by Dr. James B. Beard

TURFGRASS RESEARCH REVIEW

The effects of nitrogen on Washington creeping bentgrass

Influence of nitrogen fertilizers on Washington creeping bentgrass* (Agrostis palustris) *Hud.) I. Incidence of dollar spot* (Sclerotinia homoeocarpa) *infection.

F. E. Markland, E. C. Roberts and L. R. Frederick. 1969. Agronomy Journal. 61(5):701-705. (from the Department of Horticulture, Iowa State University, Ames, Ia. 50010).

The effects of seven nitrogen sources on the disease proneness of Washington creeping bentgrass were investigated in this study. The turf was irrigated and maintained at a cutting height of 0.25 inch. Optimum levels of phosphorus and potassium were maintained. The seven nitrogen sources applied to the plot area during a five-year period included (a) activated sewage sludge, (b) ammonium nitrate (NH_4NO_3), (c) ammonium sulfate ($(NH_4)_2SO_4$), (d) processed tankage, (e) sodium nitrate ($NaNO_3$), (f) urea and (g) urea-formaldehyde. Each of the nitrogen fertilizers were applied at rates of five and ten pounds of nitrogen per 1,000 square feet per year. The applications were made in one pound increments of nitrogen at two and four week intervals for the 10 and five pound rates, respectively. The fertilizer treatments were initiated during the third week of May and continued through the third week of September. All treatments were watered in immediately after application to avoid foliar burn.

Data collected from the field plots included (a) number of dollar spot infection sites, (b) mineral content of the leaf tissue, (c) microbial activity as measured by the amount of carbon dioxide involved from the soil, (d) soil pH, (e) change in soil fertility, and (f) differential fungistasis of the soil. Five laboratory experiments were also conducted in association with the field experiments just described, with the soil and plant tissues used in these experiments obtained from the field plots.

Results of the field studies showed that dollar spot infection was most severe on the unfertilized plots. The incidence of dollar spot infection decreased as the level of nitrogen fertilization was increased. A comparison among the various nitrogen sources at both levels of nitrogen fertility showed significant, small differences in the incidence of dollar spot. Turfs fertilized with activated sewage sludge tended to be less prone to dollar spot infection.

With the exception of potassium no association was found between the mineral content of the foliage and the incidence of dollar spot diseases. Low levels of potassium in the leaf tissue tended to be associated with an increased incidence of dollar spot. Higher contents of iron, copper and zinc were observed in the leaves of plants receiving activated sewage sludge, but this could not be correlated with disease incidence in this particular study.

Soil characteristics such as (a) pH, (b) microbiological activity as measured by carbon dioxide production, (c) fertility level and (d) fungistasis were not altered signif-

Continued on page 29

Continued from page 26

icantly by the fertilizer treatments to the extent that any association with the incidence of dollar spot could be determined. In the laboratory studies, no measureably fungitoxic agents were isolated or indicated.

Comments: The rate of application, type of carrier and time of application of fertilizers can significantly affect the incidence of a number of turfgrass diseases as was observed in this paper. Facultative saphrophytes such as dollar spot, rust and *Corticium* red thread are most severe on nitrogen deficient turfs. The increased disease proneness associated with low levels of nitrogen nutrition is attributed to the rate of vertical shoot growth. The rapidly growing leaves which are infected will also be removed more frequently.

It should also be indicated that the opposite type of response will occur with certain other common turfgrass diseases. For example, a soft succulent tissue produced by a high level of nitrogen fertility will result in increased incidence of brown patch, *Fusarium* blight, gray leaf spot, *Helminthosporium* leaf spot and *Ophiobolus* patch.

The influence of the type of nitrogen carrier and time of nitrogen application on the incidence of disease, such as was reported in this study, have been observed but the exact mechanism or factors associated with this response are not yet understood. Further investigations are needed to more fully understand these more subtle disease effects associated with various types of nitrogen carriers and the time of application.

There is also scattered evidence that the potassium level influences disease incidence of turfgrasses. A potassium response was also suggested in this study. In general, high potassium levels result in a reduction in the incidence of such diseases as brown patch, *Corticium* red thread, dollar spot, *Fusarium* patch, leaf spot and *Ophiobolus* patch. The increased proneness to disease resulting from a potassium deficiency is attributed to an excessive accumulation of nitrogen and carbohydrates which is an ideal media for disease development. Also associated with a potassium deficiency and increased disease activity are thin delicate cell walls which are easily crushed by mowing operations and provide ready entrance for pathogens. Overall plant vigor is also reduced by a potassium deficiency, although turfgrass color and shoot growth rate are seldom affected.

Factors affecting carbohydrate reserves of cool season turfgrasses.

Continued on page 32

BEARD

Continued from page 29

L. J. Zanoni, L. F. Michelson, W. G. Colby and M. Drake. 1969. Agronomy Journal. 61:195-198. (from the Department of Plant and Soil Sciences, University of Massachusetts, Amherst, Mass. 01002).

Field investigations were conducted to study the affect of fertilization and season of the year on the carbohydrate levels in tissues of four turfgrasses. Merion Kentucky bluegrass was maintained at a 1.5 inch cutting height whereas Penncross creeping bentgrass, Astoria colonial bentgrass and Kingston velvet bentgrass were maintained at a maximum cutting height of 0.5 inch. Two levels of nitrogen and potassium were maintained. The lower level was not fertilized during the growing season whereas the high level represented a fertilization program which attempted to maintain an optimum level of nitrogen and potassium for the particular species involved. Tissue samples were collected at two week intervals and analyses made of the total soluble carbohydrate and total fructose content. Soil temperatures were recorded at a two-inch depth.

Carbohydrate reserves were reported highest in the stem and leaf sheath tissues. The application of nitrogen fertilizer resulted in a decrease in the total soluble carbohydrate level. Potassium fertilizer did not affect the level of total soluble carbohydrates. Merion Kentucky bluegrass cut at 1.5 inch contained substantially higher lefels of total soluble carbohydrates than the close cut bentgrasses. Among the bentgrasses, the total soluble carbohydrate level was lowest in Astoria colonial bentgrass and slightly higher in the Kingston velvet bentgrass with Penncross creeping bentgrass possessing the highest level.

Definite seasonal fluctuations in total soluble carbohydrates were observed among all turfgrass species and fertility treatments. Substantial carbohydrate increases were evident during the fall.

An insulating affect associated with the amount of vegetative cover is evident from the temperature measurements. Highest extremes in temperature occurred on the bare soil plots whereas the greatest insulating affect from the vegetative cover was evident under Merion Kentucky bluegrass cut at 1.5 inches. The insulating affect of the shorter cut bentgrasses was intermediate between the bare soil and the high cut Merion Kentucky bluegrass.

Comments: The level of reserve or storage carbohydrates in turfgrass tissues is one of the better physiological indicators of the

Continued on page 34

BEARD

Continued from page 32

overall vigor and recuperative potential of the plant. Certain cultural factors can definitely influence the level of reserve carbohydrates. For example, in this study the Merion Kentucky bluegrass contained substantially higher carbohydrate reserves than the creeping bentgrasses. A considerable portion of this differential is due to the higher cutting height of Merion (1.5 inch) compared to the closely cut bentgrass (0.5 inch). The greater the amount of leaf area retained, the higher the level of carbohydrate reserves which can be maintained. Similarly, judicious, controlled nitrogen fertilization is important in maintaining a higher level of carbohydrate reserves. Nitrogen stimulates shoot growth which, in turn, tends to deplete the amount of carbohydrate reserves stored primarily in the stem tissues. Excessively high total seasonal applications or excessively high amounts of nitrogen applied in any one single application should be avoided.

A distinct seasonal variation in carbohydrate reserves was evident in all species studied. This variation should be recognized by any professional turfman in the timing of cultural practices. The use of cultural practices which place additional stress on the carbohydrate reserve level of the turfgrass plant should be avoided when these reserves are minimal.

Finally, the effect of the amount of above ground vegetation on the variation in surface soil temperatures is evident in this study. It is the temperature in the surface one to two inches of soil that is most critical in terms of temperature stress because the vital meristematic tissues of the stems and nodes are located in this region. Higher cutting heights which maintain a greater amount of vegetation will serve a vital function in insulating against temperature extremes. Many turfmen have probably observed that bentgrass putting greens maintained at 0.25 inch will freeze much earlier in the winter than the higher cut, adjacent aprons. This differential affect is due to the insulating value of the turfgrass vegetation. □

Other papers of interest:

1. *Annual bluegrass* (Poa annua) —*A common grass and weed.*
R. E. Engel. 1970. Proceedings of Rutgers University Three Day Turf Courses. pp. 51-52. (from the Department of Soils and Crops, Rutgers University, New Brunswick, N. J.).

2. *A review of recent turfgrass research in Southern California.*
V. B. Youngner. 1969. California Turfgrass Culture. 19(1):6-7. (from the Department of Agronomy, University of California at Riverside, Riverside, Calif. 92502).