Turfgrass research review

By Dr. James B. Beard

The role of guttation fluid in fungal disease development.
R. M. Endo. *California Turfgrass Culture*. 17(2):12-13. 1967. (from the Department of Plant Pathology, University of California at Riverside, Riverside, Calif. 92502).

The objective of this study was to ascertain the relationship of guttation to the spread of turfgrass diseases by (a) fungal thread and (b) spores. Guttation fluid was collected in early morning. Drops of guttation fluid and water were placed on seaside bentgrass leaves and fungal threads of dollar spot and brown patch were added to the droplets. Actual infection occurred only with the droplets containing the guttation fluid.

In a related study, guttation of moistened four-inch plugs of turf was induced by placing the plug in a closed plastic bag. Fungal threads of brown patch were placed on a single leaf. In this situation, the fungal threads were observed to bridge from one guttation droplet to another with mycelial growth being stimulated from each droplet.

Studies were also conducted with leafspot which spreads by spores. Spores suspended in guttation fluid and water were sprayed on bentgrass seedlings. All plants sprayed with the spore-guttation fluid were dead after six days. All plants sprayed with the spore-water suspension survived even after 14 days. The guttation fluid induced acceleration and increase in spore germination, percentage of infections and the subsequent development and spread of the fungus in the infected tissues.

Comments—Droplets of water occur at the leaf tips of turfgrasses during the night and early morning hours. These droplets are produced by guttation or may be the result of direct wound exudation from the freshly cut leaf. Leaf exudations should not be confused with dew, which is more likely to be distributed over the leaf rather than at the tip. Rapid water absorption by roots, restricted transpiration, frequent irrigation, close-frequent mowing and heavy nitrogen fertilization will stimulate leaf exudation. Exudation fluids enhance turfgrass disease spread and infection because of the mineral salts, sugars, amino acids, amides and other organic acids contained in the exudate.

Since leaf exudates enhance disease activity, it is a desirable practice to break up or remove these droplets. The preferred method of exudate removal is by syringing, since the water washes the disease-favoring organic material from the leaf surface. Dragging, brushing or poling are also effective in disrupting the droplets and increasing evaporation. However, the latter methods may also tend to distribute the fungal threads over the entire leaf surface. Leaf exudation can be minimized by effective air movement and avoiding excessive nitrogen fertilization or watering.

Recent advances in controlling winter injury of turfgrasses.
J. P. Lebeau. Proceedings of the 21st Annual Northwest Turfgrass Conference. pp. 14-21. 1967. (from the Canada Department of Agriculture, Lethbridge, Alberta, Canada).

Turf heating with electrical cables has ensured the winter survival of non-hardy turfgrasses on greens at Lethbridge, Alberta, Canada. Turfs maintained at minimum temperature of 38 to 42° F. showed injury and had an uneconomical power requirement. On the other hand, turfs held at a mimimum temperature of 26 to 32° F. survived the winters in good condition and had an economical power consumption. The results indicate that the power requirement to bring non-hardy turfs through the winter uninjured was in the economical range.

Polyethylene covers are also being evaluated for use in winterkill prevention caused by desiccation and low temperature. Studies in southern Alberta indicate that polyethylene covers increase the effectiveness of inorganic mercurial fungicides used in the control of snow mold. One half the recommended rate for mercurial fungicides was effective in the control of snow mold when the turf was covered immediately after application of the fungicide. Problems were encountered in securing the cover to the ground. In addition, the covers had to be removed at intervals during the spring in order to mow the excessive leaf growth.

Tests at Edmonton and Lethbridge showed most creeping bentgrasses to be more winter hardy than colonial bentgrass and annual bluegrass. Northland creeping bentgrass has exhibited superior winter hardiness to low temperature and snow mold.

Comments—Electrical heating of golf greens and tees is still in the experimental stage of development in North America. Soil warming shows promise for future use on courses having medium high to high budgets. This technique may offer

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a means of providing frost free turf throughout the year. Also, spring green up will be earlier.

An evaluation of high temperature effects on annual bluegrass. *(Poa annua L.)*

J. A. Fischer, Master of Science Thesis. Michigan State University. pp. 1-42, (from the Department of Crop Science, Michigan State University, East Lansing, Michigan 48823.)

The effects of high temperature on *Poa annua* were studied in a specially designed wind tunnel chamber. Wind speed in the chamber was 11.4 mph and the relative humidity approximately 100 per cent. The temperature treatments ranged from 98 to 112° F. with exposure times varying from ten minutes to twelve hours. Injury was evaluated by grass observations and a histological technique.

High temperature resulted in a systematic injury to the *Poa annua* plant tissue. Injury occurred first at the junction of the leaf sheath and the leaf blade of all affected leaves. The root crown tissue, the youngest leaf and the apical meristem, in that order, were the least susceptible to lethal high temperatures. Exposure to high temperature hastened aging of leaves. The order of cellular changes observed was protoplasmic granulation, protoplasmic coagulation, cell wall breakdown, and total cell collapse.

At any one temperature treatment the degree of kill increased proportionally with exposure time. Kill of *Poa annua* at 100 per cent relative humidity occurred after only one hour exposure to a temperature of 106° F.

Comments—Direct high temperature kill of *Poa annua* was observed to occur at surprisingly low temperatures. Temperatures of turfs in the 104 to 108° F. range occur under field conditions. Turf-

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men should recognize that it is the plant tissue temperature and not the air temperature that is critical. Actually, a high soil temperature is a more valid indicator of potential high temperature injury than high air temperatures.

These data suggest that high temperatures may cause a greater portion of the mid-summer death of *Poa annua* than has been thought in the past. Plants under a water deficit are more susceptible to low temperature kill. Proper water management, good air movement and a healthy turf are important factors that will increase the tolerance of turfgrasses to high temperature.

Early growth of annual and perennial ryegrass.
M. Barbour. *Agronomy Journal* 59 (2):204-205. 1967 (from the Department of Botany, Duke University, Durham, North Carolina).

Two stages of early growth were observed for annual ryegrass (*Lolium temulentum*) and perennial ryegrass (*L. perenne*). The first stage encompasses the initial nine days following seeding when the growth rate is extremely rapid. Annual ryegrass had 90 per cent germination in 48 hours while perennial ryegrass had 80 per cent germination after four days at 68° F. The second state, which may be indicative of the rest of the growing season, is one of slower growth. Annual ryegrass had a larger root system and a higher respiration and photosynthetic rate.

Comments—This paper emphasizes the superior establishment vigor of the ryegrasses, with annual being more vigorous than perennial. The rapid establishment is valuable where a quick, temporary cover is desired. This attribute is desirable when planting on steep slopes having a high erosion probability and when conditions for germination are inadequate due to moisture stress.

An undesirable aspect of such rapid establishment is excessive competition to the more desirable, permanent species contained in the mixture. It can be especially det-

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rimental to Kentucky bluegrass and red fescue, which can be almost crowded out. The competition is most severe for light with the quicker germinating species shading the slower germinating grasses.

Bermudagrass variety effects on winter overseeding in 1965-66. W. R. Kneebone and G. L. Major. 1966 Report on Turfgrass Research at the University of Arizona. Report 240. pp. 1-3. (from the Department of Agronomy, University of Arizona, Tucson, Arizona 85721).

Sixteen bermudagrass varieties were overseeded using the following: (a) roughstalk bluegrass (*Poa trivialis*) at six pounds per 1,000 sq. ft., (b) Pennlawn red fescue (*Festuca rubra*) at six pounds per 1,000 sq. ft., (c) annual ryegrass (*Lolium multiflorum*) at 15 pounds per 1,000 sq. ft., and (d) a mixture of Highland bentgrass, Pennlawn red fescue, and Kentucky bluegrass at 10 pounds per 1,000 sq. ft. The bermudagrass was maintained at 3/4 inch. In November the seed was applied, the area renovated with a vertical mower leaving the debris as a mulch, and irrigated. All four seed sources had excellent initial stands.

In early February, thinning in stands of the overseeded turfs became evident. Stand data was taken on February 18 and March 14. The stands for roughstalk had the highest density followed closely by Pennlawn red fescue. The densities for annual ryegrass and the mixture were significantly less. From February 18 to March 14 the roughstalk bluegrass density remained constant, while the other three overseeding treatments increased in stand density.

The bermudagrass varieties varied in their response to overseeding by certain grasses. These differences must be recognized in evaluating overseeding practices. Stands from overseeding were significantly lower for Tifway, Ormond, and Tiflawn bermudagrass varieties. Stands were quite high for Arizona Common, Midway, and Tifcote. *Continued on page 85*

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A comparison of colonial and creeping bentgrasses for 1/2-and 3/4-inch turf.

R. E. Engel. Report on Turfgrass Research at Rutgers University. New Jersey Ag. Exp. Sta. Bulletin 816. pp. 45-47. 1966. (from the Department of Soils and Crops, Rutgers, the State University, New Brunswick, New Jersey).

The objective of this study was to compare the performance of colonial and creeping bentgrasses when mowed at fairway mowing heights. Five colonial bentgrasses (Astoria, Exeter, Highland, New Zealand browntop, and R. J. colonial) and four creeping bentgrasses (Arlington, Dahlgren, Penncross and Seaside) were maintained at cutting heights of 1/2 and 3/4 inches. Also included were two nitrogen treatments: two and four pounds of nitrogen per 1,000 square feet per year. There were a maximum of four irrigations per year with no fungicides applied. The length of the experiment was eight years.

For the first five years, the creeping bentgrasses ranked higher in turfgrass quality than the colonial bentgrasses. This advantage decreased after seven years. The advantage of the creeping bentgrasses was more apparent at a 1/2-inch cut than at 3/4-inch. The incidence of dandelions and annual bluegrass was less in the creeping bentgrasses than in the colonial types.

Thatch accumulation was greater at the higher (3/4 inch) and nitrogen level (four pounds nitrogen). The thatch accumulation was greater with the creeping bentgrasses, but it did not appear to offer unusual increases in trouble through eight years. The greater thatch accumulation was attributed, at least partially, to the greater natural density of growth of the creeping types.

Dollar spot incidence resulted in a late summer and early fall slump in turf performance greater in the creeping bentgrasses than in the colonials. Dollarspot infestations were greater at the lower cut.

A comparison among the seven bentgrasses showed Arlington to give the best performance under fairway management and New Jersey conditions. Seaside showed no advantages over the colonial bentgrasses. In spite of the high cut and vigorous growth characteristics, Penncross had good overall quality. Among the colonial bentgrasses, Exeter and R. I. colonial had a decided advantage. At the 3/4-inch mowing height all the bentgrasses except Seaside, Arlington, and Penncross had good dollarspot resistance.

Comments—These results indicate that some creeping bentgrass selections are just as desirable as the colonial types for use under fairway management. The creeping types have a greater thatching tendency but also have a greater density of growth and thus can compete more favorably against invading weeds such as *Poa annua*. The net result is better quality. One should not conclude from these

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results that all creeping bentgrasses are desirable for fairways. Certain creeping bentgrasses thatch excessively and/or have a high susceptibility to certain turfgrass diseases. These characteristics are not desired in a bentgrass for fairway use. □

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Archibald M. Reid who died recently at 83 in New York was president, USGA for three years (1935-36-37) . . . His father, *John Reid*, a founding member of the St. Andrews GC (Apple Tree Gang), one of the USGA first five clubs, had been a member of the USGA executive committee and a USGA vice president, as was his brother, *John Reid, Jr* . . . One of the finest things about golf is getting to know a man like *Arch Reid* . . . There was a very pleasant 100 per cent quality American gentleman.

Good Luck to *Bill* and *Kathy Cornelius*, pros who have bought the Greentree G&CC, Victorville, Calif. . . . Kathy won the USGA Women's Open championship in 1956 after a play-off with *Barbara McIntire* . . . Public and fee courses in many places already have announced rate increases . . . Cost much higher and nobody is expecting course labor to be easier to get while the "Great Society" gives a fellow about as much for bumming and rioting as for working . . . With the higher pay-play rates you will see more courses issuing rain checks.

Swaim Fields course at Cincinnati, closed three years ago when a road cut into it, is running again . . . Owner *Nick Todd* has *Joe McGarry* as pro-manager of the 18-hole layout . . . *Harold Sanderson* retiring after 37 years as pro at Canoe Brook CC, Summit, N.J. . . . He's just going to take it easy . . . Before going to Canoe Brook, Harold was pro at Edgewater GC in Chicago . . . Interesting "folksy" column *Dale Dempsey* is writing in Argus of Hillsboro, Ore., in suburban Portland . . . Dempsey is pro at Rock Creek CC, part of a real estate development and he gives a