronomy and Plant Genetics, University of Arizona, Tucson, Ariz. 85721).*

This paper is a preliminary report on investigations of nitrogen fertilization of Penncross creeping bentgrass putting greens in the warm climatic region. The nitrogen fertility treatments involved one-half pound per 1,000 square feet applied in the form of ammonium nitrate in the following four schedules: (a) applied weekly throughout the year; (b) applied weekly from September through May; (c) applied every two weeks throughout the year, and (d) applied every two weeks from September through May. There were four replications in a randomized complete block design.

Clipping yields, collected after two days' growth, revealed that more frequent nitrogen applications and continuous annual applications throughout the year resulted in increased shoot growth. Variations in shoot growth throughout the year appeared to be influenced more by temperature and evapotranspiration rate than the fertilizer treatments. Root growth, as measured in terms of both length and dry weight production, showed that the more frequent nitrogen fertilizations as well as those applied throughout the year resulted in decreased root growth. The turfgrass color evaluations, both visual estimates and actual chlorophyll analysis, showed no large differences, although turfs receiving nitrogen applications throughout the summer tended to be somewhat darker green.

Only one disease infestation occurred during the year, this was the result of *Pythium* activity in early August. Extensive observations revealed that the severity of *Pythium* incidence increased as the level of nitrogen fertilization increased and also that the disease occurred only in those plots which received nitrogen fertilization during the summer.

The authors concluded that bentgrass greens can be maintained quite well in Arizona on one-half to one pound of nitrogen per month during the cooler part of the year and that the hazard of disease is minimized by using minimal to no nitrogen fertilization during the summer months. They also pointed out that this is a preliminary report on a continuing study in which additional information and some changes in results may occur as the study is continued over the next few years.

Comments: Turfgrasses require nitrogen in larger amounts than any other plant nutrient. It is involved in many physiological reactions within the plant, including chlorophyll synthesis which in turn provides the green turfgrass color. A certain minimal amount of nitrogen is required to maintain the over-all health, vigor, rooting depth, shoot density and hardiness to environmental stresses and disease. As nitrogen is increased above this level certain detrimental as well as a number of beneficial turfgrass quality responses occur. Shoot growth, shoot density and turfgrass color increase as the level of nitrogen fertilization increases. But this stimulation in shoot growth and density results in decreased carbohydrate reserves, which can become limiting. At this point shoot growth has priority over the roots to the extent that loss of the root system may occur.

Associated with reduced root depth at higher nitrogen levels is an increase in the succulence of the tissue and a general reduction of the over-all health and vigor of the turfgrass plant. Consequently, tolerance to heat, cold and drought stress is reduced. The turf is more prone to wilting during the summer as well as to winter desiccation.

The final detrimental aspect of excessive nitrogen fertilization is the loss in recuperative potential associated with a lower carbohydrate reserve. Turfs that are more prone to injury from environmental stress and certain diseases under higher nitrogen fertility levels also have a reduced recuperative potential.

As has been shown in this paper, excessive nitrogen fertilization may result from (a) too much nitrogen applied in one application, (b) excessively frequent nitrogen fertilization and (c) nitrogen applied at the improper time. A few additional comments are warranted on the latter. A creeping bentgrass putting green requires less nitrogen during the midsummer heat stress period, because the rate of shoot and root growth has been substantially decreased. In addition, decomposition of any organic material in the soil also is enhanced by the warm temperature, which causes greater release of nitrogen to the soil solution for potential uptake by the bentgrass root system. Thus, nitrogen fertilization during periods of heat stress is more likely to result in detrimental than in beneficial effects unless an obvious nitrogen deficiency exists. It should also be kept in mind that tolerance to heat stress is enhanced by lower nitrogen levels. This alters the physiological condition and water content of the bentgrass leaves so that they are best able to survive the heat stress. □