Dollar spot tests yield tips

Nutrient-turf disease relationships investigated at Iowa State on experimental putting green of Washington bentgrass.

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Bentgrasses are grown for golf purposes under conditions more severe and restrictive than for grasses grown under natural field conditions. As a result, prevention and control of disease becomes more difficult, particularly on greens.

Bentgrass greens require large applications of nitrogen fertilizer each year. These high levels of nitrogen are needed to maintain the vigor of grass subjected to frequent mowings at heights of one-quarter inch or less. Turf treated with high nitrogen and frequent mowing essentially never matures and remains soft and succulent. These conditions often lead to an increase in disease. However, one common disease of bentgrass greens, dollar spot, caused by the fungus *Sclerotinia homoeocarpa* is known to be worse on underfertilized turf than on well-fed turf.

Bentgrass Resistance to Dollar Spot— Dollar spot resistance in bentgrasses may be divided into two categories. The first category may be referred to as genetic resistance. This involves the classification of strains of bentgrasses into groups which demonstrate a natural resistance to the disease. For example, at Ames, Iowa, Penncross bentgrass is less susceptible than Washington bentgrass to dollar spot. Various strains of Washington show differences in degree of susceptibility. The second category may be called managed resistance to dollar spot.

Factors commonly associated with management include fungicide application to remove the disease organism, sanitation which helps prevent the entry of the disease, moisture regulation which may prevent infection, and finally fertilization which helps prevent spread of disease.

Effect of Nitrogen Fertilization of Turf on Dollar Spot— Emphasis in this paper will be confined to nitrogen fertilization and its effect on dollar spot resistance in bentgrass. The important aspects are source, amount and frequency of application.

Some nitrogen sources contain, in addition to nitrogen, potassium, phosphorus, and trace elements. Use of these fertilizers could lead to a more balanced nutrient status for the grass. This would increase growth and reduce dollar spot.

Direct fungicidal effects could arise from the presence of copper, zinc, chromium, iron, etc.

Increasing the total amount of nitrogen may stimulate the grass so that it simply outgrows the disease symptoms. The type of nitrogen may exert its influence by governing the rate of nitrogen release. Nitrogen sources most effective in disease control would supply nitrogen so as to maintain the grass in a vigorous, but not over-succulent state.

Experimental Methods and Materials— To investigate these nutrient-turf disease

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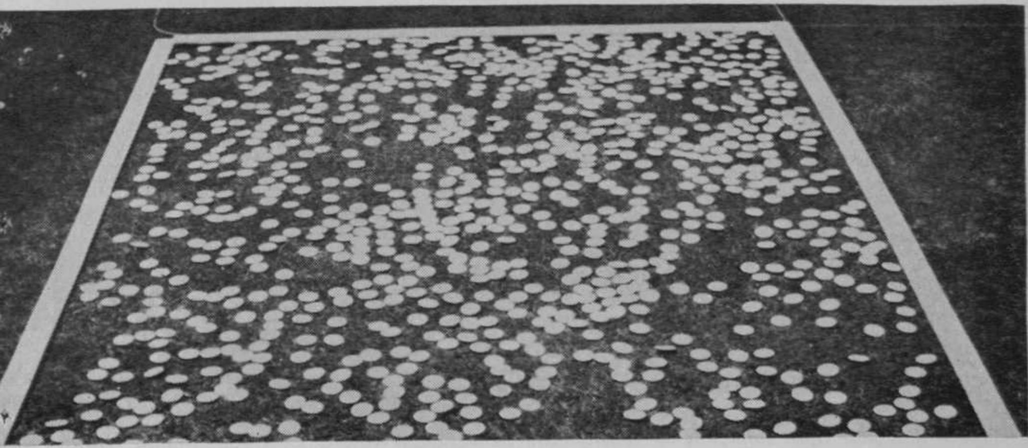

Figure 6 Dollar Spot infection of Washington bentgrass which was not fertilized with nitrogen. Note high rate of infection as indicated by number of caps placed over each diseased spot—June 1964.

relationships, an experimental putting green of Washington bentgrass was established. It was maintained under simulated playing conditions at Iowa State University. One hundred twenty 5′ by 8′ plots were arranged in eight blocks of 15 plots each. The following nitrogen sources were used: 1-activated sewage sludge; 2-processed tankage; 3-ureaform, urea, ammonium nitrate, ammonium sulfate; 4-sodium nitrate.

(Number 1 is Milorganite, a product of the Milwaukee Sewerage Commission, Milwaukee, Wis.; No. 2 is Agrinite, a product of the American Agricultural Chemical Company, New York, N.Y.; No. 3 is Nitroform (Blue Chip); a product of Hercules Powder Co., Wilmington, Del.; No. 4 is Chilean nitrate of soda, a natural product from Chile.)

Rates consisted of 5- and 10-pound actual nitrogen per 1000 square feet for the growing season. Each nitrogen source was applied in one-pound nitrogen increments at two-week intervals for the ten-pound level, and every four weeks for the five-pound level. A plot without nitrogen (as a check) was included in each block. All plots received adequate amounts of phosphorus and potassium.

Treatments started the third week in May and continued until the third week of September during each year of the test.

Response of the grass to applied nitrogen was recorded using visual color ratings and growth measurements. Color ratings were scaled, using a one-to-four scoring system with one best. Growth measurements were recorded as yield of foliage, and as percent dry weights.

Differences in potassium, phosphorus, and trace elements in leaf tissue were also determined.

Resistance of Washington bentgrass to dollar spot was evaluated by counting the number of spots. Dollar spot was then correlated with growth response and potassium content of the foliage.

Results and Discussion— Color response of turf to nitrogen fertilizer over a four-year period is noted in Figure 1. The five-pound nitrogen level was superior to the no-nitrogen check in every instance, but inferior to the ten-pound nitrogen level. No differences have yet been noted between types of fertilizers applied at the five-pound level. At the ten-pound nitrogen level, the type of fertilizer had an effect on color response. Processed tankage and ureaform produced poor color response. Activated sewage sludge, urea, ammonium sulfate, ammonium nitrate and sodium nitrate gave essentially the same color response.

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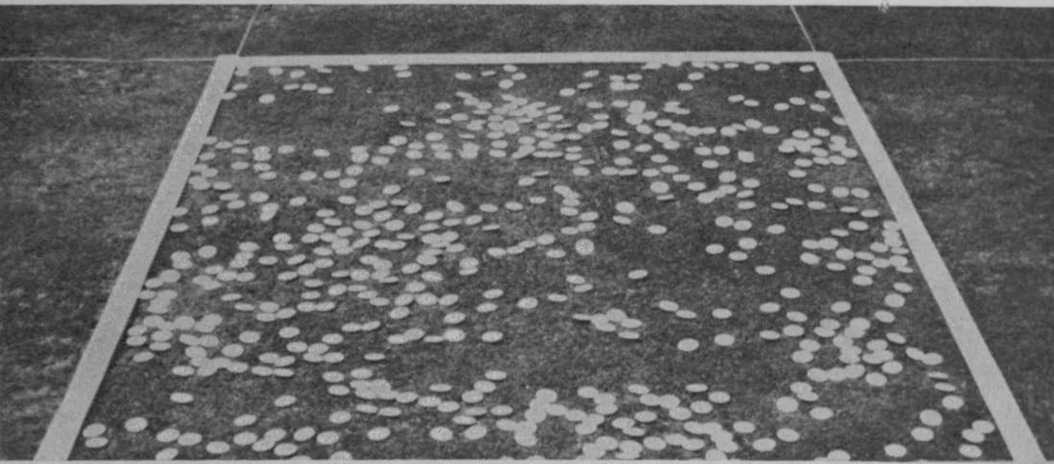

Figure 7 Dollar Spot infection of Washington bentgrass fertilized with Ammonium Nitrate at 5 lbs. nitrogen per 1000 square feet per year. Note high rate of infection as indicated by number of caps placed over each diseased spot—June 1964.

DOLLAR SPOT

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The color was such that any user would have been well satisfied.

Fresh weight yields reveal that early in the season natural and synthetic organics produce less foliage than the readily available inorganics and urea. By late June, activated sewage sludge caused a larger increase in foliar production than other fertilizer materials (Figure 2). Less response was obtained from ureaform, sodium nitrate, and even poorer yields came from the no-nitrogen checks.

Per cent dry weight (dry matter) is a measure of food reserves in the plant. Reserves increase when growth rates are low and decrease when they are high. Accumulations of these food reserves may increase disease incidence by furnishing disease causing organisms with a readily-available food supply.

Early in the season weather conditions governed the per cent dry weight (dry matter) of the grass. The source of nitrogen fertilizer had little effect. In June, when weather conditions became more favorable, the amount of available nitrogen determined growth and per

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TABLE 1

Mineral content of Washington bentgrass foliage in parts per million

		K	Na	Cu	Zn
Activated Sewage Sludge	(L)[a]	28600	3100	17.2[b]	39.8[b]
Nitrate of Soda	(L)	28500	6200[c]	10.0	31.7
Activated Sewage Sludge	(H)	31200[b]	2800	18.2[b]	42.3[b]
Nitrate of Soda	(H)	32000[b]	8500[c]	10.3	35.7

[a](H) and (L) refer to 10 lb. nitrogen/season and 5 lb. nitrogen/season respectively.

[b]Indicates values which are significantly greater than others in the column.

[c]Indicates values which are significantly greater than others in the column and also differ significantly from each other.

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cent dry weight. Differences due to the type of nitrogen could also be detected at this time. Grass on the no-nitrogen checks had the highest per cent dry weight, folowed by processed tankage and ureaform (Figure 3).

Activated sewage sludge, urea, ammonium nitrate, and sodium nitrate all had about the same medium per cent dry weight. Ammonium sulfate was the lowest. Although the total amount of nitrogen applied was the same for each nitrogen source, the amount available to the plant for growth was different.

Mineral content of the foliage revealed that high levels of applied nitrogen increased potassium (Table 1). It has been
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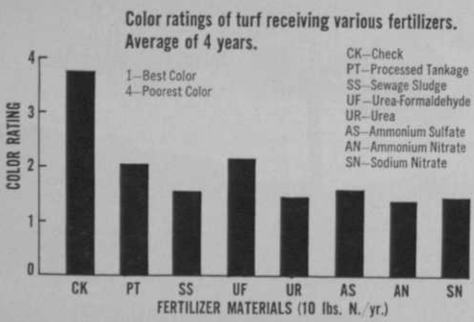

Figure 1 Color rating of Washington bluegrass fertilized with nitrogen from various sources. Note best color resulted from fertilization with activated sewage sludge and the readily available nitrogen sources.

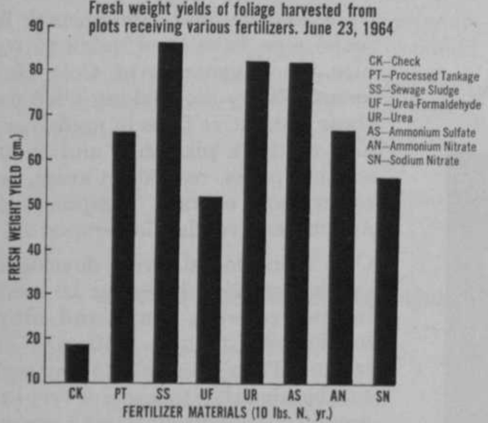

Figure 2 Fresh weight yields of foliage harvested from Washington bentgrass fertilized with nitrogen from various sources. Note least foliar growth in the check and most growth where turf was fertilized with activated sewage sludge, urea, or ammonium sulfate.

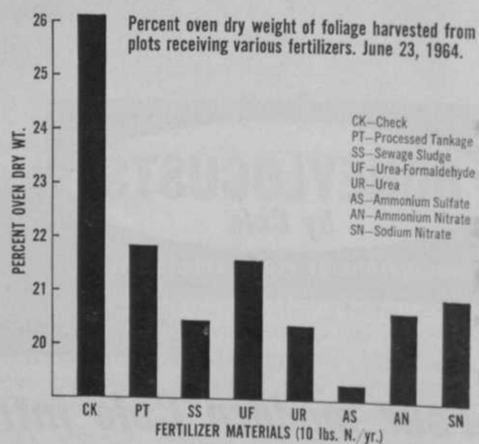

Figure 3 Per cent dry weight (dry matter) of foliage harvested from Washington bentgrass fertilized with nitrogen from various sources. Note highest per cent dry weight in the nonfertilized check and lower per cent dry weight where turf was fertilized with activated sewage sludge or readily available nitrogen sources.

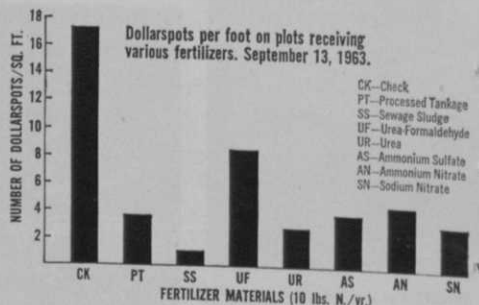

Figure 4 Number of Dollar Spots per square foot on Washington bentgrass receiving various nitrogen sources. Note most disease in September in the non-fertilized check and least disease where turf was fertilized with activated sewage sludge.

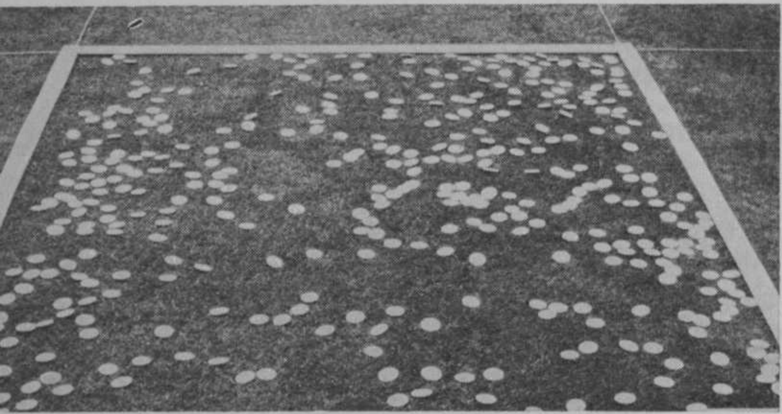

Figure 8 Dollar Spot infection of Washington bentgrass fertilized with processed tankage at 10 lbs. nitrogen per 1000 square feet per year. Note high rate of infection as indicated by number of caps placed over each diseased spot—June 1964.

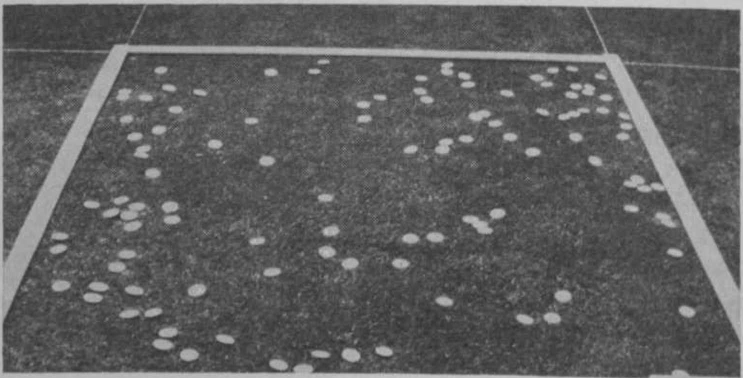

Figure 9 Dollar Spot infection of Washington bentgrass fertilized with ureaform at 10 lbs. nitrogen per 1000 square feet per year. Note moderate rate of infection as indicated by number of caps placed over each diseased spot—June 1964.

Figure 10 Dollar Spot infection of Washington bentgrass fertilized with Ammonium Nitrate at 10 lbs. nitrogen per 1000 square feet per year. Note moderate rate of infection as indicated by number of caps placed over each diseased spot—June 1964.

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reported to be of value in increasing disease resistance. This study showed that as potassium increased, dollar spot decreased.

Amounts of copper and zinc also increased in the foliage of plants receiving activated sewage sludge. Sodium content was higher in plants receiving Chilean nitrate of soda. It may be that these mineral elements are related to disease suppression.

The number of dollar spots per square feet varied with the nitrogen source (Figures 4 and 5). As yields increased,

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the number of dollar spots decreased. Fertilizer materials applied in sufficient quantities to stimulate the production of high yields significantly reduced dollar spot. Per cent dry weight of foliage showed a direct relationship to dollar spot. As per cent dry weights increased, so did dollar spot. Nitrogen sources, when supplied in adequate amounts to stimulate vigorous growth, decreased food reserves (per cent dry weight) and decreased dollar spot.

No-nitrogen check plots always had more dollar spot (Figure 6). Plots receiving five pounds of nitrogen per year were less diseased than the check, but were still severely infected with dollar spot (Figure 7).

As yet, the nitrogen source has had no effect on disease when applied at the five-pound rate. At the ten-pound rate, the grass showed a marked reduction in dollar spot. The source of nitrogen used made the difference. In general processed tankage, ureaform, and ammonium nitrate failed to give satisfactory results (Figures 8, 9, and 10). The least disease was noted where turf was fertilized with nitrate of soda and activated sewage sludge, (Figures 11 and 12).

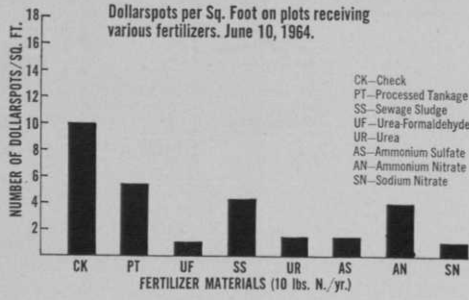

Figure 5 Number of Dollar Spots per square foot on Washington bentgrass receiving various nitrogen sources. Note most disease in June in the nonfertilized check and least disease where turf was fertilized with activated sewage sludge, urea, ammonium sulfate, or sodium nitrate.

Results of these tests at Iowa State University show that nitrogen is an important factor in promoting dollar spot resistance in Washington bentgrass. When adequate nitrogen is available, yields increase and dollar spot decreases. Dollar spot incidence was extremely bad on the no-nitrogen checks. At the low rate of five pounds actual nitrogen per 1000 square feet during the seven-month growing season, dollar spot was bad but less than the checks. There were no

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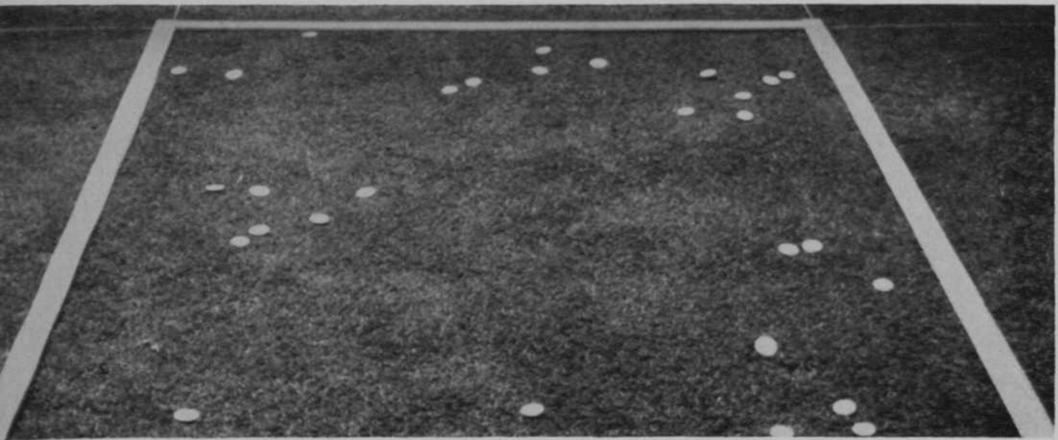

Figure 11 Dollar Spot infection of Washington bentgrass fertilized with nitrate of soda at 10 lbs. of nitrogen per 1000 square feet per year. Note low rate of infection as indicated by number of caps placed over each diseased spot—June 1964.

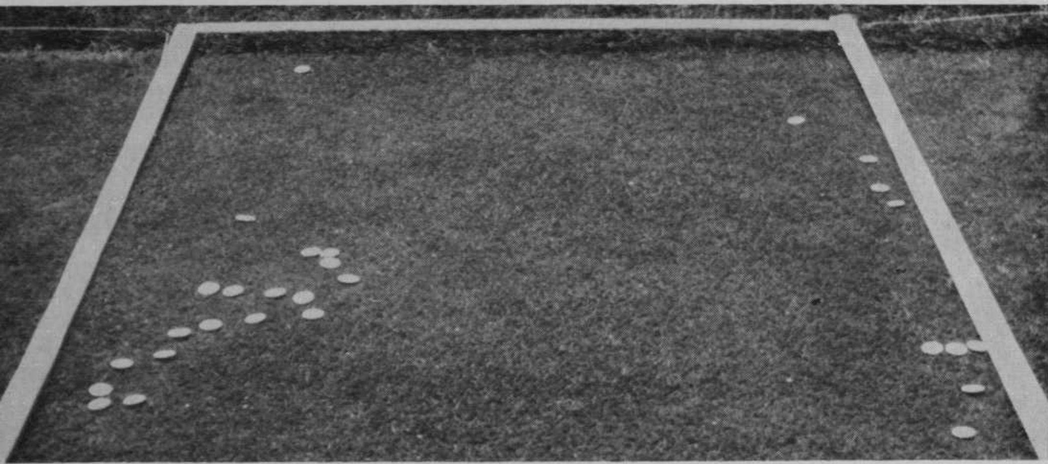

Figure 12 Dollar Spot infection of Washington bentgrass fertilized with activated sewage sludge at 10 lbs. nitrogen per 1000 square feet per year. Note low rate of infection as indicated by number of caps placed over each diseased spot—June 1964.

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marked differences between nitrogen sources. At the high rate of ten pounds actual nitrogen, there was appreciably less dollar spot and significant differences between the nitrogen sources.

The water soluble nitrogen sources (urea, ammonium nitrate, ammonium sulfate, and Chilean nitrate of soda) were similar in their effect in reducing dollar spot. The exception was ammonium nitrate. Dollar spot was consistently worse where it was used, compared to the other water solubles. Among the organics, activated sewage sludge plots had the least dollar spot. They were always equal to or better than the water solubles. In general, processed tankage and ureaform were less effective in suppressing dollar spot.

Emphasis should also be placed on proper use of fungicides. Increases in dollar spot resistance from nitrogen sources is not sufficient to be considered a substitute for fungicides. But an increased disease resistance from proper nitrogen use will make fungicides more effective.

Studies are continuing to more fully evaluate the cumulative effects of nitrogen sources, because different rates and times of application may in time influence the results. •

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